

LIGHT UNFLAVORED MESONS

($S = C = B = 0$)

For $I = 1$ (π, ρ, ω): $u\bar{d}, (u\bar{u}-d\bar{d})/\sqrt{2}, d\bar{u}$;
 for $I = 0$ ($\eta, \eta', h, h', \omega, \phi, f, f'$): $c_1(u\bar{u} + d\bar{d}) + c_2(s\bar{s})$

π^\pm

$$J^{PC} = 1^-(0^-)$$

Mass $m = 139.57039 \pm 0.00018$ MeV ($S = 1.8$)
 Mean life $\tau = (2.6033 \pm 0.0005) \times 10^{-8}$ s ($S = 1.2$)
 $c\tau = 7.8045$ m

$\pi^\pm \rightarrow \ell^\pm \nu \gamma$ form factors [a]

$F_V = 0.0254 \pm 0.0017$
 $F_A = 0.0119 \pm 0.0001$
 F_V slope parameter $a = 0.10 \pm 0.06$
 $R = 0.059^{+0.009}_{-0.008}$

π^- modes are charge conjugates of the modes below.

For decay limits to particles which are not established, see the section on Searches for Axions and Other Very Light Bosons.

π^+ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	$\frac{p}{c}$ (MeV/c)
$\mu^+ \nu_\mu$	[b] (99.98770 ± 0.00004) %		30
$\mu^+ \nu_\mu \gamma$	[c] (2.00 ± 0.25) × 10 ⁻⁴		30
$e^+ \nu_e$	[b] (1.230 ± 0.004) × 10 ⁻⁴		70
$e^+ \nu_e \gamma$	[c] (7.39 ± 0.05) × 10 ⁻⁷		70
$e^+ \nu_e \pi^0$	(1.036 ± 0.006) × 10 ⁻⁸		4
$e^+ \nu_e e^+ e^-$	(3.2 ± 0.5) × 10 ⁻⁹		70
$e^+ \nu_e \nu \bar{\nu}$	< 5 × 10 ⁻⁶	90%	70

Lepton Family number (LF) or Lepton number (L) violating modes

$\mu^+ \bar{\nu}_e$	L	[d] < 1.5	× 10 ⁻³ 90%	30
$\mu^+ \nu_e$	LF	[d] < 8.0	× 10 ⁻³ 90%	30
$\mu^- e^+ e^+ \nu$	LF	< 1.6	× 10 ⁻⁶ 90%	30

π^0

$$J^{PC} = 1^-(0^{-+})$$

Mass $m = 134.9768 \pm 0.0005$ MeV ($S = 1.1$)
 $m_{\pi^\pm} - m_{\pi^0} = 4.5936 \pm 0.0005$ MeV
 Mean life $\tau = (8.52 \pm 0.18) \times 10^{-17}$ s ($S = 1.2$)
 $c\tau = 25.5$ nm

For decay limits to particles which are not established, see the appropriate Search sections (A^0 (axion) and Other Light Boson (X^0) Searches, etc.).

π^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)	
2γ	$(98.823 \pm 0.034) \%$	S=1.5	67	
$e^+ e^- \gamma$	$(1.174 \pm 0.035) \%$	S=1.5	67	
γ positronium	$(1.82 \pm 0.29) \times 10^{-9}$		67	
$e^+ e^+ e^- e^-$	$(3.34 \pm 0.16) \times 10^{-5}$		67	
$e^+ e^-$	$(6.46 \pm 0.33) \times 10^{-8}$		67	
4γ	< 2	$\times 10^{-8}$ CL=90%	67	
$\nu \bar{\nu}$	[e] < 2.7	$\times 10^{-7}$ CL=90%	67	
$\nu_e \bar{\nu}_e$	< 1.7	$\times 10^{-6}$ CL=90%	67	
$\nu_\mu \bar{\nu}_\mu$	< 1.6	$\times 10^{-6}$ CL=90%	67	
$\nu_\tau \bar{\nu}_\tau$	< 2.1	$\times 10^{-6}$ CL=90%	67	
$\gamma \nu \bar{\nu}$	< 1.9	$\times 10^{-7}$ CL=90%	67	
Charge conjugation (C) or Lepton Family number (LF) violating modes				
3γ	C	< 3.1	$\times 10^{-8}$ CL=90%	67
$\mu^+ e^-$	LF	< 3.8	$\times 10^{-10}$ CL=90%	26
$\mu^- e^+$	LF	< 3.4	$\times 10^{-9}$ CL=90%	26
$\mu^+ e^- + \mu^- e^+$	LF	< 3.6	$\times 10^{-10}$ CL=90%	26

η

$$I^G(J^{PC}) = 0^+(0^{-+})$$

Mass $m = 547.862 \pm 0.017$ MeV

Full width $\Gamma = 1.31 \pm 0.05$ keV

C-nonconserving decay parameters

$$\pi^+ \pi^- \pi^0 \text{ left-right asymmetry} = (0.09_{-0.12}^{+0.11}) \times 10^{-2}$$

$$\pi^+ \pi^- \pi^0 \text{ sextant asymmetry} = (0.12_{-0.11}^{+0.10}) \times 10^{-2}$$

$$\pi^+ \pi^- \pi^0 \text{ quadrant asymmetry} = (-0.09 \pm 0.09) \times 10^{-2}$$

$$\pi^+ \pi^- \gamma \text{ left-right asymmetry} = (0.9 \pm 0.4) \times 10^{-2}$$

$$\pi^+ \pi^- \gamma \beta \text{ (D-wave)} = -0.02 \pm 0.07 \quad (S = 1.3)$$

CP-nonconserving decay parameters

$$\pi^+ \pi^- e^+ e^- \text{ decay-plane asymmetry } A_\phi = (-0.6 \pm 3.1) \times 10^{-2}$$

Other decay parameters

$$\pi^0 \pi^0 \pi^0 \text{ Dalitz plot } \alpha = -0.0288 \pm 0.0012 \quad (S = 1.1)$$

$$\text{Parameter } \Lambda \text{ in } \eta \rightarrow \ell^+ \ell^- \gamma \text{ decay} = 0.716 \pm 0.011 \text{ GeV}/c^2$$

η DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Neutral modes			
neutral modes	(72.12±0.34) %	S=1.2	–
2 γ	(39.41±0.20) %	S=1.1	274
3 π^0	(32.68±0.23) %	S=1.1	179
$\pi^0 2\gamma$	(2.56±0.22) $\times 10^{-4}$		257
2 $\pi^0 2\gamma$	< 1.2 $\times 10^{-3}$	CL=90%	238
4 γ	< 2.8 $\times 10^{-4}$	CL=90%	274
invisible	< 1.0 $\times 10^{-4}$	CL=90%	–
Charged modes			
charged modes	(27.89±0.29) %	S=1.2	–
$\pi^+ \pi^- \pi^0$	(22.92±0.28) %	S=1.2	174
$\pi^+ \pi^- \gamma$	(4.22±0.08) %	S=1.1	236
$e^+ e^- \gamma$	(6.9 ±0.4) $\times 10^{-3}$	S=1.3	274
$\mu^+ \mu^- \gamma$	(3.1 ±0.4) $\times 10^{-4}$		253
$e^+ e^-$	< 7 $\times 10^{-7}$	CL=90%	274
$\mu^+ \mu^-$	(5.8 ±0.8) $\times 10^{-6}$		253
2 $e^+ 2e^-$	(2.40±0.22) $\times 10^{-5}$		274
$\pi^+ \pi^- e^+ e^- (\gamma)$	(2.68±0.11) $\times 10^{-4}$		235
$e^+ e^- \mu^+ \mu^-$	< 1.6 $\times 10^{-4}$	CL=90%	253
2 $\mu^+ 2\mu^-$	< 3.6 $\times 10^{-4}$	CL=90%	161
$\mu^+ \mu^- \pi^+ \pi^-$	< 3.6 $\times 10^{-4}$	CL=90%	113
$\pi^+ e^- \bar{\nu}_e + \text{c.c.}$	< 1.7 $\times 10^{-4}$	CL=90%	256
$\pi^+ \pi^- 2\gamma$	< 2.1 $\times 10^{-3}$		236
$\pi^+ \pi^- \pi^0 \gamma$	< 5 $\times 10^{-4}$	CL=90%	174
$\pi^0 \mu^+ \mu^- \gamma$	< 3 $\times 10^{-6}$	CL=90%	210
Charge conjugation (C), Parity (P), Charge conjugation \times Parity (CP), or Lepton Family number (LF) violating modes			
$\pi^0 \gamma$	C [f] < 9 $\times 10^{-5}$	CL=90%	257
$\pi^+ \pi^-$	P,CP < 1.3 $\times 10^{-5}$	CL=90%	236
2 π^0	P,CP < 3.5 $\times 10^{-4}$	CL=90%	238
2 $\pi^0 \gamma$	C < 5 $\times 10^{-4}$	CL=90%	238
3 $\pi^0 \gamma$	C < 6 $\times 10^{-5}$	CL=90%	179
3 γ	C < 1.6 $\times 10^{-5}$	CL=90%	274
4 π^0	P,CP < 6.9 $\times 10^{-7}$	CL=90%	40
$\pi^0 e^+ e^-$	C [g] < 8 $\times 10^{-6}$	CL=90%	257
$\pi^0 \mu^+ \mu^-$	C [g] < 5 $\times 10^{-6}$	CL=90%	210
$\mu^+ e^- + \mu^- e^+$	LF < 6 $\times 10^{-6}$	CL=90%	264

$f_0(500)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

also known as σ ; was $f_0(600)$

See the review on "Scalar Mesons below 2 GeV."

Mass (T-Matrix Pole \sqrt{s}) = (400–550)– i (200–350) MeV

Mass (Breit-Wigner) = (400–550) MeV

Full width (Breit-Wigner) = (400–700) MeV

$f_0(500)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	seen	–
$\gamma\gamma$	seen	–

$\rho(770)$

$$I^G(J^{PC}) = 1^+(1^{--})$$

See the note in $\rho(770)$ Particle Listings.

Mass $m = 775.26 \pm 0.25$ MeV

Full width $\Gamma = 149.1 \pm 0.8$ MeV

$\Gamma_{ee} = 7.04 \pm 0.06$ keV

$\rho(770)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi\pi$	~ 100	%	363
$\rho(770)^\pm$ decays			
$\pi^\pm\gamma$	(4.5 ± 0.5) $\times 10^{-4}$	S=2.2	375
$\pi^\pm\eta$	< 6 $\times 10^{-3}$	CL=84%	152
$\pi^\pm\pi^+\pi^-\pi^0$	< 2.0 $\times 10^{-3}$	CL=84%	254
$\rho(770)^0$ decays			
$\pi^+\pi^-\gamma$	(9.9 ± 1.6) $\times 10^{-3}$		362
$\pi^0\gamma$	(4.7 ± 0.6) $\times 10^{-4}$	S=1.4	376
$\eta\gamma$	(3.00 ± 0.21) $\times 10^{-4}$		194
$\pi^0\pi^0\gamma$	(4.5 ± 0.8) $\times 10^{-5}$		363
$\mu^+\mu^-$	[h] (4.55 ± 0.28) $\times 10^{-5}$		373
e^+e^-	[h] (4.72 ± 0.05) $\times 10^{-5}$		388
$\pi^+\pi^-\pi^0$	($1.01^{+0.54}_{-0.36} \pm 0.34$) $\times 10^{-4}$		323
$\pi^+\pi^-\pi^+\pi^-$	(1.8 ± 0.9) $\times 10^{-5}$		251
$\pi^+\pi^-\pi^0\pi^0$	(1.6 ± 0.8) $\times 10^{-5}$		257
$\pi^0e^+e^-$	< 1.2 $\times 10^{-5}$	CL=90%	376

$\omega(782)$

$$J^{PC} = 0^-(1^--)$$

Mass $m = 782.65 \pm 0.12$ MeV ($S = 1.9$)

Full width $\Gamma = 8.49 \pm 0.08$ MeV

$\Gamma_{ee} = 0.60 \pm 0.02$ keV

$\omega(782)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	ρ (MeV/c)
$\pi^+\pi^-\pi^0$	(89.3 \pm 0.6) %		327
$\pi^0\gamma$	(8.40 \pm 0.22) %	S=1.8	380
$\pi^+\pi^-$	(1.53 \pm 0.06) %		366
neutrals (excluding $\pi^0\gamma$)	(7 $^{+7}_{-4}$) $\times 10^{-3}$	S=1.1	–
$\eta\gamma$	(4.5 \pm 0.4) $\times 10^{-4}$	S=1.1	200
$\pi^0e^+e^-$	(7.7 \pm 0.6) $\times 10^{-4}$		380
$\pi^0\mu^+\mu^-$	(1.34 \pm 0.18) $\times 10^{-4}$	S=1.5	349
e^+e^-	(7.36 \pm 0.15) $\times 10^{-5}$	S=1.5	391
$\pi^+\pi^-\pi^0\pi^0$	< 2 $\times 10^{-4}$	CL=90%	262
$\pi^+\pi^-\gamma$	< 3.6 $\times 10^{-3}$	CL=95%	366
$\pi^+\pi^-\pi^+\pi^-$	< 1 $\times 10^{-3}$	CL=90%	256
$\pi^0\pi^0\gamma$	(6.7 \pm 1.1) $\times 10^{-5}$		367
$\eta\pi^0\gamma$	< 3.3 $\times 10^{-5}$	CL=90%	162
$\mu^+\mu^-$	(7.4 \pm 1.8) $\times 10^{-5}$		377
3γ	< 1.9 $\times 10^{-4}$	CL=95%	391
Charge conjugation (C) violating modes			
$\eta\pi^0$	C < 2.2 $\times 10^{-4}$	CL=90%	162
$2\pi^0$	C < 2.2 $\times 10^{-4}$	CL=90%	367
$3\pi^0$	C < 2.3 $\times 10^{-4}$	CL=90%	330
invisible	< 7 $\times 10^{-5}$	CL=90%	–

$\eta'(958)$

$$J^{PC} = 0^+(0^{-+})$$

Mass $m = 957.78 \pm 0.06$ MeV

Full width $\Gamma = 0.188 \pm 0.006$ MeV

$\eta'(958)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	ρ (MeV/c)
$\pi^+\pi^-\eta$	(42.5 \pm 0.5) %		232
$\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$)	(29.5 \pm 0.4) %		165
$\pi^0\pi^0\eta$	(22.4 \pm 0.5) %		239
$\omega\gamma$	(2.52 \pm 0.07) %		159
ωe^+e^-	(2.0 \pm 0.4) $\times 10^{-4}$		159
$\gamma\gamma$	(2.307 \pm 0.033) %		479

$3\pi^0$		$(2.50 \pm 0.17) \times 10^{-3}$		430
$\mu^+ \mu^- \gamma$		$(1.13 \pm 0.28) \times 10^{-4}$		467
$\pi^+ \pi^- \mu^+ \mu^-$		$< 2.9 \times 10^{-5}$	90%	401
$\pi^+ \pi^- \pi^0$		$(3.61 \pm 0.17) \times 10^{-3}$		428
$(\pi^+ \pi^- \pi^0)$ S-wave		$(3.8 \pm 0.5) \times 10^{-3}$		428
$\pi^\mp \rho^\pm$		$(7.4 \pm 2.3) \times 10^{-4}$		106
$\pi^0 \rho^0$		$< 4 \%$	90%	111
$2(\pi^+ \pi^-)$		$(8.4 \pm 0.9) \times 10^{-5}$		372
$\pi^+ \pi^- 2\pi^0$		$(1.8 \pm 0.4) \times 10^{-4}$		376
$2(\pi^+ \pi^-)$ neutrals		$< 1 \%$	95%	–
$2(\pi^+ \pi^-) \pi^0$		$< 1.8 \times 10^{-3}$	90%	298
$2(\pi^+ \pi^-) 2\pi^0$		$< 1 \%$	95%	197
$3(\pi^+ \pi^-)$		$< 3.1 \times 10^{-5}$	90%	189
$K^\pm \pi^\mp$		$< 4 \times 10^{-5}$	90%	334
$\pi^+ \pi^- e^+ e^-$		$(2.4 \begin{smallmatrix} +1.3 \\ -1.0 \end{smallmatrix}) \times 10^{-3}$		458
$\pi^+ e^- \nu_e + \text{c.c.}$		$< 2.1 \times 10^{-4}$	90%	469
$\gamma e^+ e^-$		$(4.91 \pm 0.27) \times 10^{-4}$		479
$\pi^0 \gamma \gamma$		$(3.20 \pm 0.24) \times 10^{-3}$		469
$\pi^0 \gamma \gamma (\text{non resonant})$		$(6.2 \pm 0.9) \times 10^{-4}$		–
$\eta \gamma \gamma$		$< 1.33 \times 10^{-4}$	90%	322
$4\pi^0$		$< 3.2 \times 10^{-4}$	90%	380
$e^+ e^-$		$< 5.6 \times 10^{-9}$	90%	479
invisible		$< 6 \times 10^{-4}$	90%	–

**Charge conjugation (C), Parity (P),
Lepton family number (LF) violating modes**

$\pi^+ \pi^-$	P, CP	$< 1.8 \times 10^{-5}$	90%	458
$\pi^0 \pi^0$	P, CP	$< 4 \times 10^{-4}$	90%	459
$\pi^0 e^+ e^-$	C [g]	$< 1.4 \times 10^{-3}$	90%	469
$\eta e^+ e^-$	C [g]	$< 2.4 \times 10^{-3}$	90%	322
3γ	C	$< 1.0 \times 10^{-4}$	90%	479
$\mu^+ \mu^- \pi^0$	C [g]	$< 6.0 \times 10^{-5}$	90%	445
$\mu^+ \mu^- \eta$	C [g]	$< 1.5 \times 10^{-5}$	90%	273
$e\mu$	LF	$< 4.7 \times 10^{-4}$	90%	473

$f_0(980)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the review on "Scalar Mesons below 2 GeV."

Mass $m = 990 \pm 20$ MeV

Full width $\Gamma = 10$ to 100 MeV

$f_0(980)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi \pi$	seen	476

$K\bar{K}$	seen	36
$\gamma\gamma$	seen	495

 $a_0(980)$

$$I^G(J^{PC}) = 1^-(0^{++})$$

See the review on "Scalar Mesons below 2 GeV."

Mass $m = 980 \pm 20$ MeV

Full width $\Gamma = 50$ to 100 MeV

$a_0(980)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi$	seen	319
$K\bar{K}$	seen	†
$\rho\pi$	not seen	137
$\gamma\gamma$	seen	490

 $\phi(1020)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

Mass $m = 1019.461 \pm 0.016$ MeV

Full width $\Gamma = 4.249 \pm 0.013$ MeV ($S = 1.1$)

$\phi(1020)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
K^+K^-	(49.2 \pm 0.5) %	S=1.3	127
$K_L^0 K_S^0$	(34.0 \pm 0.4) %	S=1.3	110
$\rho\pi + \pi^+\pi^-\pi^0$	(15.24 \pm 0.33) %	S=1.2	—
$\eta\gamma$	(1.303 \pm 0.025) %	S=1.2	363
$\pi^0\gamma$	(1.30 \pm 0.05) $\times 10^{-3}$		501
$\ell^+\ell^-$	—		510
e^+e^-	(2.973 \pm 0.034) $\times 10^{-4}$	S=1.3	510
$\mu^+\mu^-$	(2.86 \pm 0.19) $\times 10^{-4}$		499
ηe^+e^-	(1.08 \pm 0.04) $\times 10^{-4}$		363
$\pi^+\pi^-$	(7.3 \pm 1.3) $\times 10^{-5}$		490
$\omega\pi^0$	(4.7 \pm 0.5) $\times 10^{-5}$		172
$\omega\gamma$	< 5 %	CL=84%	209
$\rho\gamma$	< 1.2 $\times 10^{-5}$	CL=90%	215
$\pi^+\pi^-\gamma$	(4.1 \pm 1.3) $\times 10^{-5}$		490
$f_0(980)\gamma$	(3.22 \pm 0.19) $\times 10^{-4}$	S=1.1	29
$\pi^0\pi^0\gamma$	(1.12 \pm 0.06) $\times 10^{-4}$		492
$\pi^+\pi^-\pi^+\pi^-$	(3.9 $\begin{smallmatrix} +2.8 \\ -2.2 \end{smallmatrix}$) $\times 10^{-6}$		410
$\pi^+\pi^+\pi^-\pi^-\pi^0$	< 4.6 $\times 10^{-6}$	CL=90%	342
$\pi^0 e^+ e^-$	(1.33 $\begin{smallmatrix} +0.07 \\ -0.10 \end{smallmatrix}$) $\times 10^{-5}$		501

$\pi^0 \eta \gamma$	$(7.27 \pm 0.30) \times 10^{-5}$	S=1.5	346
$a_0(980) \gamma$	$(7.6 \pm 0.6) \times 10^{-5}$		39
$K^0 \bar{K}^0 \gamma$	< 1.9	$\times 10^{-8}$ CL=90%	110
$\eta'(958) \gamma$	$(6.22 \pm 0.21) \times 10^{-5}$		60
$\eta \pi^0 \pi^0 \gamma$	< 2	$\times 10^{-5}$ CL=90%	293
$\mu^+ \mu^- \gamma$	$(1.4 \pm 0.5) \times 10^{-5}$		499
$\rho \gamma \gamma$	< 1.2	$\times 10^{-4}$ CL=90%	215
$\eta \pi^+ \pi^-$	< 1.8	$\times 10^{-5}$ CL=90%	288
$\eta \mu^+ \mu^-$	< 9.4	$\times 10^{-6}$ CL=90%	321
$\eta U \rightarrow \eta e^+ e^-$	< 1	$\times 10^{-6}$ CL=90%	—
invisible	< 1.7	$\times 10^{-4}$ CL=90%	—

Lepton Family number (LF) violating modes

$e^\pm \mu^\mp$	LF	< 2	$\times 10^{-6}$ CL=90%	504
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$h_1(1170)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

Mass $m = 1166 \pm 6$ MeV

Full width $\Gamma = 375 \pm 35$ MeV

$h_1(1170)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho \pi$	seen	305

$b_1(1235)$

$$I^G(J^{PC}) = 1^+(1^{+-})$$

Mass $m = 1229.5 \pm 3.2$ MeV (S = 1.6)

Full width $\Gamma = 142 \pm 9$ MeV (S = 1.2)

$b_1(1235)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\omega \pi$	seen		348
	[D/S amplitude ratio = 0.277 ± 0.027]		
$\pi^\pm \gamma$	$(1.6 \pm 0.4) \times 10^{-3}$		607
$\eta \rho$	seen		†
$\pi^+ \pi^+ \pi^- \pi^0$	< 50 %	84%	535
$K^*(892)^\pm K^\mp$	seen		†
$(K\bar{K})^\pm \pi^0$	< 8 %	90%	248
$K_S^0 K_L^0 \pi^\pm$	< 6 %	90%	235
$K_S^0 K_S^0 \pi^\pm$	< 2 %	90%	235
$\phi \pi$	< 1.5 %	84%	147

$a_1(1260)$ [i]

$$I^G(J^{PC}) = 1^-(1^{++})$$

Mass $m = 1230 \pm 40$ MeV [i]Full width $\Gamma = 250$ to 600 MeV

$a_1(1260)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
3π	seen	577
$(\rho\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi$	seen	353
$(\rho\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi$	seen	353
$(\rho(1450)\pi)_{S\text{-wave}}, \rho \rightarrow \pi\pi$	seen	†
$(\rho(1450)\pi)_{D\text{-wave}}, \rho \rightarrow \pi\pi$	seen	†
$f_0(500)\pi, f_0 \rightarrow \pi\pi$	seen	—
$f_0(980)\pi, f_0 \rightarrow \pi\pi$	not seen	179
$f_0(1370)\pi, f_0 \rightarrow \pi\pi$	seen	†
$f_2(1270)\pi, f_2 \rightarrow \pi\pi$	seen	†
$\pi^+\pi^-\pi^0$	seen	576
$\pi^0\pi^0\pi^0$	not seen	577
$KK\pi$	seen	250
$K^*(892)K$	seen	†
$\pi\gamma$	seen	608

 $f_2(1270)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass $m = 1275.5 \pm 0.8$ MeVFull width $\Gamma = 186.7^{+2.2}_{-2.5}$ MeV ($S = 1.4$)

$f_2(1270)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi\pi$	$(84.2^{+2.9}_{-0.9})\%$	S=1.1	623
$\pi^+\pi^-\pi^0$	$(7.7^{+1.1}_{-3.2})\%$	S=1.2	563
$K\bar{K}$	$(4.6^{+0.5}_{-0.4})\%$	S=2.7	404
$2\pi^+2\pi^-$	$(2.8 \pm 0.4)\%$	S=1.2	560
$\eta\eta$	$(4.0 \pm 0.8) \times 10^{-3}$	S=2.1	326
$4\pi^0$	$(3.0 \pm 1.0) \times 10^{-3}$		565
$\gamma\gamma$	$(1.42 \pm 0.24) \times 10^{-5}$	S=1.4	638
$\eta\pi\pi$	$< 8 \times 10^{-3}$	CL=95%	478
$K^0K^-\pi^+ + \text{c.c.}$	$< 3.4 \times 10^{-3}$	CL=95%	293
e^+e^-	$< 6 \times 10^{-10}$	CL=90%	638

$f_1(1285)$

$$J^{PC} = 0^+(1^{++})$$

 Mass $m = 1281.9 \pm 0.5$ MeV (S = 1.8)

 Full width $\Gamma = 22.7 \pm 1.1$ MeV (S = 1.5)

$f_1(1285)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
4π	$(32.7 \pm 1.9) \%$	S=1.2	568
$\pi^0 \pi^0 \pi^+ \pi^-$	$(21.8 \pm 1.3) \%$	S=1.2	566
$2\pi^+ 2\pi^-$	$(10.9 \pm 0.6) \%$	S=1.2	563
$\rho^0 \pi^+ \pi^-$	$(10.9 \pm 0.6) \%$	S=1.2	336
$\rho^0 \rho^0$	seen		†
$4\pi^0$	$< 7 \times 10^{-4}$	CL=90%	568
$\eta \pi^+ \pi^-$	$(35 \pm 15) \%$		479
$\eta \pi \pi$	$(52.2 \pm 2.0) \%$	S=1.2	482
$a_0(980)\pi$ [ignoring $a_0(980) \rightarrow K \bar{K}$]	$(38 \pm 4) \%$		238
$\eta \pi \pi$ [excluding $a_0(980)\pi$]	$(14 \pm 4) \%$		482
$K \bar{K} \pi$	$(9.0 \pm 0.4) \%$	S=1.1	308
$K \bar{K}^*(892)$	not seen		†
$\pi^+ \pi^- \pi^0$	$(3.0 \pm 0.9) \times 10^{-3}$		603
$\rho^\pm \pi^\mp$	$< 3.1 \times 10^{-3}$	CL=95%	390
$\gamma \rho^0$	$(6.1 \pm 1.0) \%$	S=1.7	406
$\phi \gamma$	$(7.4 \pm 2.6) \times 10^{-4}$		236
$e^+ e^-$	$< 9.4 \times 10^{-9}$	CL=90%	641

 $\eta(1295)$

$$J^{PC} = 0^+(0^{-+})$$

See the review on "Pseudoscalar and pseudovector mesons in the 1400 MeV region."

 Mass $m = 1294 \pm 4$ MeV (S = 1.6)

 Full width $\Gamma = 55 \pm 5$ MeV

$\eta(1295)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta \pi^+ \pi^-$	seen	487
$a_0(980)\pi$	seen	248
$\eta \pi^0 \pi^0$	seen	490
$\eta(\pi\pi)$ S-wave	seen	—

$\pi(1300)$

$$I^G(J^{PC}) = 1^-(0^{-+})$$

Mass $m = 1300 \pm 100$ MeV [j]Full width $\Gamma = 200$ to 600 MeV

$\pi(1300)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	404
$\pi(\pi\pi)_{S\text{-wave}}$	seen	–

 $a_2(1320)$

$$I^G(J^{PC}) = 1^-(2^{++})$$

Mass $m = 1316.9 \pm 0.9$ MeV ($S = 1.9$)Full width $\Gamma = 107 \pm 5$ MeV [j]

$a_2(1320)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
3π	(70.1 \pm 2.7) %	S=1.2	623
$\eta\pi$	(14.5 \pm 1.2) %		535
$\omega\pi\pi$	(10.6 \pm 3.2) %	S=1.3	364
$K\bar{K}$	(4.9 \pm 0.8) %		436
$\eta'(958)\pi$	(5.5 \pm 0.9) $\times 10^{-3}$		287
$\pi^\pm\gamma$	(2.91 \pm 0.27) $\times 10^{-3}$		651
$\gamma\gamma$	(9.4 \pm 0.7) $\times 10^{-6}$		658
e^+e^-	< 5 $\times 10^{-9}$	CL=90%	658

 $f_0(1370)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the review on "Scalar Mesons below 2 GeV."

Mass $m = 1200$ to 1500 MeVFull width $\Gamma = 200$ to 500 MeV

$f_0(1370)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	seen	672
4π	seen	617
$4\pi^0$	seen	617
$2\pi^+2\pi^-$	seen	612
$\pi^+\pi^-2\pi^0$	seen	615
$\rho\rho$	seen	†
$2(\pi\pi)_{S\text{-wave}}$	seen	–
$\pi(1300)\pi$	seen	†

$a_1(1260)\pi$	seen	35
$\eta\eta$	seen	411
$K\bar{K}$	seen	475
$K\bar{K}n\pi$	not seen	†
6π	not seen	508
$\omega\omega$	not seen	†
$\gamma\gamma$	seen	685
e^+e^-	not seen	685

$\pi_1(1400)^{[k]}$

$$I^G(J^{PC}) = 1^-(1^-+)$$

See the review on "Non- $q\bar{q}$ Mesons."

Mass $m = 1354 \pm 25$ MeV (S = 1.8)

Full width $\Gamma = 330 \pm 35$ MeV

$\pi_1(1400)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi^0$	seen	557
$\eta\pi^-$	seen	556
$\rho(770)\pi$	not seen	442

$\eta(1405)$

$$I^G(J^{PC}) = 0^+(0^-+)$$

See the review on "Pseudoscalar and Pseudovector Mesons in the 1400 MeV Region."

Mass $m = 1408.8 \pm 2.0$ MeV (S = 2.2)

Full width $\Gamma = 50.1 \pm 2.6$ MeV (S = 1.7)

$\eta(1405)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K\bar{K}\pi$	seen		424
$\eta\pi\pi$	seen		562
$a_0(980)\pi$	seen		345
$\eta(\pi\pi)$ S-wave	seen		—
$f_0(980)\pi^0 \rightarrow \pi^+\pi^-\pi^0$	not seen		—
$f_0(980)\eta$	seen		†
4π	seen		639
$\rho\rho$	<58 %	99.85%	†
$\rho^0\gamma$	seen		491
$K^*(892)K$	seen		123

$h_1(1415)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

was $h_1(1380)$

Mass $m = 1416 \pm 8$ MeV ($S = 1.5$)

Full width $\Gamma = 90 \pm 15$ MeV

 $f_1(1420)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

See the review on "Pseudoscalar and Pseudovector Mesons in the 1400 MeV Region."

Mass $m = 1426.3 \pm 0.9$ MeV ($S = 1.1$)

Full width $\Gamma = 54.5 \pm 2.6$ MeV

 $f_1(1420)$ DECAY MODES

	Fraction (Γ_i/Γ)	p (MeV/c)
$K\bar{K}\pi$	seen	438
$K\bar{K}^*(892) + \text{c.c.}$	seen	163
$\eta\pi\pi$	possibly seen	573
$\phi\gamma$	seen	349

 $\omega(1420)$ [1]

$$I^G(J^{PC}) = 0^-(1^{--})$$

Mass $m = 1410 \pm 60$ MeV [1]

Full width $\Gamma = 290 \pm 190$ MeV [1]

 $\omega(1420)$ DECAY MODES

	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	480
$\omega\pi\pi$	seen	437
$b_1(1235)\pi$	seen	112
e^+e^-	seen	705

 $a_0(1450)$

$$I^G(J^{PC}) = 1^-(0^{++})$$

See the review on "Scalar Mesons below 2 GeV."

Mass $m = 1474 \pm 19$ MeV

Full width $\Gamma = 265 \pm 13$ MeV

 $a_0(1450)$ DECAY MODES

	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\eta$	0.093 ± 0.020	627

$\pi \eta'(958)$	0.033 ± 0.017	410
$K \bar{K}$	0.082 ± 0.028	547
$\omega \pi \pi$	DEFINED AS 1	484
$a_0(980) \pi \pi$	seen	342
$\gamma \gamma$	seen	737

 $\rho(1450)$

$$I^G(J^{PC}) = 1^+(1^{--})$$

See the note in $\rho(1450)$ Particle Listings.

$$\text{Mass } m = 1465 \pm 25 \text{ MeV } [j]$$

$$\text{Full width } \Gamma = 400 \pm 60 \text{ MeV } [j]$$

$\rho(1450)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi \pi$	seen	720
$\pi^+ \pi^-$	seen	719
4π	seen	669
$e^+ e^-$	seen	732
$\eta \rho$	seen	311
$a_2(1320) \pi$	not seen	58
$K \bar{K}$	seen	541
$K^+ K^-$	seen	541
$K \bar{K}^*(892) + \text{c.c.}$	possibly seen	229
$\eta \gamma$	seen	630
$f_0(500) \gamma$	not seen	—
$f_0(980) \gamma$	not seen	398
$f_0(1370) \gamma$	not seen	92
$f_2(1270) \gamma$	not seen	177

 $\eta(1475)$

$$I^G(J^{PC}) = 0^+(0^{-+})$$

See the review on "Pseudoscalar and Pseudovector Mesons in the 1400 MeV Region."

$$\text{Mass } m = 1475 \pm 4 \text{ MeV } (S = 1.4)$$

$$\text{Full width } \Gamma = 90 \pm 9 \text{ MeV } (S = 1.6)$$

$\eta(1475)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K \bar{K} \pi$	seen	477
$K \bar{K}^*(892) + \text{c.c.}$	seen	244
$a_0(980) \pi$	seen	396

$\gamma\gamma$	seen	738
$K_S^0 K_S^0 \eta$	possibly seen	†
$\gamma\phi(1020)$	possibly seen	385

$f_0(1500)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the reviews on "Scalar Mesons below 2 GeV" and on "Non- $q\bar{q}$ Mesons".

$$\text{Mass } m = 1506 \pm 6 \text{ MeV} \quad (S = 1.4)$$

$$\text{Full width } \Gamma = 112 \pm 9 \text{ MeV}$$

$f_0(1500)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	ρ (MeV/c)
$\pi\pi$	(34.5±2.2) %	1.2	741
$\pi^+\pi^-$	seen		740
$2\pi^0$	seen		741
4π	(48.9±3.3) %	1.2	692
$4\pi^0$	seen		692
$2\pi^+2\pi^-$	seen		687
$2(\pi\pi)_{S\text{-wave}}$	seen		—
$\rho\rho$	seen		†
$\pi(1300)\pi$	seen		145
$a_1(1260)\pi$	seen		219
$\eta\eta$	(6.0±0.9) %	1.1	517
$\eta\eta'(958)$	(2.2±0.8) %	1.4	20
$K\bar{K}$	(8.5±1.0) %	1.1	569
$\gamma\gamma$	not seen		753

$f'_2(1525)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

$$\text{Mass } m = 1517.4 \pm 2.5 \text{ MeV} \quad (S = 2.8)$$

$$\text{Full width } \Gamma = 86 \pm 5 \text{ MeV} \quad (S = 2.2)$$

$f'_2(1525)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	ρ (MeV/c)
$K\bar{K}$	(87.6±2.2) %	1.1	576
$\eta\eta$	(11.6±2.2) %	1.1	525
$\pi\pi$	(8.3±1.6) × 10 ⁻³		747
$\gamma\gamma$	(9.5±1.1) × 10 ⁻⁷	1.1	759

$\pi_1(1600)$

$$I^G(J^{PC}) = 1^-(1^-+)$$

See the review on "Non- $q\bar{q}$ Mesons" and a note in PDG 06, Journal of Physics **G33** 1 (2006).

$$\text{Mass } m = 1660^{+15}_{-11} \text{ MeV} \quad (S = 1.2)$$

$$\text{Full width } \Gamma = 257 \pm 60 \text{ MeV} \quad (S = 1.9)$$

$\pi_1(1600)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi\pi$	seen	802
$\rho^0\pi^-$	seen	640
$f_2(1270)\pi^-$	not seen	316
$b_1(1235)\pi$	seen	355
$\eta'(958)\pi^-$	seen	542
$f_1(1285)\pi$	seen	312

 $a_1(1640)$

$$I^G(J^{PC}) = 1^-(1^{++})$$

$$\text{Mass } m = 1655 \pm 16 \text{ MeV} \quad (S = 1.2)$$

$$\text{Full width } \Gamma = 254 \pm 40 \text{ MeV} \quad (S = 1.8)$$

$a_1(1640)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi\pi$	seen	800
$f_2(1270)\pi$	seen	314
$\sigma\pi$	seen	—
$\rho\pi$ <i>S-wave</i>	seen	638
$\rho\pi$ <i>D-wave</i>	seen	638
$\omega\pi\pi$	seen	607
$f_1(1285)\pi$	seen	309
$a_1(1260)\eta$	not seen	†

 $\eta_2(1645)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

$$\text{Mass } m = 1617 \pm 5 \text{ MeV}$$

$$\text{Full width } \Gamma = 181 \pm 11 \text{ MeV}$$

$\eta_2(1645)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$a_2(1320)\pi$	seen	243
$K\bar{K}\pi$	seen	580
$K^*\bar{K}$	seen	404

$\eta\pi^+\pi^-$	seen	685
$a_0(980)\pi$	seen	499
$f_2(1270)\eta$	not seen	†

 $\omega(1650)$ [n]

$$J^{PC} = 0^-(1^--)$$

 Mass $m = 1670 \pm 30$ MeV [j]

 Full width $\Gamma = 315 \pm 35$ MeV [j]

$\omega(1650)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	647
$\omega\pi\pi$	seen	617
$\omega\eta$	seen	500
e^+e^-	seen	835
$\pi^0\gamma$	not seen	830

 $\omega_3(1670)$

$$J^{PC} = 0^-(3^--)$$

 Mass $m = 1667 \pm 4$ MeV

 Full width $\Gamma = 168 \pm 10$ MeV

$\omega_3(1670)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	645
$\omega\pi\pi$	seen	615
$b_1(1235)\pi$	possibly seen	361

 $\pi_2(1670)$

$$J^{PC} = 1^-(2^-+)$$

 Mass $m = 1670.6^{+2.9}_{-1.2}$ MeV ($S = 1.3$)

 Full width $\Gamma = 258^{+8}_{-9}$ MeV ($S = 1.2$)

$\pi_2(1670)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
3π	(95.8±1.4) %		808
$f_2(1270)\pi$	(56.3±3.2) %		327
$\rho\pi$	(31 ±4) %		647
$\sigma\pi$	(10 ±4) %		—
$\pi(\pi\pi)_{S\text{-wave}}$	(8.7±3.4) %		—
$\pi^\pm\pi^+\pi^-$	(53 ±4) %		806
$K\bar{K}^*(892) + \text{c.c.}$	(4.2±1.4) %		453
$\omega\rho$	(2.7±1.1) %		302

$\pi^\pm \gamma$	$(7.0 \pm 1.2) \times 10^{-4}$		829
$\gamma \gamma$	$< 2.8 \times 10^{-7}$	90%	835
$\eta \pi$	$< 5 \%$		739
$\pi^\pm 2\pi^+ 2\pi^-$	$< 5 \%$		735
$\rho(1450)\pi$	$< 3.6 \times 10^{-3}$	97.7%	145
$b_1(1235)\pi$	$< 1.9 \times 10^{-3}$	97.7%	364
$f_1(1285)\pi$	possibly seen		322
$a_2(1320)\pi$	not seen		292

$\phi(1680)$

$$J^G(J^{PC}) = 0^-(1^{--})$$

Mass $m = 1680 \pm 20$ MeV [j]

Full width $\Gamma = 150 \pm 50$ MeV [j]

$\phi(1680)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K \bar{K}^*(892) + \text{c.c.}$	seen	462
$K_S^0 K \pi$	seen	621
$K \bar{K}$	seen	680
$e^+ e^-$	seen	840
$\omega \pi \pi$	not seen	623
$K^+ K^- \pi^+ \pi^-$	seen	544
$\eta \phi$	seen	290
$\eta \gamma$	seen	751

$\rho_3(1690)$

$$J^G(J^{PC}) = 1^+(3^{--})$$

Mass $m = 1688.8 \pm 2.1$ MeV

Full width $\Gamma = 161 \pm 10$ MeV ($S = 1.5$)

$\rho_3(1690)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
4π	$(71.1 \pm 1.9) \%$		790
$\pi^\pm \pi^+ \pi^- \pi^0$	$(67 \pm 22) \%$		787
$\omega \pi$	$(16 \pm 6) \%$		655
$\pi \pi$	$(23.6 \pm 1.3) \%$		834
$K \bar{K} \pi$	$(3.8 \pm 1.2) \%$		629
$K \bar{K}$	$(1.58 \pm 0.26) \%$	1.2	685
$\eta \pi^+ \pi^-$	seen		727
$\rho(770)\eta$	seen		520
$\pi \pi \rho$	seen		633
$a_2(1320)\pi$	seen		308
$\rho \rho$	seen		335

$\rho(1700)$

$$J^{PC} = 1^{+}(1^{-}-)$$

See the note in $\rho(1700)$ Particle Listings.Mass $m = 1720 \pm 20$ MeV [*j*] ($\eta\rho^0$ and $\pi^+\pi^-$ modes)Full width $\Gamma = 250 \pm 100$ MeV [*j*] ($\eta\rho^0$ and $\pi^+\pi^-$ modes)

$\rho(1700)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$2(\pi^+\pi^-)$	seen	803
$\rho\pi\pi$	seen	653
$\rho^0\pi^+\pi^-$	seen	651
$\rho^\pm\pi^\mp\pi^0$	seen	652
$a_1(1260)\pi$	seen	404
$h_1(1170)\pi$	seen	450
$\pi(1300)\pi$	seen	349
$\rho\rho$	seen	372
$\pi^+\pi^-$	seen	849
$\pi\pi$	seen	849
$K\bar{K}^*(892) + \text{c.c.}$	seen	496
$\eta\rho$	seen	545
$a_2(1320)\pi$	not seen	335
$K\bar{K}$	seen	704
e^+e^-	seen	860
$\pi^0\omega$	seen	674
$\pi^0\gamma$	not seen	855

 $a_2(1700)$

$$J^{PC} = 1^{-}(2^{++})$$

Mass $m = 1705 \pm 40$ MeVFull width $\Gamma = 258 \pm 40$ MeV

$a_2(1700)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi$	$(3.7 \pm 1.0) \%$	758
$\gamma\gamma$	$(1.16 \pm 0.27) \times 10^{-6}$	852
$\rho\pi$	seen	668
$f_2(1270)\pi$	seen	356
$K\bar{K}$	$(1.9 \pm 1.2) \%$	695
$\omega\pi^-\pi^0$	seen	638
$\omega\rho$	seen	346

$f_0(1710)$

$$I^G(J^{PC}) = 0^+(0^{++})$$

See the review on "Non- $q\bar{q}$ Mesons."Mass $m = 1704 \pm 12$ MeVFull width $\Gamma = 123 \pm 18$ MeV

$f_0(1710)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\bar{K}$	seen	694
$\eta\eta$	seen	652
$\pi\pi$	seen	841
$\gamma\gamma$	seen	852
$\omega\omega$	seen	337

 $\pi(1800)$

$$I^G(J^{PC}) = 1^-(0^{-+})$$

Mass $m = 1810^{+9}_{-11}$ MeV ($S = 2.2$)Full width $\Gamma = 215^{+7}_{-8}$ MeV

$\pi(1800)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi^+\pi^-\pi^-$	seen	878
$f_0(500)\pi^-$	seen	—
$f_0(980)\pi^-$	seen	624
$f_0(1370)\pi^-$	seen	366
$f_0(1500)\pi^-$	not seen	247
$\rho\pi^-$	not seen	731
$\eta\eta\pi^-$	seen	660
$a_0(980)\eta$	seen	471
$a_2(1320)\eta$	not seen	†
$f_2(1270)\pi$	not seen	441
$f_0(1370)\pi^-$	not seen	366
$f_0(1500)\pi^-$	seen	247
$\eta\eta'(958)\pi^-$	seen	373
$K_0^*(1430)K^-$	seen	†
$K^*(892)K^-$	not seen	568

 $\phi_3(1850)$

$$I^G(J^{PC}) = 0^-(3^{--})$$

Mass $m = 1854 \pm 7$ MeVFull width $\Gamma = 87^{+28}_{-23}$ MeV ($S = 1.2$)

$\phi_3(1850)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\bar{K}$	seen	785
$K\bar{K}^*(892)+$ c.c.	seen	602

 $\eta_2(1870)$

$$I^G(J^{PC}) = 0^+(2^-+)$$

Mass $m = 1842 \pm 8$ MeVFull width $\Gamma = 225 \pm 14$ MeV

$\eta_2(1870)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\gamma\gamma$	seen	921

 $\pi_2(1880)$

$$I^G(J^{PC}) = 1^-(2^-+)$$

Mass $m = 1874_{-5}^{+26}$ MeV ($S = 1.6$)Full width $\Gamma = 237_{-30}^{+33}$ MeV ($S = 1.2$) **$f_2(1950)$**

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass $m = 1936 \pm 12$ MeV ($S = 1.3$)Full width $\Gamma = 464 \pm 24$ MeV

$f_2(1950)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K^*(892)\bar{K}^*(892)$	seen	377
$\pi^+\pi^-$	seen	958
$\pi^0\pi^0$	seen	959
4π	seen	921
$\eta\eta$	seen	798
$K\bar{K}$	seen	833
$\gamma\gamma$	seen	968
$p\bar{p}$	seen	238

 $a_4(1970)$

$$I^G(J^{PC}) = 1^-(4^{++})$$

was $a_4(2040)$ Mass $m = 1967 \pm 16$ MeV ($S = 2.1$)Full width $\Gamma = 324_{-18}^{+15}$ MeV

$a_4(1970)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\bar{K}$	seen	851
$\pi^+\pi^-\pi^0$	seen	959
$\rho\pi$	seen	825
$f_2(1270)\pi$	seen	559
$\omega\pi^-\pi^0$	seen	801
$\omega\rho$	seen	601
$\eta\pi$	seen	902
$\eta'(958)\pi$	seen	743

 $f_2(2010)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

 Mass $m = 2011^{+60}_{-80}$ MeV

 Full width $\Gamma = 202 \pm 60$ MeV

$f_2(2010)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\phi\phi$	seen	†
$K\bar{K}$	seen	876

 $f_4(2050)$

$$I^G(J^{PC}) = 0^+(4^{++})$$

 Mass $m = 2018 \pm 11$ MeV ($S = 2.1$)

 Full width $\Gamma = 237 \pm 18$ MeV ($S = 1.9$)

$f_4(2050)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega\omega$	seen	637
$\pi\pi$	$(17.0 \pm 1.5)\%$	1000
$K\bar{K}$	$(6.8^{+3.4}_{-1.8}) \times 10^{-3}$	880
$\eta\eta$	$(2.1 \pm 0.8) \times 10^{-3}$	848
$4\pi^0$	$< 1.2\%$	964
$a_2(1320)\pi$	seen	568

 $\phi(2170)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

 Mass $m = 2160 \pm 80$ MeV [j]

 Full width $\Gamma = 125 \pm 65$ MeV [j]

$\phi(2170)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
e^+e^-	seen	1080

$\phi f_0(980)$	seen	396
$K^+ K^- f_0(980) \rightarrow$	seen	—
$K^+ K^- \pi^+ \pi^-$		
$K^+ K^- f_0(980) \rightarrow K^+ K^- \pi^0 \pi^0$	seen	—
$K^{*0} K^\pm \pi^\mp$	not seen	759
$K^*(892)^0 \bar{K}^*(892)^0$	not seen	609

$f_2(2300)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass $m = 2297 \pm 28$ MeV

Full width $\Gamma = 149 \pm 40$ MeV

$f_2(2300)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\phi\phi$	seen	529
$K\bar{K}$	seen	1037
$\gamma\gamma$	seen	1149

$f_2(2340)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass $m = 2345^{+50}_{-40}$ MeV

Full width $\Gamma = 322^{+70}_{-60}$ MeV

$f_2(2340)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\phi\phi$	seen	580
$\eta\eta$	seen	1037

STRANGE MESONS

($S = \pm 1, C = B = 0$)

$K^+ = u\bar{s}, K^0 = d\bar{s}, \bar{K}^0 = \bar{d}s, K^- = \bar{u}s,$ similarly for K^* 's

K^\pm

$$I(J^P) = \frac{1}{2}(0^-)$$

Mass $m = 493.677 \pm 0.016$ MeV [o] ($S = 2.8$)

Mean life $\tau = (1.2380 \pm 0.0020) \times 10^{-8}$ s ($S = 1.8$)

$c\tau = 3.711$ m

CPT violation parameters ($\Delta = \text{rate difference/sum}$)

$$\Delta(K^\pm \rightarrow \mu^\pm \nu_\mu) = (-0.27 \pm 0.21)\%$$

$$\Delta(K^\pm \rightarrow \pi^\pm \pi^0) = (0.4 \pm 0.6)\% [p]$$

CP violation parameters (Δ = rate difference/sum)

$$\Delta(K^\pm \rightarrow \pi^\pm e^+ e^-) = (-2.2 \pm 1.6) \times 10^{-2}$$

$$\Delta(K^\pm \rightarrow \pi^\pm \mu^+ \mu^-) = 0.010 \pm 0.023$$

$$\Delta(K^\pm \rightarrow \pi^\pm \pi^0 \gamma) = (0.0 \pm 1.2) \times 10^{-3}$$

$$\Delta(K^\pm \rightarrow \pi^\pm \pi^+ \pi^-) = (0.04 \pm 0.06)\%$$

$$\Delta(K^\pm \rightarrow \pi^\pm \pi^0 \pi^0) = (-0.02 \pm 0.28)\%$$

T violation parameters

$$K^+ \rightarrow \pi^0 \mu^+ \nu_\mu \quad P_T = (-1.7 \pm 2.5) \times 10^{-3}$$

$$K^+ \rightarrow \mu^+ \nu_\mu \gamma \quad P_T = (-0.6 \pm 1.9) \times 10^{-2}$$

$$K^+ \rightarrow \pi^0 \mu^+ \nu_\mu \quad \text{Im}(\xi) = -0.006 \pm 0.008$$

Slope parameter g [q]

(See Particle Listings for quadratic coefficients and alternative parametrization related to $\pi\pi$ scattering)

$$K^\pm \rightarrow \pi^\pm \pi^+ \pi^- \quad g = -0.21134 \pm 0.00017$$

$$(g_+ - g_-) / (g_+ + g_-) = (-1.5 \pm 2.2) \times 10^{-4}$$

$$K^\pm \rightarrow \pi^\pm \pi^0 \pi^0 \quad g = 0.626 \pm 0.007$$

$$(g_+ - g_-) / (g_+ + g_-) = (1.8 \pm 1.8) \times 10^{-4}$$

 K^\pm decay form factors [a,r]

Assuming μ - e universality

$$\lambda_+(K_{\mu 3}^+) = \lambda_+(K_{e 3}^+) = (2.959 \pm 0.025) \times 10^{-2}$$

$$\lambda_0(K_{\mu 3}^+) = (1.76 \pm 0.25) \times 10^{-2} \quad (S = 2.7)$$

Not assuming μ - e universality

$$\lambda_+(K_{e 3}^+) = (2.956 \pm 0.025) \times 10^{-2}$$

$$\lambda_+(K_{\mu 3}^+) = (3.09 \pm 0.25) \times 10^{-2} \quad (S = 1.5)$$

$$\lambda_0(K_{\mu 3}^+) = (1.73 \pm 0.27) \times 10^{-2} \quad (S = 2.6)$$

$K_{e 3}$ form factor quadratic fit

$$\lambda'_+(K_{e 3}^\pm) \text{ linear coeff.} = (2.59 \pm 0.04) \times 10^{-2}$$

$$\lambda''_+(K_{e 3}^\pm) \text{ quadratic coeff.} = (0.186 \pm 0.021) \times 10^{-2}$$

$$\lambda'_+(\text{LINEAR } K_{\mu 3}^\pm \text{ FORM FACTOR FROM QUADRATIC FIT})$$

$$= (24 \pm 4) \times 10^{-3}$$

$$\lambda''_+(\text{QUADRATIC } K_{\mu 3}^\pm \text{ FORM FACTOR}) = (1.8 \pm 1.5) \times 10^{-3}$$

$$\begin{aligned}
 M_V \text{ (VECTOR POLE MASS FOR } K_{e3}^\pm \text{ DECAY)} &= 890.3 \pm 2.8 \text{ MeV} \\
 M_V \text{ (VECTOR POLE MASS FOR } K_{\mu3}^\pm \text{ DECAY)} &= 878 \pm 12 \text{ MeV} \\
 M_S \text{ (SCALAR POLE MASS FOR } K_{\mu3}^\pm \text{ DECAY)} &= 1215 \pm 50 \text{ MeV} \\
 \Lambda_+ \text{ (DISPERSIVE VECTOR FORM FACTOR IN } K_{e3}^\pm \text{ DECAY)} &= (2.460 \pm 0.017) \times 10^{-2} \\
 \Lambda_+ \text{ (DISPERSIVE VECTOR FORM FACTOR IN } K_{\mu3}^\pm \text{ DECAY)} &= (25.4 \pm 0.9) \times 10^{-3} \\
 \ln(C) \text{ (DISPERSIVE SCALAR FORM FACTOR in } K_{\mu3}^\pm \text{ decays)} &= (182 \pm 16) \times 10^{-3} \\
 K_{e3}^+ \quad |f_S/f_+| &= (-0.08^{+0.34}_{-0.40}) \times 10^{-2} \\
 K_{e3}^+ \quad |f_T/f_+| &= (-1.2^{+1.3}_{-1.1}) \times 10^{-2} \\
 K_{\mu3}^+ \quad |f_S/f_+| &= (0.2 \pm 0.6) \times 10^{-2} \\
 K_{\mu3}^+ \quad |f_T/f_+| &= (-0.1 \pm 0.7) \times 10^{-2} \\
 K^+ \rightarrow e^+ \nu_e \gamma \quad |F_A + F_V| &= 0.133 \pm 0.008 \quad (S = 1.3) \\
 K^+ \rightarrow \mu^+ \nu_\mu \gamma \quad |F_A + F_V| &= 0.165 \pm 0.013 \\
 K^+ \rightarrow e^+ \nu_e \gamma \quad |F_A - F_V| &< 0.49, \text{ CL} = 90\% \\
 K^+ \rightarrow \mu^+ \nu_\mu \gamma \quad |F_A - F_V| &= -0.153 \pm 0.033 \quad (S = 1.1)
 \end{aligned}$$

Charge radius

$$\langle r \rangle = 0.560 \pm 0.031 \text{ fm}$$

Forward-backward asymmetry

$$\begin{aligned}
 A_{FB}(K_{\pi\mu\mu}^\pm) &= \frac{\Gamma(\cos(\theta_{K\mu}) > 0) - \Gamma(\cos(\theta_{K\mu}) < 0)}{\Gamma(\cos(\theta_{K\mu}) > 0) + \Gamma(\cos(\theta_{K\mu}) < 0)} < 2.3 \times 10^{-2}, \text{ CL} \\
 &= 90\%
 \end{aligned}$$

K^- modes are charge conjugates of the modes below.

K^+ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level (MeV/c)	p
Leptonic and semileptonic modes			
$e^+ \nu_e$	$(1.582 \pm 0.007) \times 10^{-5}$		247
$\mu^+ \nu_\mu$	$(63.56 \pm 0.11) \%$	S=1.2	236
$\pi^0 e^+ \nu_e$	$(5.07 \pm 0.04) \%$	S=2.1	228
Called K_{e3}^+ .			
$\pi^0 \mu^+ \nu_\mu$	$(3.352 \pm 0.033) \%$	S=1.9	215
Called $K_{\mu3}^+$.			
$\pi^0 \pi^0 e^+ \nu_e$	$(2.55 \pm 0.04) \times 10^{-5}$	S=1.1	206
$\pi^+ \pi^- e^+ \nu_e$	$(4.247 \pm 0.024) \times 10^{-5}$		203

$\pi^+ \pi^- \mu^+ \nu_\mu$	(1.4 ± 0.9) × 10 ⁻⁵	151
$\pi^0 \pi^0 \pi^0 e^+ \nu_e$	< 3.5 × 10 ⁻⁶ CL=90%	135

Hadronic modes

$\pi^+ \pi^0$	(20.67 ± 0.08) %	S=1.2	205
$\pi^+ \pi^0 \pi^0$	(1.760 ± 0.023) %	S=1.1	133
$\pi^+ \pi^+ \pi^-$	(5.583 ± 0.024) %		125

Leptonic and semileptonic modes with photons

$\mu^+ \nu_\mu \gamma$	[s,t] (6.2 ± 0.8) × 10 ⁻³	236
$\mu^+ \nu_\mu \gamma (SD^+)$	[a,u] (1.33 ± 0.22) × 10 ⁻⁵	–
$\mu^+ \nu_\mu \gamma (SD^+INT)$	[a,u] < 2.7 × 10 ⁻⁵ CL=90%	–
$\mu^+ \nu_\mu \gamma (SD^- + SD^-INT)$	[a,u] < 2.6 × 10 ⁻⁴ CL=90%	–
$e^+ \nu_e \gamma$	(9.4 ± 0.4) × 10 ⁻⁶	247
$\pi^0 e^+ \nu_e \gamma$	[s,t] (2.56 ± 0.16) × 10 ⁻⁴	228
$\pi^0 e^+ \nu_e \gamma (SD)$	[a,u] < 5.3 × 10 ⁻⁵ CL=90%	228
$\pi^0 \mu^+ \nu_\mu \gamma$	[s,t] (1.25 ± 0.25) × 10 ⁻⁵	215
$\pi^0 \pi^0 e^+ \nu_e \gamma$	< 5 × 10 ⁻⁶ CL=90%	206

Hadronic modes with photons or $\ell\bar{\ell}$ pairs

$\pi^+ \pi^0 \gamma (INT)$	(– 4.2 ± 0.9) × 10 ⁻⁶	–
$\pi^+ \pi^0 \gamma (DE)$	[s,v] (6.0 ± 0.4) × 10 ⁻⁶	205
$\pi^+ \pi^0 e^+ e^-$	(4.24 ± 0.14) × 10 ⁻⁶	205
$\pi^+ \pi^0 \pi^0 \gamma$	[s,t] (7.6 $\begin{smallmatrix} +6.0 \\ -3.0 \end{smallmatrix}$) × 10 ⁻⁶	133
$\pi^+ \pi^+ \pi^- \gamma$	[s,t] (7.1 ± 0.5) × 10 ⁻⁶	125
$\pi^+ \gamma \gamma$	[s] (1.01 ± 0.06) × 10 ⁻⁶	227
$\pi^+ 3\gamma$	[s] < 1.0 × 10 ⁻⁴ CL=90%	227
$\pi^+ e^+ e^- \gamma$	(1.19 ± 0.13) × 10 ⁻⁸	227

Leptonic modes with $\ell\bar{\ell}$ pairs

$e^+ \nu_e \nu\bar{\nu}$	< 6 × 10 ⁻⁵ CL=90%	247
$\mu^+ \nu_\mu \nu\bar{\nu}$	< 2.4 × 10 ⁻⁶ CL=90%	236
$e^+ \nu_e e^+ e^-$	(2.48 ± 0.20) × 10 ⁻⁸	247
$\mu^+ \nu_\mu e^+ e^-$	(7.06 ± 0.31) × 10 ⁻⁸	236
$e^+ \nu_e \mu^+ \mu^-$	(1.7 ± 0.5) × 10 ⁻⁸	223
$\mu^+ \nu_\mu \mu^+ \mu^-$	< 4.1 × 10 ⁻⁷ CL=90%	185

Lepton family number (LF), Lepton number (L), $\Delta S = \Delta Q$ (SQ) violating modes, or $\Delta S = 1$ weak neutral current (S1) modes

$\pi^+ \pi^+ e^- \bar{\nu}_e$	SQ	< 1.3 × 10 ⁻⁸ CL=90%	203
$\pi^+ \pi^+ \mu^- \bar{\nu}_\mu$	SQ	< 3.0 × 10 ⁻⁶ CL=95%	151
$\pi^+ e^+ e^-$	S1	(3.00 ± 0.09) × 10 ⁻⁷	227
$\pi^+ \mu^+ \mu^-$	S1	(9.4 ± 0.6) × 10 ⁻⁸ S=2.6	172
$\pi^+ \nu\bar{\nu}$	S1	(1.7 ± 1.1) × 10 ⁻¹⁰	227
$\pi^+ \pi^0 \nu\bar{\nu}$	S1	< 4.3 × 10 ⁻⁵ CL=90%	205

$\mu^- \nu e^+ e^+$	<i>LF</i>	<	2.1	$\times 10^{-8}$	CL=90%	236
$\mu^+ \nu_e$	<i>LF</i>	[<i>d</i>]	<	4	$\times 10^{-3}$	CL=90% 236
$\pi^+ \mu^+ e^-$	<i>LF</i>	<	1.3	$\times 10^{-11}$	CL=90%	214
$\pi^+ \mu^- e^+$	<i>LF</i>	<	5.2	$\times 10^{-10}$	CL=90%	214
$\pi^- \mu^+ e^+$	<i>L</i>	<	5.0	$\times 10^{-10}$	CL=90%	214
$\pi^- e^+ e^+$	<i>L</i>	<	2.2	$\times 10^{-10}$	CL=90%	227
$\pi^- \mu^+ \mu^+$	<i>L</i>	<	4.2	$\times 10^{-11}$	CL=90%	172
$\mu^+ \bar{\nu}_e$	<i>L</i>	[<i>d</i>]	<	3.3	$\times 10^{-3}$	CL=90% 236
$\pi^0 e^+ \bar{\nu}_e$	<i>L</i>	<	3	$\times 10^{-3}$	CL=90%	228
$\pi^+ \gamma$		[<i>x</i>]	<	2.3	$\times 10^{-9}$	CL=90% 227

K^0

$$I(J^P) = \frac{1}{2}(0^-)$$

50% K_S , 50% K_L

$$\text{Mass } m = 497.611 \pm 0.013 \text{ MeV} \quad (S = 1.2)$$

$$m_{K^0} - m_{K^\pm} = 3.934 \pm 0.020 \text{ MeV} \quad (S = 1.6)$$

Mean square charge radius

$$\langle r^2 \rangle = -0.077 \pm 0.010 \text{ fm}^2$$

***T*-violation parameters in K^0 - \bar{K}^0 mixing [*r*]**

$$\text{Asymmetry } A_T \text{ in } K^0\text{-}\bar{K}^0 \text{ mixing} = (6.6 \pm 1.6) \times 10^{-3}$$

***CP*-violation parameters**

$$\text{Re}(\epsilon) = (1.596 \pm 0.013) \times 10^{-3}$$

***CPT*-violation parameters [*r*]**

$$\text{Re } \delta = (2.5 \pm 2.3) \times 10^{-4}$$

$$\text{Im } \delta = (-1.5 \pm 1.6) \times 10^{-5}$$

$$\text{Re}(\gamma), K_{e3} \text{ parameter} = (0.4 \pm 2.5) \times 10^{-3}$$

$$\text{Re}(x_-), K_{e3} \text{ parameter} = (-2.9 \pm 2.0) \times 10^{-3}$$

$$|m_{K^0} - m_{\bar{K}^0}| / m_{\text{average}} < 6 \times 10^{-19}, \text{ CL} = 90\% \text{ [}\gamma\text{]}$$

$$(\Gamma_{K^0} - \Gamma_{\bar{K}^0}) / m_{\text{average}} = (8 \pm 8) \times 10^{-18}$$

Tests of $\Delta S = \Delta Q$

$$\text{Re}(x_+), K_{e3} \text{ parameter} = (-0.9 \pm 3.0) \times 10^{-3}$$

K_S^0

$$I(J^P) = \frac{1}{2}(0^-)$$

Mean life $\tau = (0.8954 \pm 0.0004) \times 10^{-10} \text{ s}$ ($S = 1.1$) Assuming *CPT*

Mean life $\tau = (0.89564 \pm 0.00033) \times 10^{-10} \text{ s}$ Not assuming *CPT*

$$c\tau = 2.6844 \text{ cm} \quad \text{Assuming } CPT$$

CP-violation parameters [z]

$$\text{Im}(\eta_{+-0}) = -0.002 \pm 0.009$$

$$\text{Im}(\eta_{000}) = -0.001 \pm 0.016$$

$$|\eta_{000}| = |A(K_S^0 \rightarrow 3\pi^0)/A(K_L^0 \rightarrow 3\pi^0)| < 0.0088, \text{ CL} = 90\%$$

$$\text{CP asymmetry } A \text{ in } \pi^+ \pi^- e^+ e^- = (-0.4 \pm 0.8)\%$$

K_S^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic modes			
$\pi^0 \pi^0$	(30.69±0.05) %		209
$\pi^+ \pi^-$	(69.20±0.05) %		206
$\pi^+ \pi^- \pi^0$	(3.5 $^{+1.1}_{-0.9}$) × 10 ⁻⁷		133
Modes with photons or $\ell\bar{\ell}$ pairs			
$\pi^+ \pi^- \gamma$	[<i>t,aa</i>] (1.79±0.05) × 10 ⁻³		206
$\pi^+ \pi^- e^+ e^-$	(4.79±0.15) × 10 ⁻⁵		206
$\pi^0 \gamma \gamma$	[<i>aa</i>] (4.9 ±1.8) × 10 ⁻⁸		230
$\gamma \gamma$	(2.63±0.17) × 10 ⁻⁶	S=3.0	249
Semileptonic modes			
$\pi^\pm e^\mp \nu_e$	[<i>bb</i>] (7.04±0.08) × 10 ⁻⁴		229
CP violating (CP) and $\Delta S = 1$ weak neutral current (S1) modes			
$3\pi^0$	CP < 2.6 × 10 ⁻⁸	CL=90%	139
$\mu^+ \mu^-$	S1 < 8 × 10 ⁻¹⁰	CL=90%	225
$e^+ e^-$	S1 < 9 × 10 ⁻⁹	CL=90%	249
$\pi^0 e^+ e^-$	S1 [<i>aa</i>] (3.0 $^{+1.5}_{-1.2}$) × 10 ⁻⁹		230
$\pi^0 \mu^+ \mu^-$	S1 (2.9 $^{+1.5}_{-1.2}$) × 10 ⁻⁹		177



$$I(J^P) = \frac{1}{2}(0^-)$$

$$m_{K_L} - m_{K_S}$$

$$= (0.5293 \pm 0.0009) \times 10^{10} \hbar \text{ s}^{-1} \quad (S = 1.3) \quad \text{Assuming } CPT$$

$$= (3.484 \pm 0.006) \times 10^{-12} \text{ MeV} \quad \text{Assuming } CPT$$

$$= (0.5289 \pm 0.0010) \times 10^{10} \hbar \text{ s}^{-1} \quad \text{Not assuming } CPT$$

$$\text{Mean life } \tau = (5.116 \pm 0.021) \times 10^{-8} \text{ s} \quad (S = 1.1)$$

$$c\tau = 15.34 \text{ m}$$

Slope parameters [q]

(See Particle Listings for other linear and quadratic coefficients)

$$K_L^0 \rightarrow \pi^+ \pi^- \pi^0: g = 0.678 \pm 0.008 \quad (S = 1.5)$$

$$K_L^0 \rightarrow \pi^+ \pi^- \pi^0: h = 0.076 \pm 0.006$$

$$K_L^0 \rightarrow \pi^+ \pi^- \pi^0: k = 0.0099 \pm 0.0015$$

$$K_L^0 \rightarrow \pi^0 \pi^0 \pi^0: h = (0.6 \pm 1.2) \times 10^{-3}$$

 K_L decay form factors [r]Linear parametrization assuming μ - e universality

$$\lambda_+(K_{\mu 3}^0) = \lambda_+(K_{e 3}^0) = (2.82 \pm 0.04) \times 10^{-2} \quad (S = 1.1)$$

$$\lambda_0(K_{\mu 3}^0) = (1.38 \pm 0.18) \times 10^{-2} \quad (S = 2.2)$$

Quadratic parametrization assuming μ - e universality

$$\lambda'_+(K_{\mu 3}^0) = \lambda'_+(K_{e 3}^0) = (2.40 \pm 0.12) \times 10^{-2} \quad (S = 1.2)$$

$$\lambda''_+(K_{\mu 3}^0) = \lambda''_+(K_{e 3}^0) = (0.20 \pm 0.05) \times 10^{-2} \quad (S = 1.2)$$

$$\lambda_0(K_{\mu 3}^0) = (1.16 \pm 0.09) \times 10^{-2} \quad (S = 1.2)$$

Pole parametrization assuming μ - e universality

$$M_V^\mu(K_{\mu 3}^0) = M_V^e(K_{e 3}^0) = 878 \pm 6 \text{ MeV} \quad (S = 1.1)$$

$$M_S^\mu(K_{\mu 3}^0) = 1252 \pm 90 \text{ MeV} \quad (S = 2.6)$$

Dispersive parametrization assuming μ - e universality

$$\Lambda_+ = (2.51 \pm 0.06) \times 10^{-2} \quad (S = 1.5)$$

$$\ln(C) = (1.75 \pm 0.18) \times 10^{-1} \quad (S = 2.0)$$

$$K_{e 3}^0 \quad |f_S/f_+| = (1.5^{+1.4}_{-1.6}) \times 10^{-2}$$

$$K_{e 3}^0 \quad |f_T/f_+| = (5^{+4}_{-5}) \times 10^{-2}$$

$$K_{\mu 3}^0 \quad |f_T/f_+| = (12 \pm 12) \times 10^{-2}$$

$$K_L \rightarrow \ell^+ \ell^- \gamma, K_L \rightarrow \ell^+ \ell^- \ell'^+ \ell'^-: \alpha_{K^*} = -0.205 \pm 0.022 \quad (S = 1.8)$$

$$K_L^0 \rightarrow \ell^+ \ell^- \gamma, K_L^0 \rightarrow \ell^+ \ell^- \ell'^+ \ell'^-: \alpha_{DIP} = -1.69 \pm 0.08 \quad (S = 1.7)$$

$$K_L \rightarrow \pi^+ \pi^- e^+ e^-: a_1/a_2 = -0.737 \pm 0.014 \text{ GeV}^2$$

$$K_L \rightarrow \pi^0 2\gamma: a_V = -0.43 \pm 0.06 \quad (S = 1.5)$$

 CP -violation parameters [z]

$$A_L = (0.332 \pm 0.006)\%$$

$$|\eta_{00}| = (2.220 \pm 0.011) \times 10^{-3} \quad (S = 1.8)$$

$$|\eta_{+-}| = (2.232 \pm 0.011) \times 10^{-3} \quad (S = 1.8)$$

$$|\epsilon| = (2.228 \pm 0.011) \times 10^{-3} \quad (S = 1.8)$$

$$|\eta_{00}/\eta_{+-}| = 0.9950 \pm 0.0007 \text{ [cc]} \quad (S = 1.6)$$

$$\text{Re}(\epsilon'/\epsilon) = (1.66 \pm 0.23) \times 10^{-3} \text{ [cc]} \quad (S = 1.6)$$

Assuming *CPT*

$$\phi_{+-} = (43.51 \pm 0.05)^\circ \quad (S = 1.2)$$

$$\phi_{00} = (43.52 \pm 0.05)^\circ \quad (S = 1.3)$$

$$\phi_\epsilon = \phi_{\text{SW}} = (43.52 \pm 0.05)^\circ \quad (S = 1.2)$$

$$\text{Im}(\epsilon'/\epsilon) = -(\phi_{00} - \phi_{+-})/3 = (-0.002 \pm 0.005)^\circ \quad (S = 1.7)$$

Not assuming *CPT*

$$\phi_{+-} = (43.4 \pm 0.5)^\circ \quad (S = 1.2)$$

$$\phi_{00} = (43.7 \pm 0.6)^\circ \quad (S = 1.2)$$

$$\phi_\epsilon = (43.5 \pm 0.5)^\circ \quad (S = 1.3)$$

$$\text{CP asymmetry } A \text{ in } K_L^0 \rightarrow \pi^+ \pi^- e^+ e^- = (13.7 \pm 1.5)\%$$

$$\beta_{\text{CP}} \text{ from } K_L^0 \rightarrow e^+ e^- e^+ e^- = -0.19 \pm 0.07$$

$$\gamma_{\text{CP}} \text{ from } K_L^0 \rightarrow e^+ e^- e^+ e^- = 0.01 \pm 0.11 \quad (S = 1.6)$$

$$j \text{ for } K_L^0 \rightarrow \pi^+ \pi^- \pi^0 = 0.0012 \pm 0.0008$$

$$f \text{ for } K_L^0 \rightarrow \pi^+ \pi^- \pi^0 = 0.004 \pm 0.006$$

$$|\eta_{+-\gamma}| = (2.35 \pm 0.07) \times 10^{-3}$$

$$\phi_{+-\gamma} = (44 \pm 4)^\circ$$

$$|\epsilon'_{+-\gamma}|/\epsilon < 0.3, \text{ CL} = 90\%$$

$$|g_{E1}| \text{ for } K_L^0 \rightarrow \pi^+ \pi^- \gamma < 0.21, \text{ CL} = 90\%$$

T-violation parameters

$$\text{Im}(\xi) \text{ in } K_{\mu 3}^0 = -0.007 \pm 0.026$$

CPT invariance tests

$$\phi_{00} - \phi_{+-} = (0.34 \pm 0.32)^\circ$$

$$\text{Re}\left(\frac{2}{3}\eta_{+-} + \frac{1}{3}\eta_{00}\right) - \frac{A_L}{2} = (-3 \pm 35) \times 10^{-6}$$

$\Delta S = -\Delta Q$ in $K_{\ell 3}^0$ decay

$$\text{Re } x = -0.002 \pm 0.006$$

$$\text{Im } x = 0.0012 \pm 0.0021$$

K_L^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level (MeV/c)	p
Semileptonic modes			
$\pi^\pm e^\mp \nu_e$ Called K_{e3}^0 .	[bb] (40.55 ± 0.11) %	S=1.7	229
$\pi^\pm \mu^\mp \nu_\mu$ Called $K_{\mu3}^0$.	[bb] (27.04 ± 0.07) %	S=1.1	216
$(\pi \mu \text{atom})\nu$	(1.05 ± 0.11) × 10 ⁻⁷		188
$\pi^0 \pi^\pm e^\mp \nu$	[bb] (5.20 ± 0.11) × 10 ⁻⁵		207
$\pi^\pm e^\mp \nu e^+ e^-$	[bb] (1.26 ± 0.04) × 10 ⁻⁵		229
Hadronic modes, including Charge conjugation × Parity Violating (CPV) modes			
$3\pi^0$	(19.52 ± 0.12) %	S=1.6	139
$\pi^+ \pi^- \pi^0$	(12.54 ± 0.05) %		133
$\pi^+ \pi^-$	CPV [dd] (1.967 ± 0.010) × 10 ⁻³	S=1.5	206
$\pi^0 \pi^0$	CPV (8.64 ± 0.06) × 10 ⁻⁴	S=1.8	209
Semileptonic modes with photons			
$\pi^\pm e^\mp \nu_e \gamma$	[t,bb,ee] (3.79 ± 0.06) × 10 ⁻³		229
$\pi^\pm \mu^\mp \nu_\mu \gamma$	(5.65 ± 0.23) × 10 ⁻⁴		216
Hadronic modes with photons or $\ell\bar{\ell}$ pairs			
$\pi^0 \pi^0 \gamma$	< 2.43 × 10 ⁻⁷	CL=90%	209
$\pi^+ \pi^- \gamma$	[t,ee] (4.15 ± 0.15) × 10 ⁻⁵	S=2.8	206
$\pi^+ \pi^- \gamma$ (DE)	(2.84 ± 0.11) × 10 ⁻⁵	S=2.0	206
$\pi^0 2\gamma$	[ee] (1.273 ± 0.033) × 10 ⁻⁶		230
$\pi^0 \gamma e^+ e^-$	(1.62 ± 0.17) × 10 ⁻⁸		230
Other modes with photons or $\ell\bar{\ell}$ pairs			
2γ	(5.47 ± 0.04) × 10 ⁻⁴	S=1.1	249
3γ	< 7.4 × 10 ⁻⁸	CL=90%	249
$e^+ e^- \gamma$	(9.4 ± 0.4) × 10 ⁻⁶	S=2.0	249
$\mu^+ \mu^- \gamma$	(3.59 ± 0.11) × 10 ⁻⁷	S=1.3	225
$e^+ e^- \gamma \gamma$	[ee] (5.95 ± 0.33) × 10 ⁻⁷		249
$\mu^+ \mu^- \gamma \gamma$	[ee] (1.0 ^{+0.8} / _{-0.6}) × 10 ⁻⁸		225
Charge conjugation × Parity (CP) or Lepton Family number (LF) violating modes, or $\Delta S = 1$ weak neutral current (S1) modes			
$\mu^+ \mu^-$	S1 (6.84 ± 0.11) × 10 ⁻⁹		225
$e^+ e^-$	S1 (9 ⁺⁶ / ₋₄) × 10 ⁻¹²		249
$\pi^+ \pi^- e^+ e^-$	S1 [ee] (3.11 ± 0.19) × 10 ⁻⁷		206
$\pi^0 \pi^0 e^+ e^-$	S1 < 6.6 × 10 ⁻⁹	CL=90%	209
$\pi^0 \pi^0 \mu^+ \mu^-$	S1 < 9.2 × 10 ⁻¹¹	CL=90%	57
$\mu^+ \mu^- e^+ e^-$	S1 (2.69 ± 0.27) × 10 ⁻⁹		225

$e^+ e^- e^+ e^-$	$S1$	$(3.56 \pm 0.21) \times 10^{-8}$		249
$\pi^0 \mu^+ \mu^-$	$CP, S1 [ff]$	< 3.8	$\times 10^{-10}$	CL=90% 177
$\pi^0 e^+ e^-$	$CP, S1 [ff]$	< 2.8	$\times 10^{-10}$	CL=90% 230
$\pi^0 \nu \bar{\nu}$	$CP, S1 [gg]$	< 3.0	$\times 10^{-9}$	CL=90% 230
$\pi^0 \pi^0 \nu \bar{\nu}$	$S1$	< 8.1	$\times 10^{-7}$	CL=90% 209
$e^\pm \mu^\mp$	$LF [bb]$	< 4.7	$\times 10^{-12}$	CL=90% 238
$e^\pm e^\pm \mu^\mp \mu^\mp$	$LF [bb]$	< 4.12	$\times 10^{-11}$	CL=90% 225
$\pi^0 \mu^\pm e^\mp$	$LF [bb]$	< 7.6	$\times 10^{-11}$	CL=90% 217
$\pi^0 \pi^0 \mu^\pm e^\mp$	LF	< 1.7	$\times 10^{-10}$	CL=90% 159

$K_0^*(700)$

$$I(J^P) = \frac{1}{2}(0^+)$$

also known as κ ; was $K_0^*(800)$

Mass (T-Matrix Pole \sqrt{s}) = $(630-730) - i(260-340)$ MeV

Mass (Breit-Wigner) = 824 ± 30 MeV

Full width (Breit-Wigner) = 478 ± 50 MeV

$K_0^*(700)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K \pi$	100 %	240

$K^*(892)$

$$I(J^P) = \frac{1}{2}(1^-)$$

$K^*(892)^\pm$ hadroproduced mass $m = 891.66 \pm 0.26$ MeV

$K^*(892)^\pm$ in τ decays mass $m = 895.5 \pm 0.8$ MeV

$K^*(892)^0$ mass $m = 895.55 \pm 0.20$ MeV ($S = 1.7$)

$K^*(892)^\pm$ hadroproduced full width $\Gamma = 50.8 \pm 0.9$ MeV

$K^*(892)^\pm$ in τ decays full width $\Gamma = 46.2 \pm 1.3$ MeV

$K^*(892)^0$ full width $\Gamma = 47.3 \pm 0.5$ MeV ($S = 1.9$)

$K^*(892)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K \pi$	~ 100	%	289
$K^0 \gamma$	$(2.46 \pm 0.21) \times 10^{-3}$		307
$K^\pm \gamma$	$(9.9 \pm 0.9) \times 10^{-4}$		309
$K \pi \pi$	< 7	$\times 10^{-4}$	95% 223

$K_1(1270)$

$$I(J^P) = \frac{1}{2}(1^+)$$

Mass $m = 1253 \pm 7$ MeV [j] ($S = 2.2$)

Full width $\Gamma = 90 \pm 20$ MeV [j]

$K_1(1270)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\rho$	(42 \pm 6) %	†
$K_0^*(1430)\pi$	(28 \pm 4) %	†
$K^*(892)\pi$	(16 \pm 5) %	286
$K\omega$	(11.0 \pm 2.0) %	†
$Kf_0(1370)$	(3.0 \pm 2.0) %	†
γK^0	seen	528

$K_1(1400)$

$$I(J^P) = \frac{1}{2}(1^+)$$

Mass $m = 1403 \pm 7$ MeV

Full width $\Gamma = 174 \pm 13$ MeV (S = 1.6)

$K_1(1400)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K^*(892)\pi$	(94 \pm 6) %	402
$K\rho$	(3.0 \pm 3.0) %	293
$Kf_0(1370)$	(2.0 \pm 2.0) %	†
$K\omega$	(1.0 \pm 1.0) %	284
$K_0^*(1430)\pi$	not seen	†
γK^0	seen	613

$K^*(1410)$

$$I(J^P) = \frac{1}{2}(1^-)$$

Mass $m = 1414 \pm 15$ MeV (S = 1.3)

Full width $\Gamma = 232 \pm 21$ MeV (S = 1.1)

$K^*(1410)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K^*(892)\pi$	> 40 %	95%	410
$K\pi$	(6.6 \pm 1.3) %		612
$K\rho$	< 7 %	95%	305
γK^0	< 2.3 $\times 10^{-4}$	90%	619

$K_0^*(1430) [hh]$

$$I(J^P) = \frac{1}{2}(0^+)$$

Mass $m = 1425 \pm 50$ MeV

Full width $\Gamma = 270 \pm 80$ MeV

$K_0^*(1430)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\pi$	(93 \pm 10) %	619
$K\eta$	(8.6 $^{+2.7}_{-3.4}$) %	486
$K\eta'(958)$	seen	†

$K_2^*(1430)$

$$I(J^P) = \frac{1}{2}(2^+)$$

$K_2^*(1430)^\pm$ mass $m = 1427.3 \pm 1.5$ MeV (S = 1.3)

$K_2^*(1430)^0$ mass $m = 1432.4 \pm 1.3$ MeV

$K_2^*(1430)^\pm$ full width $\Gamma = 100.0 \pm 2.1$ MeV

$K_2^*(1430)^0$ full width $\Gamma = 109 \pm 5$ MeV (S = 1.9)

$K_2^*(1430)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$K\pi$	(49.9 \pm 1.2) %		620
$K^*(892)\pi$	(24.7 \pm 1.5) %		420
$K^*(892)\pi\pi$	(13.4 \pm 2.2) %		373
$K\rho$	(8.7 \pm 0.8) %	S=1.2	320
$K\omega$	(2.9 \pm 0.8) %		313
$K^+\gamma$	(2.4 \pm 0.5) $\times 10^{-3}$	S=1.1	628
$K\eta$	(1.5 $^{+3.4}_{-1.0}$) $\times 10^{-3}$	S=1.3	488
$K\omega\pi$	< 7.2 $\times 10^{-4}$	CL=95%	106
$K^0\gamma$	< 9 $\times 10^{-4}$	CL=90%	627

$K^*(1680)$

$$I(J^P) = \frac{1}{2}(1^-)$$

Mass $m = 1718 \pm 18$ MeV

Full width $\Gamma = 322 \pm 110$ MeV (S = 4.2)

$K^*(1680)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\pi$	(38.7 \pm 2.5) %	782
$K\rho$	(31.4 $^{+5.0}_{-2.1}$) %	571
$K^*(892)\pi$	(29.9 $^{+2.2}_{-5.0}$) %	618
$K\phi$	seen	387

$K_2(1770)$ ^[ii]

$$I(J^P) = \frac{1}{2}(2^-)$$

Mass $m = 1773 \pm 8$ MeVFull width $\Gamma = 186 \pm 14$ MeV

$K_2(1770)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K \pi \pi$		794
$K_2^*(1430) \pi$	seen	287
$K^*(892) \pi$	seen	654
$K f_2(1270)$	seen	53
$K \phi$	seen	441
$K \omega$	seen	607

 $K_3^*(1780)$

$$I(J^P) = \frac{1}{2}(3^-)$$

Mass $m = 1776 \pm 7$ MeV (S = 1.1)Full width $\Gamma = 159 \pm 21$ MeV (S = 1.3)

$K_3^*(1780)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K \rho$	(31 \pm 9) %		613
$K^*(892) \pi$	(20 \pm 5) %		656
$K \pi$	(18.8 \pm 1.0) %		813
$K \eta$	(30 \pm 13) %		719
$K_2^*(1430) \pi$	< 16 %	95%	290

 $K_2(1820)$ ^[ij]

$$I(J^P) = \frac{1}{2}(2^-)$$

Mass $m = 1819 \pm 12$ MeVFull width $\Gamma = 264 \pm 34$ MeV

$K_2(1820)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K_2^*(1430) \pi$	seen	328
$K^*(892) \pi$	seen	683
$K f_2(1270)$	seen	191
$K \omega$	seen	640
$K \phi$	seen	483

$K_4^*(2045)$

$$I(J^P) = \frac{1}{2}(4^+)$$

Mass $m = 2048_{-9}^{+8}$ MeV ($S = 1.1$)

Full width $\Gamma = 199_{-19}^{+27}$ MeV

$K_4^*(2045)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\pi$	$(9.9 \pm 1.2)\%$	960
$K^*(892)\pi\pi$	$(9 \pm 5)\%$	804
$K^*(892)\pi\pi\pi$	$(7 \pm 5)\%$	770
$\rho K\pi$	$(5.7 \pm 3.2)\%$	744
$\omega K\pi$	$(5.0 \pm 3.0)\%$	740
$\phi K\pi$	$(2.8 \pm 1.4)\%$	597
$\phi K^*(892)$	$(1.4 \pm 0.7)\%$	368

CHARMED MESONS ($C = \pm 1$)

$$D^+ = c\bar{d}, D^0 = c\bar{u}, \bar{D}^0 = \bar{c}u, D^- = \bar{c}d, \text{ similarly for } D^{*'}\text{'s}$$

 D^\pm

$$I(J^P) = \frac{1}{2}(0^-)$$

Mass $m = 1869.65 \pm 0.05$ MeV

Mean life $\tau = (1040 \pm 7) \times 10^{-15}$ s

$c\tau = 311.8 \mu\text{m}$

c-quark decays

$$\Gamma(c \rightarrow \ell^+ \text{ anything})/\Gamma(c \rightarrow \text{ anything}) = 0.096 \pm 0.004 \text{ [kk]}$$

$$\Gamma(c \rightarrow D^*(2010)^+ \text{ anything})/\Gamma(c \rightarrow \text{ anything}) = 0.255 \pm 0.017$$

CP-violation decay-rate asymmetries

$$A_{CP}(\mu^\pm \nu) = (8 \pm 8)\%$$

$$A_{CP}(K_L^0 e^\pm \nu) = (-0.6 \pm 1.6)\%$$

$$A_{CP}(K_S^0 \pi^\pm) = (-0.41 \pm 0.09)\%$$

$$A_{CP}(K_L^0 K^\pm) \text{ in } D^\pm \rightarrow K_L^0 K^\pm = (-4.2 \pm 3.4) \times 10^{-2}$$

$$A_{CP}(K^\mp 2\pi^\pm) = (-0.18 \pm 0.16)\%$$

$$A_{CP}(K^\mp \pi^\pm \pi^\pm \pi^0) = (-0.3 \pm 0.7)\%$$

$$A_{CP}(K_S^0 \pi^\pm \pi^0) = (-0.1 \pm 0.7)\%$$

$$A_{CP}(K_S^0 \pi^\pm \pi^+ \pi^-) = (0.0 \pm 1.2)\%$$

$$A_{CP}(\pi^\pm \pi^0) = (2.4 \pm 1.2)\%$$

$$A_{CP}(\pi^\pm \eta) = (1.0 \pm 1.5)\% \quad (S = 1.4)$$

$$\begin{aligned}
 A_{CP}(\pi^\pm \eta'(958)) &= (-0.6 \pm 0.7)\% \\
 A_{CP}(\bar{K}^0 / K^0 K^\pm) &= (0.11 \pm 0.17)\% \\
 A_{CP}(K_S^0 K^\pm) &= (-0.01 \pm 0.07)\% \\
 A_{CP}(K_S^0 K^\pm \pi^0) \text{ in } D^\pm \rightarrow K_S^0 K^\pm \pi^0 &= (1 \pm 4) \times 10^{-2} \\
 A_{CP}(K_L^0 K^\pm \pi^0) \text{ in } D^\pm \rightarrow K_L^0 K^\pm \pi^0 &= (-1 \pm 4) \times 10^{-2} \\
 A_{CP}(K^+ K^- \pi^\pm) &= (0.37 \pm 0.29)\% \\
 A_{CP}(K^\pm K^{*0}) &= (-0.3 \pm 0.4)\% \\
 A_{CP}(\phi \pi^\pm) &= (0.01 \pm 0.09)\% \quad (S = 1.8) \\
 A_{CP}(K^\pm K_0^*(1430)^0) &= (8_{-6}^{+7})\% \\
 A_{CP}(K^\pm K_2^*(1430)^0) &= (43_{-26}^{+20})\% \\
 A_{CP}(K^\pm K_0^*(700)) &= (-12_{-13}^{+18})\% \\
 A_{CP}(a_0(1450)^0 \pi^\pm) &= (-19_{-16}^{+14})\% \\
 A_{CP}(\phi(1680) \pi^\pm) &= (-9 \pm 26)\% \\
 A_{CP}(\pi^+ \pi^- \pi^\pm) &= (-2 \pm 4)\% \\
 A_{CP}(K_S^0 K^\pm \pi^+ \pi^-) &= (-4 \pm 7)\% \\
 A_{CP}(K^\pm \pi^0) &= (-4 \pm 11)\%
 \end{aligned}$$

χ^2 tests of CP-violation (CPV)

$$\begin{aligned}
 \text{Local CPV in } D^\pm \rightarrow \pi^+ \pi^- \pi^\pm &= 78.1\% \\
 \text{Local CPV in } D^\pm \rightarrow K^+ K^- \pi^\pm &= 31\%
 \end{aligned}$$

CP violating asymmetries of P-odd (T-odd) moments

$$A_T(K_S^0 K^\pm \pi^+ \pi^-) = (-12 \pm 11) \times 10^{-3} \text{ [1]}$$

D^+ form factors

$$\begin{aligned}
 f_+(0) |V_{cs}| \text{ in } \bar{K}^0 \ell^+ \nu_\ell &= 0.719 \pm 0.011 \quad (S = 1.6) \\
 r_1 \equiv a_1/a_0 \text{ in } \bar{K}^0 \ell^+ \nu_\ell &= -2.13 \pm 0.14 \\
 r_2 \equiv a_2/a_0 \text{ in } \bar{K}^0 \ell^+ \nu_\ell &= -3 \pm 12 \quad (S = 1.5) \\
 f_+(0) |V_{cd}| \text{ in } \pi^0 \ell^+ \nu_\ell &= 0.1407 \pm 0.0025 \\
 r_1 \equiv a_1/a_0 \text{ in } \pi^0 \ell^+ \nu_\ell &= -2.00 \pm 0.13 \\
 r_2 \equiv a_2/a_0 \text{ in } \pi^0 \ell^+ \nu_\ell &= -4 \pm 5 \\
 f_+(0) |V_{cd}| \text{ in } D^+ \rightarrow \eta e^+ \nu_e &= (8.3 \pm 0.5) \times 10^{-2} \\
 r_1 \equiv a_1/a_0 \text{ in } D^+ \rightarrow \eta e^+ \nu_e &= -5.3 \pm 2.7 \quad (S = 1.9) \\
 r_v \equiv V(0)/A_1(0) \text{ in } D^+ \rightarrow \omega e^+ \nu_e &= 1.24 \pm 0.11 \\
 r_2 \equiv A_2(0)/A_1(0) \text{ in } D^+ \rightarrow \omega e^+ \nu_e &= 1.06 \pm 0.16 \\
 r_v \equiv V(0)/A_1(0) \text{ in } D^+, D^0 \rightarrow \rho e^+ \nu_e &= 1.64 \pm 0.10 \quad (S = 1.2) \\
 r_2 \equiv A_2(0)/A_1(0) \text{ in } D^+, D^0 \rightarrow \rho e^+ \nu_e &= 0.84 \pm 0.06 \\
 r_v \equiv V(0)/A_1(0) \text{ in } \bar{K}^*(892)^0 \ell^+ \nu_\ell &= 1.49 \pm 0.05 \quad (S = 2.1) \\
 r_2 \equiv A_2(0)/A_1(0) \text{ in } \bar{K}^*(892)^0 \ell^+ \nu_\ell &= 0.802 \pm 0.021 \\
 r_3 \equiv A_3(0)/A_1(0) \text{ in } \bar{K}^*(892)^0 \ell^+ \nu_\ell &= 0.0 \pm 0.4 \\
 \Gamma_L/\Gamma_T \text{ in } \bar{K}^*(892)^0 \ell^+ \nu_\ell &= 1.13 \pm 0.08 \\
 \Gamma_+/\Gamma_- \text{ in } \bar{K}^*(892)^0 \ell^+ \nu_\ell &= 0.22 \pm 0.06 \quad (S = 1.6)
 \end{aligned}$$

Most decay modes (other than the semileptonic modes) that involve a neutral K meson are now given as K_S^0 modes, not as \bar{K}^0 modes. Nearly always it is a K_S^0 that is measured, and interference between Cabibbo-allowed and doubly Cabibbo-suppressed modes can invalidate the assumption that $2\Gamma(K_S^0) = \Gamma(\bar{K}^0)$.

D⁺ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Inclusive modes			
e^+ semileptonic	(16.07 ± 0.30) %		—
μ^+ anything	(17.6 ± 3.2) %		—
K^- anything	(25.7 ± 1.4) %		—
\bar{K}^0 anything + K^0 anything	(61 ± 5) %		—
K^+ anything	(5.9 ± 0.8) %		—
$K^*(892)^-$ anything	(6 ± 5) %		—
$\bar{K}^*(892)^0$ anything	(23 ± 5) %		—
$K^*(892)^0$ anything	< 6.6	% CL=90%	—
η anything	(6.3 ± 0.7) %		—
η' anything	(1.04 ± 0.18) %		—
ϕ anything	(1.12 ± 0.04) %		—
Leptonic and semileptonic modes			
$e^+ \nu_e$	< 8.8	$\times 10^{-6}$ CL=90%	935
$\gamma e^+ \nu_e$	< 3.0	$\times 10^{-5}$ CL=90%	935
$\mu^+ \nu_\mu$	(3.74 ± 0.17)	$\times 10^{-4}$	932
$\tau^+ \nu_\tau$	(1.20 ± 0.27)	$\times 10^{-3}$	90
$\bar{K}^0 e^+ \nu_e$	(8.73 ± 0.10) %		869
$\bar{K}^0 \mu^+ \nu_\mu$	(8.76 ± 0.19) %		865
$K^- \pi^+ e^+ \nu_e$	(4.02 ± 0.18) %	S=3.2	864
$\bar{K}^*(892)^0 e^+ \nu_e, \bar{K}^*(892)^0 \rightarrow$ $K^- \pi^+$	(3.77 ± 0.17) %		722
$(K^- \pi^+) [0.8-1.0]\text{GeV} e^+ \nu_e$	(3.39 ± 0.09) %		864
$(K^- \pi^+)_{S\text{-wave}} e^+ \nu_e$	(2.28 ± 0.11)	$\times 10^{-3}$	—
$\bar{K}^*(1410)^0 e^+ \nu_e,$ $\bar{K}^*(1410)^0 \rightarrow K^- \pi^+$	< 6	$\times 10^{-3}$ CL=90%	—
$\bar{K}_2^*(1430)^0 e^+ \nu_e,$ $\bar{K}_2^*(1430)^0 \rightarrow K^- \pi^+$	< 5	$\times 10^{-4}$ CL=90%	—
$K^- \pi^+ e^+ \nu_e$ nonresonant	< 7	$\times 10^{-3}$ CL=90%	864
$\bar{K}^*(892)^0 e^+ \nu_e$	(5.40 ± 0.10) %	S=1.1	722
$K^- \pi^+ \mu^+ \nu_\mu$	(3.65 ± 0.34) %		851
$\bar{K}^*(892)^0 \mu^+ \nu_\mu,$ $\bar{K}^*(892)^0 \rightarrow K^- \pi^+$	(3.52 ± 0.10) %		717
$K^- \pi^+ \mu^+ \nu_\mu$ nonresonant	(1.9 ± 0.5)	$\times 10^{-3}$	851
$\bar{K}^*(892)^0 \mu^+ \nu_\mu$	(5.27 ± 0.15) %		717

$K^- \pi^+ \pi^0 \mu^+ \nu_\mu$	< 1.5	$\times 10^{-3}$ CL=90%	825
$\bar{K}_1(1270)^0 e^+ \nu_e, \bar{K}_1^0 \rightarrow$	(1.06 ± 0.15)	$\times 10^{-3}$	—
$\bar{K}_0^*(1430)^0 \mu^+ \nu_\mu$	< 2.3	$\times 10^{-4}$ CL=90%	380
$\bar{K}^*(1680)^0 \mu^+ \nu_\mu$	< 1.5	$\times 10^{-3}$ CL=90%	105
$\pi^0 e^+ \nu_e$	(3.72 ± 0.17)	$\times 10^{-3}$ S=2.0	930
$\pi^0 \mu^+ \nu_\mu$	(3.50 ± 0.15)	$\times 10^{-3}$	927
$\eta e^+ \nu_e$	(1.11 ± 0.07)	$\times 10^{-3}$	855
$\pi^- \pi^+ e^+ \nu_e$	(2.45 ± 0.10)	$\times 10^{-3}$	924
$f_0(500)^0 e^+ \nu_e, f_0(500)^0 \rightarrow$	(6.3 ± 0.5)	$\times 10^{-4}$	—
$\pi^+ \pi^-$			
$\rho^0 e^+ \nu_e$	$(2.18 \pm_{-0.25}^{+0.17})$	$\times 10^{-3}$	774
$\rho^0 \mu^+ \nu_\mu$	(2.4 ± 0.4)	$\times 10^{-3}$	770
$\omega e^+ \nu_e$	(1.69 ± 0.11)	$\times 10^{-3}$	771
$\eta'(958) e^+ \nu_e$	(2.0 ± 0.4)	$\times 10^{-4}$	690
$a(980)^0 e^+ \nu_e, a(980)^0 \rightarrow \eta \pi^0$	$(1.7 \pm_{-0.7}^{+0.8})$	$\times 10^{-4}$	—
$\phi e^+ \nu_e$	< 1.3	$\times 10^{-5}$ CL=90%	657
$D^0 e^+ \nu_e$	< 1.0	$\times 10^{-4}$ CL=90%	5

Hadronic modes with a \bar{K} or $\bar{K}K\bar{K}$

$K_S^0 \pi^+$	(1.562 ± 0.031) %	S=1.7	863
$K_L^0 \pi^+$	(1.46 ± 0.05) %		863
$K^- 2\pi^+$	[nn] (9.38 ± 0.16) %	S=1.6	846
$(K^- \pi^+)_{S\text{-wave}} \pi^+$	(7.52 ± 0.17) %		846
$\bar{K}_0^*(1430)^0 \pi^+,$	[oo] (1.25 ± 0.06) %		382
$\bar{K}_0^*(1430)^0 \rightarrow K^- \pi^+$			
$\bar{K}^*(892)^0 \pi^+,$	(1.04 ± 0.12) %		714
$\bar{K}^*(892)^0 \rightarrow K^- \pi^+$			
$\bar{K}^*(1410)^0 \pi^+, \bar{K}^{*0} \rightarrow$	not seen		381
$\bar{K}_2^*(1430)^0 \pi^+,$	[oo] (2.3 ± 0.7) $\times 10^{-4}$		371
$\bar{K}_2^*(1430)^0 \rightarrow K^- \pi^+$			
$\bar{K}^*(1680)^0 \pi^+,$	[oo] (2.2 ± 1.1) $\times 10^{-4}$		58
$\bar{K}^*(1680)^0 \rightarrow K^- \pi^+$			
$K^-(2\pi^+)_{I=2}$	(1.45 ± 0.26) %		—
$K_S^0 \pi^+ \pi^0$	[nn] (7.36 ± 0.21) %		845
$K_S^0 \rho^+$	$(6.14 \pm_{-0.35}^{+0.60})$ %		677
$K_S^0 \rho(1450)^+, \rho^+ \rightarrow \pi^+ \pi^0$	$(1.5 \pm_{-1.4}^{+1.2})$ $\times 10^{-3}$		—
$\bar{K}^*(892)^0 \pi^+,$	(2.64 ± 0.32) $\times 10^{-3}$		714
$\bar{K}^*(892)^0 \rightarrow K_S^0 \pi^0$			

$\bar{K}_0^*(1430)^0 \pi^+, \bar{K}_0^{*0} \rightarrow K_S^0 \pi^0$	$(2.7 \pm 0.9) \times 10^{-3}$	—
$\bar{K}_0^*(1680)^0 \pi^+, \bar{K}_0^{*0} \rightarrow K_S^0 \pi^0$	$(10 \pm 7) \times 10^{-4}$	—
$\bar{\kappa}^0 \pi^+, \bar{\kappa}^0 \rightarrow K_S^0 \pi^0$	$(6 \pm 5) \times 10^{-3}$	—
$K_S^0 \pi^+ \pi^0$ nonresonant	$(3 \pm 4) \times 10^{-3}$	845
$K_S^0 \pi^+ \pi^0$ nonresonant and $\bar{\kappa}^0 \pi^+$	$(1.37 \pm 0.21) \%$	—
$(K_S^0 \pi^0)_{S\text{-wave}} \pi^+$	$(1.27 \pm 0.27) \%$	845
$K_S^0 \pi^+ \eta'(958)$	$(1.90 \pm 0.21) \times 10^{-3}$	481
$K^- 2\pi^+ \pi^0$	[$\rho\rho$] $(6.25 \pm 0.18) \%$	816
$K_S^0 2\pi^+ \pi^-$	[$\rho\rho$] $(3.10 \pm 0.09) \%$	814
$K^- 3\pi^+ \pi^-$	[nn] $(5.7 \pm 0.5) \times 10^{-3}$	S=1.1 772
$\bar{K}^*(892)^0 2\pi^+ \pi^-, \bar{K}^*(892)^0 \rightarrow K^- \pi^+$	$(1.2 \pm 0.4) \times 10^{-3}$	645
$\bar{K}^*(892)^0 \rho^0 \pi^+, \bar{K}^*(892)^0 \rightarrow K^- \pi^+$	$(2.3 \pm 0.4) \times 10^{-3}$	239
$\bar{K}^*(892)^0 a_1(1260)^+$	[qq] $(9.3 \pm 1.9) \times 10^{-3}$	†
$K^- \rho^0 2\pi^+$	$(1.72 \pm 0.28) \times 10^{-3}$	524
$K^- 3\pi^+ \pi^-$ nonresonant	$(4.0 \pm 2.9) \times 10^{-4}$	772
$K^+ 2K_S^0$	$(2.54 \pm 0.13) \times 10^{-3}$	545
$K^+ K^- K_S^0 \pi^+$	$(2.4 \pm 0.5) \times 10^{-4}$	436
Pionic modes		
$\pi^+ \pi^0$	$(1.247 \pm 0.033) \times 10^{-3}$	925
$2\pi^+ \pi^-$	$(3.27 \pm 0.18) \times 10^{-3}$	909
$\rho^0 \pi^+$	$(8.3 \pm 1.5) \times 10^{-4}$	767
$\pi^+(\pi^+ \pi^-)_{S\text{-wave}}$	$(1.83 \pm 0.16) \times 10^{-3}$	909
$\sigma \pi^+, \sigma \rightarrow \pi^+ \pi^-$	$(1.38 \pm 0.12) \times 10^{-3}$	—
$f_0(980) \pi^+, f_0(980) \rightarrow \pi^+ \pi^-$	$(1.56 \pm 0.33) \times 10^{-4}$	669
$f_0(1370) \pi^+, f_0(1370) \rightarrow \pi^+ \pi^-$	$(8 \pm 4) \times 10^{-5}$	—
$f_2(1270) \pi^+, f_2(1270) \rightarrow \pi^+ \pi^-$	$(5.0 \pm 0.9) \times 10^{-4}$	485
$\rho(1450)^0 \pi^+, \rho(1450)^0 \rightarrow \pi^+ \pi^-$	$< 8 \times 10^{-5}$ CL=95%	338
$f_0(1500) \pi^+, f_0(1500) \rightarrow \pi^+ \pi^-$	$(1.1 \pm 0.4) \times 10^{-4}$	—
$f_0(1710) \pi^+, f_0(1710) \rightarrow \pi^+ \pi^-$	$< 5 \times 10^{-5}$ CL=95%	—

$f_0(1790)\pi^+$,	< 7	$\times 10^{-5}$ CL=95%	—
$f_0(1790) \rightarrow \pi^+\pi^-$			
$(\pi^+\pi^+)_{S\text{-wave}}\pi^-$	< 1.2	$\times 10^{-4}$ CL=95%	909
$2\pi^+\pi^-$ nonresonant	< 1.1	$\times 10^{-4}$ CL=95%	909
$\pi^+2\pi^0$	(4.7 ± 0.4)	$\times 10^{-3}$	910
$2\pi^+\pi^-\pi^0$	(1.16 ± 0.08)	%	883
$3\pi^+2\pi^-$	(1.66 ± 0.16)	$\times 10^{-3}$ S=1.1	845
$\eta\pi^+$	(3.77 ± 0.09)	$\times 10^{-3}$	848
$\eta\pi^+\pi^0$	(1.38 ± 0.35)	$\times 10^{-3}$	831
$\omega\pi^+$	(2.8 ± 0.6)	$\times 10^{-4}$	764
$\eta'(958)\pi^+$	(4.97 ± 0.19)	$\times 10^{-3}$	681
$\eta'(958)\pi^+\pi^0$	(1.6 ± 0.5)	$\times 10^{-3}$	654

Hadronic modes with a $K\bar{K}$ pair

$K^+K_S^0$	(3.04 ± 0.09)	$\times 10^{-3}$ S=2.2	793
$K_L^0K^+$	(3.21 ± 0.16)	$\times 10^{-3}$	793
$K_S^0K^+\pi^0$	(5.07 ± 0.30)	$\times 10^{-3}$	744
$K_L^0K^+\pi^0$	(5.24 ± 0.31)	$\times 10^{-3}$	744
$K^+K^-\pi^+$	[nn] (9.68 ± 0.18)	$\times 10^{-3}$	744
$\phi\pi^+$	(5.70 ± 0.14)	$\times 10^{-3}$	647
$\phi\pi^+, \phi \rightarrow K^+K^-$	$(2.69 \pm_{-0.08}^{+0.07})$	$\times 10^{-3}$	647
$K^+\bar{K}^*(892)^0,$	$(2.49 \pm_{-0.13}^{+0.08})$	$\times 10^{-3}$	613
$\bar{K}^*(892)^0 \rightarrow K^-\pi^+$			
$K^+\bar{K}_0^*(1430)^0,$	(1.82 ± 0.35)	$\times 10^{-3}$	—
$\bar{K}_0^*(1430)^0 \rightarrow K^-\pi^+$			
$K^+\bar{K}_2^*(1430)^0, \bar{K}_2^* \rightarrow$	$(1.6 \pm_{-0.8}^{+1.2})$	$\times 10^{-4}$	—
$K^-\pi^+$			
$K^+\bar{K}_0^*(700), \bar{K}_0^* \rightarrow K^-\pi^+$	$(6.8 \pm_{-2.1}^{+3.5})$	$\times 10^{-4}$	—
$a_0(1450)^0\pi^+, a_0^0 \rightarrow$	$(4.5 \pm_{-1.8}^{+7.0})$	$\times 10^{-4}$	—
K^+K^-			
$\phi(1680)\pi^+, \phi \rightarrow K^+K^-$	$(4.9 \pm_{-1.9}^{+4.0})$	$\times 10^{-5}$	—
$K_S^0K_S^0\pi^+$	(2.70 ± 0.13)	$\times 10^{-3}$	741
$K^+K_S^0\pi^+\pi^-$	(1.74 ± 0.18)	$\times 10^{-3}$	678
$K_S^0K^-2\pi^+$	(2.38 ± 0.17)	$\times 10^{-3}$	678
$K^+K^-2\pi^+\pi^-$	(2.3 ± 1.2)	$\times 10^{-4}$	601

A few poorly measured branching fractions:

$\phi\pi^+\pi^0$	(2.3 ± 1.0)	%	619
$\phi\rho^+$	< 1.5	% CL=90%	260
$K^+K^-\pi^+\pi^0$ non- ϕ	$(1.5 \pm_{-0.6}^{+0.7})$	%	682
$K^*(892)^+K_S^0$	(1.7 ± 0.8)	%	612

Doubly Cabibbo-suppressed modes

$K^+ \pi^0$	$(2.08 \pm 0.21) \times 10^{-4}$	S=1.4	864
$K^+ \eta$	$(1.25 \pm 0.16) \times 10^{-4}$	S=1.1	776
$K^+ \eta'(958)$	$(1.85 \pm 0.20) \times 10^{-4}$		571
$K^+ \pi^+ \pi^-$	$(4.91 \pm 0.09) \times 10^{-4}$		846
$K^+ \rho^0$	$(1.9 \pm 0.5) \times 10^{-4}$		679
$K^*(892)^0 \pi^+, K^*(892)^0 \rightarrow$ $K^+ \pi^-$	$(2.3 \pm 0.4) \times 10^{-4}$		714
$K^+ f_0(980), f_0(980) \rightarrow$ $\pi^+ \pi^-$	$(4.4 \pm 2.6) \times 10^{-5}$		—
$K_2^*(1430)^0 \pi^+, K_2^*(1430)^0 \rightarrow$ $K^+ \pi^-$	$(3.9 \pm 2.7) \times 10^{-5}$		—
$K^+ \pi^+ \pi^-$ nonresonant	not seen		846
$2K^+ K^-$	$(6.14 \pm 0.11) \times 10^{-5}$		550
$\phi(1020)^0 K^+$	$< 2.1 \times 10^{-5}$	CL=90%	—
$K^+ \phi(1020), \phi \rightarrow K^+ K^-$	$(4.4 \pm 0.6) \times 10^{-6}$		—
$K^+ (K^+ K^-)$ <i>S-wave</i>	$(5.77 \pm 0.12) \times 10^{-5}$		550

 **$\Delta C = 1$ weak neutral current (C1) modes, or
Lepton Family number (LF) or Lepton number (L) violating modes**

$\pi^+ e^+ e^-$	C1	< 1.1	$\times 10^{-6}$	CL=90%	930
$\pi^+ \pi^0 e^+ e^-$		< 1.4	$\times 10^{-5}$	CL=90%	925
$\pi^+ \phi, \phi \rightarrow e^+ e^-$	[rr]	$(1.7 \pm_{-0.9}^{+1.4})$	$\times 10^{-6}$		—
$\pi^+ \mu^+ \mu^-$	C1	< 7.3	$\times 10^{-8}$	CL=90%	918
$\pi^+ \phi, \phi \rightarrow \mu^+ \mu^-$	[rr]	(1.8 ± 0.8)	$\times 10^{-6}$		—
$\rho^+ \mu^+ \mu^-$	C1	< 5.6	$\times 10^{-4}$	CL=90%	757
$K^+ e^+ e^-$	[ss]	< 1.0	$\times 10^{-6}$	CL=90%	870
$K^+ \pi^0 e^+ e^-$		< 1.5	$\times 10^{-5}$	CL=90%	864
$K_S^0 \pi^+ e^+ e^-$		< 2.6	$\times 10^{-5}$	CL=90%	—
$K_S^0 K^+ e^+ e^-$		< 1.1	$\times 10^{-5}$	CL=90%	—
$K^+ \mu^+ \mu^-$	[ss]	< 4.3	$\times 10^{-6}$	CL=90%	856
$\pi^+ e^+ \mu^-$	LF	< 2.9	$\times 10^{-6}$	CL=90%	927
$\pi^+ e^- \mu^+$	LF	< 3.6	$\times 10^{-6}$	CL=90%	927
$K^+ e^+ \mu^-$	LF	< 1.2	$\times 10^{-6}$	CL=90%	866
$K^+ e^- \mu^+$	LF	< 2.8	$\times 10^{-6}$	CL=90%	866
$\pi^- 2e^+$	L	< 1.1	$\times 10^{-6}$	CL=90%	930
$\pi^- 2\mu^+$	L	< 2.2	$\times 10^{-8}$	CL=90%	918
$\pi^- e^+ \mu^+$	L	< 2.0	$\times 10^{-6}$	CL=90%	927
$\rho^- 2\mu^+$	L	< 5.6	$\times 10^{-4}$	CL=90%	757
$K^- 2e^+$	L	< 9	$\times 10^{-7}$	CL=90%	870
$K_S^0 \pi^- 2e^+$		< 3.3	$\times 10^{-6}$	CL=90%	863
$K^- \pi^0 2e^+$		< 8.5	$\times 10^{-6}$	CL=90%	864

$K^- 2\mu^+$	L	< 1.0	$\times 10^{-5}$ CL=90%	856
$K^- e^+ \mu^+$	L	< 1.9	$\times 10^{-6}$ CL=90%	866
$K^*(892)^- 2\mu^+$	L	< 8.5	$\times 10^{-4}$ CL=90%	703

 D^0

$$I(J^P) = \frac{1}{2}(0^-)$$

Mass $m = 1864.83 \pm 0.05$ MeV

$m_{D^\pm} - m_{D^0} = 4.822 \pm 0.015$ MeV

Mean life $\tau = (410.1 \pm 1.5) \times 10^{-15}$ s

$c\tau = 122.9$ μm

Mixing and related parameters

$$|m_{D_1^0} - m_{D_2^0}| = (0.95^{+0.41}_{-0.44}) \times 10^{10} \hbar \text{ s}^{-1}$$

$$(\Gamma_{D_1^0} - \Gamma_{D_2^0})/\Gamma = 2y = (1.29^{+0.14}_{-0.18}) \times 10^{-2}$$

$$|q/p| = 0.92^{+0.12}_{-0.09}$$

$$A_\Gamma = (-0.125 \pm 0.526) \times 10^{-3}$$

$$\phi^{K_S^0 \pi \pi} = -0.09^{+0.10}_{-0.13}$$

$K^+ \pi^-$ relative strong phase: $\cos \delta = 0.97 \pm 0.11$

$K^- \pi^+ \pi^0$ coherence factor $R_{K \pi \pi^0} = 0.82 \pm 0.06$

$K^- \pi^+ \pi^0$ average relative strong phase $\delta^{K \pi \pi^0} = (199 \pm 14)^\circ$

$K^- \pi^- 2\pi^+$ coherence factor $R_{K 3\pi} = 0.53^{+0.18}_{-0.21}$

$K^- \pi^- 2\pi^+$ average relative strong phase $\delta^{K 3\pi} = (125^{+22}_{-14})^\circ$

$D^0 \rightarrow K^- \pi^- 2\pi^+$, $R_{K 3\pi} (y \cos \delta^{K 3\pi} - x \sin \delta^{K 3\pi}) = (-3.0 \pm 0.7) \times 10^{-3} \text{ TeV}^{-1}$

$K_S^0 K^+ \pi^-$ coherence factor $R_{K_S^0 K \pi} = 0.70 \pm 0.08$

$K_S^0 K^+ \pi^-$ average relative strong phase $\delta^{K_S^0 K \pi} = (0 \pm 16)^\circ$

$K^* K$ coherence factor $R_{K^* K} = 0.94 \pm 0.12$

$K^* K$ average relative strong phase $\delta^{K^* K} = (-17 \pm 18)^\circ$

CP-violation decay-rate asymmetries (labeled by the D^0 decay)

$$A_{CP}(K^+ K^-) = (-0.07 \pm 0.11)\%$$

$$A_{CP}(2K_S^0) = (0.4 \pm 1.4)\%$$

$$A_{CP}(\pi^+ \pi^-) = (0.13 \pm 0.14)\%$$

$$A_{CP}(\pi^0 \pi^0) = (0.0 \pm 0.6)\%$$

$$A_{CP}(\rho \gamma) = (6 \pm 15) \times 10^{-2}$$

$$A_{CP}(\phi \gamma) = (-9 \pm 7) \times 10^{-2}$$

$$A_{CP}(\overline{K}^*(892)^0 \gamma) = (-0.3 \pm 2.0) \times 10^{-2}$$

$$A_{CP}(\pi^+ \pi^- \pi^0) = (0.3 \pm 0.4)\%$$

$$A_{CP}(\rho(770)^+ \pi^- \rightarrow \pi^+ \pi^- \pi^0) = (1.2 \pm 0.9)\% [tt]$$

$$A_{CP}(\rho(770)^0 \pi^0 \rightarrow \pi^+ \pi^- \pi^0) = (-3.1 \pm 3.0)\% [tt]$$

$$\begin{aligned}
A_{CP}(\rho(770)^- \pi^+ \rightarrow \pi^+ \pi^- \pi^0) &= (-1.0 \pm 1.7)\% \text{ [tt]} \\
A_{CP}(\rho(1450)^+ \pi^- \rightarrow \pi^+ \pi^- \pi^0) &= (0 \pm 70)\% \text{ [tt]} \\
A_{CP}(\rho(1450)^0 \pi^0 \rightarrow \pi^+ \pi^- \pi^0) &= (-20 \pm 40)\% \text{ [tt]} \\
A_{CP}(\rho(1450)^- \pi^+ \rightarrow \pi^+ \pi^- \pi^0) &= (6 \pm 9)\% \text{ [tt]} \\
A_{CP}(\rho(1700)^+ \pi^- \rightarrow \pi^+ \pi^- \pi^0) &= (-5 \pm 14)\% \text{ [tt]} \\
A_{CP}(\rho(1700)^0 \pi^0 \rightarrow \pi^+ \pi^- \pi^0) &= (13 \pm 9)\% \text{ [tt]} \\
A_{CP}(\rho(1700)^- \pi^+ \rightarrow \pi^+ \pi^- \pi^0) &= (8 \pm 11)\% \text{ [tt]} \\
A_{CP}(f_0(980) \pi^0 \rightarrow \pi^+ \pi^- \pi^0) &= (0 \pm 35)\% \text{ [tt]} \\
A_{CP}(f_0(1370) \pi^0 \rightarrow \pi^+ \pi^- \pi^0) &= (25 \pm 18)\% \text{ [tt]} \\
A_{CP}(f_0(1500) \pi^0 \rightarrow \pi^+ \pi^- \pi^0) &= (0 \pm 18)\% \text{ [tt]} \\
A_{CP}(f_0(1710) \pi^0 \rightarrow \pi^+ \pi^- \pi^0) &= (0 \pm 24)\% \text{ [tt]} \\
A_{CP}(f_2(1270) \pi^0 \rightarrow \pi^+ \pi^- \pi^0) &= (-4 \pm 6)\% \text{ [tt]} \\
A_{CP}(\sigma(400) \pi^0 \rightarrow \pi^+ \pi^- \pi^0) &= (6 \pm 8)\% \text{ [tt]} \\
A_{CP}(\text{nonresonant } \pi^+ \pi^- \pi^0) &= (-13 \pm 23)\% \text{ [tt]} \\
A_{CP}(a_1(1260)^+ \pi^- \rightarrow 2\pi^+ 2\pi^-) &= (5 \pm 6)\% \\
A_{CP}(a_1(1260)^- \pi^+ \rightarrow 2\pi^+ 2\pi^-) &= (14 \pm 18)\% \\
A_{CP}(\pi(1300)^+ \pi^- \rightarrow 2\pi^+ 2\pi^-) &= (-2 \pm 15)\% \\
A_{CP}(\pi(1300)^- \pi^+ \rightarrow 2\pi^+ 2\pi^-) &= (-6 \pm 30)\% \\
A_{CP}(a_1(1640)^+ \pi^- \rightarrow 2\pi^+ 2\pi^-) &= (9 \pm 26)\% \\
A_{CP}(\pi_2(1670)^+ \pi^- \rightarrow 2\pi^+ 2\pi^-) &= (7 \pm 18)\% \\
A_{CP}(\sigma f_0(1370) \rightarrow 2\pi^+ 2\pi^-) &= (-15 \pm 19)\% \\
A_{CP}(\sigma \rho(770)^0 \rightarrow 2\pi^+ 2\pi^-) &= (3 \pm 27)\% \\
A_{CP}(2\rho(770)^0 \rightarrow 2\pi^+ 2\pi^-) &= (-6 \pm 6)\% \\
A_{CP}(2f_2(1270) \rightarrow 2\pi^+ 2\pi^-) &= (-28 \pm 24)\% \\
A_{CP}(K^+ K^- \pi^0) &= (-1.0 \pm 1.7)\% \\
A_{CP}(K^*(892)^+ K^- \rightarrow K^+ K^- \pi^0) &= (-0.9 \pm 1.3)\% \text{ [tt]} \\
A_{CP}(K^*(1410)^+ K^- \rightarrow K^+ K^- \pi^0) &= (-21 \pm 24)\% \text{ [tt]} \\
A_{CP}((K^+ \pi^0)_{S\text{-wave}} K^- \rightarrow K^+ K^- \pi^0) &= (7 \pm 15)\% \text{ [tt]} \\
A_{CP}(\phi(1020) \pi^0 \rightarrow K^+ K^- \pi^0) &= (1.1 \pm 2.2)\% \text{ [tt]} \\
A_{CP}(f_0(980) \pi^0 \rightarrow K^+ K^- \pi^0) &= (-3 \pm 19)\% \text{ [tt]} \\
A_{CP}(a_0(980)^0 \pi^0 \rightarrow K^+ K^- \pi^0) &= (-5 \pm 16)\% \text{ [tt]} \\
A_{CP}(f'_2(1525) \pi^0 \rightarrow K^+ K^- \pi^0) &= (0 \pm 160)\% \text{ [tt]} \\
A_{CP}(K^*(892)^- K^+ \rightarrow K^+ K^- \pi^0) &= (-5 \pm 4)\% \text{ [tt]} \\
A_{CP}(K^*(1410)^- K^+ \rightarrow K^+ K^- \pi^0) &= (-17 \pm 29)\% \text{ [tt]} \\
A_{CP}((K^- \pi^0)_{S\text{-wave}} K^+ \rightarrow K^+ K^- \pi^0) &= (-10 \pm 40)\% \text{ [tt]} \\
A_{CP}(K_S^0 \pi^0) &= (-0.20 \pm 0.17)\% \\
A_{CP}(K_S^0 \eta) &= (0.5 \pm 0.5)\% \\
A_{CP}(K_S^0 \eta') &= (1.0 \pm 0.7)\% \\
A_{CP}(K_S^0 \phi) &= (-3 \pm 9)\% \\
A_{CP}(K^- \pi^+) &= (0.2 \pm 0.5)\% \\
A_{CP}(K^+ \pi^-) &= (-0.9 \pm 1.4)\% \\
A_{CP}(D_{CP}(\pm 1) \rightarrow K^\mp \pi^\pm) &= (12.7 \pm 1.5)\%
\end{aligned}$$

$$\begin{aligned}
 A_{CP}(K^- \pi^+ \pi^0) &= (0.1 \pm 0.5)\% \\
 A_{CP}(K^+ \pi^- \pi^0) &= (0 \pm 5)\% \\
 A_{CP}(K_S^0 \pi^+ \pi^-) &= (-0.1 \pm 0.8)\% \\
 A_{CP}(K^*(892)^- \pi^+ \rightarrow K_S^0 \pi^+ \pi^-) &= (0.4 \pm 0.5)\% \\
 A_{CP}(K^*(892)^+ \pi^- \rightarrow K_S^0 \pi^+ \pi^-) &= (1 \pm 6)\% \\
 A_{CP}(\bar{K}^0 \rho^0 \rightarrow K_S^0 \pi^+ \pi^-) &= (-0.1 \pm 0.5)\% \\
 A_{CP}(\bar{K}^0 \omega \rightarrow K_S^0 \pi^+ \pi^-) &= (-13 \pm 7)\% \\
 A_{CP}(\bar{K}^0 f_0(980) \rightarrow K_S^0 \pi^+ \pi^-) &= (-0.4 \pm 2.7)\% \\
 A_{CP}(\bar{K}^0 f_2(1270) \rightarrow K_S^0 \pi^+ \pi^-) &= (-4 \pm 5)\% \\
 A_{CP}(\bar{K}^0 f_0(1370) \rightarrow K_S^0 \pi^+ \pi^-) &= (-1 \pm 9)\% \\
 A_{CP}(\bar{K}^0 \rho^0(1450) \rightarrow K_S^0 \pi^+ \pi^-) &= (-4 \pm 10)\% \\
 A_{CP}(\bar{K}^0 f_0(600) \rightarrow K_S^0 \pi^+ \pi^-) &= (-3 \pm 5)\% \\
 A_{CP}(K^*(1410)^- \pi^+ \rightarrow K_S^0 \pi^+ \pi^-) &= (-2 \pm 9)\% \\
 A_{CP}(K_0^*(1430)^- \pi^+ \rightarrow K_S^0 \pi^+ \pi^-) &= (4 \pm 4)\% \\
 A_{CP}(K_0^*(1430)^+ \pi^- \rightarrow K_S^0 \pi^+ \pi^-) &= (12 \pm 15)\% \\
 A_{CP}(K_2^*(1430)^- \pi^+ \rightarrow K_S^0 \pi^+ \pi^-) &= (3 \pm 6)\% \\
 A_{CP}(K_2^*(1430)^+ \pi^- \rightarrow K_S^0 \pi^+ \pi^-) &= (-10 \pm 32)\% \\
 A_{CP}(K^- \pi^+ \pi^+ \pi^-) &= (0.2 \pm 0.5)\% \\
 A_{CP}(K^+ \pi^- \pi^+ \pi^-) &= (-2 \pm 4)\% \\
 A_{CP}(K^+ K^- \pi^+ \pi^-) &= (1.3 \pm 1.7)\% \\
 A_{CP}(K_1^*(1270)^+ K^- \rightarrow K^+ K^- \pi^+ \pi^-) &= (-2.3 \pm 1.7)\% \\
 A_{CP}(K_1^*(1270)^+ K^- \rightarrow K^{*0} \pi^+ K^-) &= (-1 \pm 10)\% \\
 A_{CP}(K_1^*(1270)^- K^+ \rightarrow \bar{K}^{*0} \pi^- K^+) &= (-10 \pm 32)\% \\
 A_{CP}(K_1^*(1270)^- K^+ \rightarrow K^+ K^- \pi^+ \pi^-) &= (1.7 \pm 3.5)\% \\
 A_{CP}(K_1^*(1270)^+ K^- \rightarrow \rho^0 K^+ K^-) &= (-7 \pm 17)\% \\
 A_{CP}(K_1^*(1270)^- K^+ \rightarrow \rho^0 K^- K^+) &= (10 \pm 13)\% \\
 A_{CP}(K_1(1400)^+ K^- \rightarrow K^+ K^- \pi^+ \pi^-) &= (-4.4 \pm 2.1)\% \\
 A_{CP}(K^*(1410)^+ K^- \rightarrow K^{*0} \pi^+ K^-) &= (-20 \pm 17)\% \\
 A_{CP}(K^*(1410)^- K^+ \rightarrow \bar{K}^{*0} \pi^- K^+) &= (-1 \pm 14)\% \\
 A_{CP}(K^*(1680)^+ K^- \rightarrow K^+ K^- \pi^+ \pi^-) &= (-17 \pm 29)\% \\
 A_{CP}(K^{*0} \bar{K}^{*0}) \text{ in } D^0, \bar{D}^0 \rightarrow K^{*0} \bar{K}^{*0} &= (-5 \pm 14)\% \\
 A_{CP}(K^{*0} \bar{K}^{*0} \text{ S-wave}) &= (-3.9 \pm 2.2)\% \\
 A_{CP}(\phi \rho^0) \text{ in } D^0, \bar{D}^0 \rightarrow \phi \rho^0 &= (1 \pm 9)\% \\
 A_{CP}(\phi \rho^0 \text{ S-wave}) &= (-3 \pm 5)\% \\
 A_{CP}(\phi \rho^0 \text{ D-wave}) &= (-37 \pm 19)\% \\
 A_{CP}(\phi(\pi^+ \pi^-)_{\text{S-wave}}) &= (6 \pm 6)\% \\
 A_{CP}(K^*(892)^0 (K^- \pi^+)_{\text{S-wave}}) &= (-10 \pm 40)\% \\
 A_{CP}(K^+ K^- \pi^+ \pi^- \text{ non-resonant}) &= (8 \pm 20)\% \\
 A_{CP}((K^- \pi^+)_{\text{P-wave}} (K^+ \pi^-)_{\text{S-wave}}) &= (3 \pm 11)\% \\
 A_{CP}(K^+ K^- \mu^+ \mu^-) \text{ in } D^0, \bar{D}^0 \rightarrow K^+ K^- \mu^+ \mu^- &= (0 \pm 11)\% \\
 A_{CP}(\pi^+ \pi^- \mu^+ \mu^-) \text{ in } D^0, \bar{D}^0 \rightarrow \pi^+ \pi^- \mu^+ \mu^- &= (5 \pm 4)\%
 \end{aligned}$$

CP-even fractions (labeled by the D^0 decay)

$$CP\text{-even fraction in } D^0 \rightarrow \pi^+ \pi^- \pi^0 \text{ decays} = (97.3 \pm 1.7)\%$$

$$CP\text{-even fraction in } D^0 \rightarrow K^+ K^- \pi^0 \text{ decays} = (73 \pm 6)\%$$

$$CP\text{-even fraction in } D^0 \rightarrow \pi^+ \pi^- \pi^+ \pi^- \text{ decays} = (76.9 \pm 2.3)\%$$

$$CP\text{-even fraction in } D^0 \rightarrow K_S^0 \pi^+ \pi^- \pi^0 \text{ decays} = (23.8 \pm 1.7)\%$$

$$CP\text{-even fraction in } D^0 \rightarrow K^+ K^- \pi^+ \pi^- \text{ decays} = (75 \pm 4)\%$$

CP-violation asymmetry difference

$$\Delta A_{CP} = A_{CP}(K^+ K^-) - A_{CP}(\pi^+ \pi^-) = (-0.154 \pm 0.029)\%$$

χ^2 tests of CP-violation (CPV) p-values

$$\text{Local CPV in } D^0, \bar{D}^0 \rightarrow \pi^+ \pi^- \pi^0 = 4.9\%$$

$$\text{Local CPV in } D^0, \bar{D}^0 \rightarrow \pi^+ \pi^- \pi^+ \pi^- = (0.6 \pm 0.2)\%$$

$$\text{Local CPV in } D^0, \bar{D}^0 \rightarrow K_S^0 \pi^+ \pi^- = 96\%$$

$$\text{Local CPV in } D^0, \bar{D}^0 \rightarrow K^+ K^- \pi^0 = 16.6\%$$

$$\text{Local CPV in } D^0, \bar{D}^0 \rightarrow K^+ K^- \pi^+ \pi^- = 9.1\%$$

T-violation decay-rate asymmetry

$$A_T(K^+ K^- \pi^+ \pi^-) = (2.9 \pm 2.2) \times 10^{-3} [//]$$

$$A_{T\text{viol}}(K_S \pi^+ \pi^- \pi^0) \text{ in } D^0, \bar{D}^0 \rightarrow K_S \pi^+ \pi^- \pi^0 = (-0.3^{+1.4}_{-1.6}) \times 10^{-3}$$

CPT-violation decay-rate asymmetry

$$A_{CPT}(K^\mp \pi^\pm) = 0.008 \pm 0.008$$

Form factors

$$r_V \equiv V(0)/A_1(0) \text{ in } D^0 \rightarrow K^*(892)^- \ell^+ \nu_\ell = 1.46 \pm 0.07$$

$$r_2 \equiv A_2(0)/A_1(0) \text{ in } D^0 \rightarrow K^*(892)^- \ell^+ \nu_\ell = 0.68 \pm 0.06$$

$$f_+(0) \text{ in } D^0 \rightarrow K^- \ell^+ \nu_\ell = 0.736 \pm 0.004$$

$$f_+(0)|V_{cs}| \text{ in } D^0 \rightarrow K^- \ell^+ \nu_\ell = 0.7166 \pm 0.0030$$

$$r_1 \equiv a_1/a_0 \text{ in } D^0 \rightarrow K^- \ell^+ \nu_\ell = -2.40 \pm 0.16$$

$$r_2 \equiv a_2/a_0 \text{ in } D^0 \rightarrow K^- \ell^+ \nu_\ell = 5 \pm 4$$

$$f_+(0) \text{ in } D^0 \rightarrow \pi^- \ell^+ \nu_\ell = 0.637 \pm 0.009$$

$$f_+(0)|V_{cd}| \text{ in } D^0 \rightarrow \pi^- \ell^+ \nu_\ell = 0.1436 \pm 0.0026 \quad (S = 1.5)$$

$$r_1 \equiv a_1/a_0 \text{ in } D^0 \rightarrow \pi^- \ell^+ \nu_\ell = -1.97 \pm 0.28 \quad (S = 1.4)$$

$$r_2 \equiv a_1/a_0 \text{ in } D^0 \rightarrow \pi^- \ell^+ \nu_\ell = -0.2 \pm 2.2 \quad (S = 1.7)$$

Most decay modes (other than the semileptonic modes) that involve a neutral K meson are now given as K_S^0 modes, not as \bar{K}^0 modes. Nearly always it is a K_S^0 that is measured, and interference between Cabibbo-allowed and doubly Cabibbo-suppressed modes can invalidate the assumption that $2\Gamma(K_S^0) = \Gamma(\bar{K}^0)$.

D^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Topological modes			
0-prongs	[uu] (15 ± 6) %		—
2-prongs	(71 ± 6) %		—
4-prongs	[$\nu\nu$] (14.6 ± 0.5) %		—
6-prongs	[xx] (6.5 ± 1.3) × 10 ⁻⁴		—
Inclusive modes			
e^+ anything	[$\gamma\gamma$] (6.49 ± 0.11) %		—
μ^+ anything	(6.8 ± 0.6) %		—
K^- anything	(54.7 ± 2.8) %	S=1.3	—
\bar{K}^0 anything + K^0 anything	(47 ± 4) %		—
K^+ anything	(3.4 ± 0.4) %		—
$K^*(892)^-$ anything	(15 ± 9) %		—
$\bar{K}^*(892)^0$ anything	(9 ± 4) %		—
$K^*(892)^+$ anything	< 3.6 %	CL=90%	—
$K^*(892)^0$ anything	(2.8 ± 1.3) %		—
η anything	(9.5 ± 0.9) %		—
η' anything	(2.48 ± 0.27) %		—
ϕ anything	(1.08 ± 0.04) %		—
invisibles	< 9.4 × 10 ⁻⁵	CL=90%	—
Semileptonic modes			
$K^- e^+ \nu_e$	(3.542 ± 0.035) %	S=1.3	867
$K^- \mu^+ \nu_\mu$	(3.41 ± 0.04) %		864
$K^*(892)^- e^+ \nu_e$	(2.15 ± 0.16) %		719
$K^*(892)^- \mu^+ \nu_\mu$	(1.89 ± 0.24) %		714
$K^- \pi^0 e^+ \nu_e$	(1.6 ± 1.3 / -0.5) %		861
$\bar{K}^0 \pi^- e^+ \nu_e$	(1.44 ± 0.04) %		860
$(\bar{K}^0 \pi^-)_{S\text{-wave}} e^+ \nu_e$	(7.9 ± 1.7) × 10 ⁻⁴		860
$K^- \pi^+ \pi^- e^+ \nu_e$	(2.8 ± 1.4 / -1.1) × 10 ⁻⁴		843
$K_1(1270)^- e^+ \nu_e$	(7.6 ± 4.0 / -3.1) × 10 ⁻⁴		511
$K^- \pi^+ \pi^- \mu^+ \nu_\mu$	< 1.3 × 10 ⁻³	CL=90%	821
$(\bar{K}^*(892)\pi)^- \mu^+ \nu_\mu$	< 1.5 × 10 ⁻³	CL=90%	692
$\pi^- e^+ \nu_e$	(2.91 ± 0.04) × 10 ⁻³		927

$\pi^- \mu^+ \nu_\mu$	$(2.67 \pm 0.12) \times 10^{-3}$	S=1.3	924
$\pi^- \pi^0 e^+ \nu_e$	$(1.45 \pm 0.07) \times 10^{-3}$		922
$\rho^- e^+ \nu_e$	$(1.50 \pm 0.12) \times 10^{-3}$	S=1.9	771
$a(980)^- e^+ \nu_e, a^- \rightarrow \eta \pi^-$	$(1.33 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.34 \\ 0.30 \end{smallmatrix}) \times 10^{-4}$		–

Hadronic modes with one \bar{K}

$K^- \pi^+$	$(3.950 \pm 0.031) \%$	S=1.2	861
$K_S^0 \pi^0$	$(1.240 \pm 0.022) \%$		860
$K_L^0 \pi^0$	$(10.0 \pm 0.7) \times 10^{-3}$		860
$K_S^0 \pi^+ \pi^-$	[nn] $(2.80 \pm 0.18) \%$	S=1.1	842
$K_S^0 \rho^0$	$(6.3 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.6 \\ 0.8 \end{smallmatrix}) \times 10^{-3}$		674
$K_S^0 \omega, \omega \rightarrow \pi^+ \pi^-$	$(2.0 \pm 0.6) \times 10^{-4}$		670
$K_S^0 (\pi^+ \pi^-)_{S\text{-wave}}$	$(3.3 \pm 0.8) \times 10^{-3}$		842
$K_S^0 f_0(980), f_0 \rightarrow \pi^+ \pi^-$	$(1.20 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.40 \\ 0.23 \end{smallmatrix}) \times 10^{-3}$		549
$K_S^0 f_0(1370), f_0 \rightarrow \pi^+ \pi^-$	$(2.8 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.9 \\ 1.3 \end{smallmatrix}) \times 10^{-3}$		†
$K_S^0 f_2(1270), f_2 \rightarrow \pi^+ \pi^-$	$(9 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 10 \\ 6 \end{smallmatrix}) \times 10^{-5}$		262
$K^*(892)^- \pi^+, K^{*-} \rightarrow K_S^0 \pi^-$	$(1.64 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.14 \\ 0.17 \end{smallmatrix}) \%$		711
$K_0^*(1430)^- \pi^+, K_0^{*-} \rightarrow K_S^0 \pi^-$	$(2.67 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.40 \\ 0.33 \end{smallmatrix}) \times 10^{-3}$		378
$K_2^*(1430)^- \pi^+, K_2^{*-} \rightarrow K_S^0 \pi^-$	$(3.4 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.9 \\ 1.0 \end{smallmatrix}) \times 10^{-4}$		367
$K^*(1680)^- \pi^+, K^{*-} \rightarrow K_S^0 \pi^-$	$(4.4 \pm 3.5) \times 10^{-4}$		46
$K^*(892)^+ \pi^-, K^{*+} \rightarrow K_S^0 \pi^+$	[zz] $(1.13 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.60 \\ 0.34 \end{smallmatrix}) \times 10^{-4}$		711
$K_0^*(1430)^+ \pi^-, K_0^{*+} \rightarrow K_S^0 \pi^+$	[zz] $< 1.4 \times 10^{-5}$	CL=95%	–
$K_2^*(1430)^+ \pi^-, K_2^{*+} \rightarrow K_S^0 \pi^+$	[zz] $< 3.4 \times 10^{-5}$	CL=95%	–
$K_S^0 \pi^+ \pi^-$ nonresonant	$(2.5 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 6.0 \\ 1.6 \end{smallmatrix}) \times 10^{-4}$		842
$K^- \pi^+ \pi^0$	[nn] $(14.4 \pm 0.5) \%$	S=2.0	844
$K^- \rho^+$	$(11.3 \pm 0.7) \%$		675
$K^- \rho(1700)^+, \rho^+ \rightarrow \pi^+ \pi^0$	$(8.2 \pm 1.8) \times 10^{-3}$		†
$K^*(892)^- \pi^+, K^*(892)^- \rightarrow K^- \pi^0$	$(2.31 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.40 \\ 0.20 \end{smallmatrix}) \%$		711
$\bar{K}^*(892)^0 \pi^0, \bar{K}^*(892)^0 \rightarrow K^- \pi^+$	$(1.95 \pm 0.24) \%$		711

$K_0^*(1430)^- \pi^+$, $K_0^{*-} \rightarrow K^- \pi^0$	(4.8 ± 2.2) × 10 ⁻³		378
$\bar{K}_0^*(1430)^0 \pi^0$, $\bar{K}_0^{*0} \rightarrow K^- \pi^+$	(5.9 $\begin{smallmatrix} + 5.0 \\ - 1.6 \end{smallmatrix}$) × 10 ⁻³		379
$K^*(1680)^- \pi^+$, $K^{*-} \rightarrow K^- \pi^0$	(1.9 ± 0.7) × 10 ⁻³		46
$K^- \pi^+ \pi^0$ nonresonant	(1.15 $\begin{smallmatrix} + 0.60 \\ - 0.20 \end{smallmatrix}$) %		844
$K_S^0 2\pi^0$	(9.1 ± 1.1) × 10 ⁻³	S=2.2	843
$K_S^0(2\pi^0)_{S\text{-wave}}$	(2.6 ± 0.7) × 10 ⁻³		–
$\bar{K}^*(892)^0 \pi^0$, $\bar{K}^{*0} \rightarrow K_S^0 \pi^0$	(8.1 ± 0.7) × 10 ⁻³		711
$\bar{K}^*(1430)^0 \pi^0$, $\bar{K}^{*0} \rightarrow K_S^0 \pi^0$	(4 ± 23) × 10 ⁻⁵		–
$\bar{K}^*(1680)^0 \pi^0$, $\bar{K}^{*0} \rightarrow K_S^0 \pi^0$	(1.0 ± 0.4) × 10 ⁻³		–
$K_S^0 f_2(1270)$, $f_2 \rightarrow 2\pi^0$	(2.3 ± 1.1) × 10 ⁻⁴		–
$2K_S^0$, one $K_S^0 \rightarrow 2\pi^0$	(3.2 ± 1.1) × 10 ⁻⁴		–
$K^- 2\pi^+ \pi^-$	[nn] (8.23 ± 0.14) %	S=1.1	813
$K^- \pi^+ \rho^0$ total	(6.87 ± 0.31) %		609
$K^- \pi^+ \rho^0$ 3-body	(6.1 ± 1.6) × 10 ⁻³		609
$\bar{K}^*(892)^0 \rho^0$, $\bar{K}^{*0} \rightarrow K^- \pi^+$	(1.01 ± 0.05) %		416
$\bar{K}^*(892)^0 \rho^0$ transverse, $\bar{K}^{*0} \rightarrow K^- \pi^+$	(1.2 ± 0.4) %		417
$K^- a_1(1260)^+$, $a_1^+ \rightarrow \rho^0 \pi^+$	(4.33 ± 0.32) %		327
$K_1(1270)^- \pi^+$, $K_1^- \rightarrow K^- \pi^+ \pi^-$ total	(3.9 ± 0.4) × 10 ⁻³		–
$K_1(1270)^- \pi^+$, $K_1^- \rightarrow \bar{K}^*(892)^0 \pi^-$, $\bar{K}^{*0} \rightarrow K^- \pi^+$	(6.6 ± 2.3) × 10 ⁻⁴		484
$K^- 2\pi^+ \pi^-$ nonresonant	(1.81 ± 0.07) %		813
$K_S^0 \pi^+ \pi^- \pi^0$	[aaa] (5.2 ± 0.6) %		813
$K_S^0 \eta$, $\eta \rightarrow \pi^+ \pi^- \pi^0$	(1.17 ± 0.03) × 10 ⁻³		772
$K_S^0 \omega$, $\omega \rightarrow \pi^+ \pi^- \pi^0$	(9.9 ± 0.6) × 10 ⁻³		670
$K^- \pi^+ 2\pi^0$	(8.86 ± 0.23) %		815
$K^- 2\pi^+ \pi^- \pi^0$	(4.3 ± 0.4) %		771
$\bar{K}^*(892)^0 \pi^+ \pi^- \pi^0$, $\bar{K}^{*0} \rightarrow K^- \pi^+$	(1.3 ± 0.6) %		643
$K^- \pi^+ \omega$, $\omega \rightarrow \pi^+ \pi^- \pi^0$	(2.8 ± 0.5) %		605
$\bar{K}^*(892)^0 \omega$, $\bar{K}^{*0} \rightarrow K^- \pi^+$, $\omega \rightarrow \pi^+ \pi^- \pi^0$	(6.5 ± 3.0) × 10 ⁻³		410
$K_S^0 \eta \pi^0$	(5.7 ± 1.1) × 10 ⁻³		721

$K_S^0 a_0(980), a_0 \rightarrow \eta \pi^0$	$(6.8 \pm 2.1) \times 10^{-3}$	—
$\overline{K}^{*0}(892)^0 \eta, \overline{K}^{*0} \rightarrow K_S^0 \pi^0$	$(1.7 \pm 0.5) \times 10^{-3}$	—
$K_S^0 2\pi^+ 2\pi^-$	$(2.66 \pm 0.30) \times 10^{-3}$	768
$K_S^0 \rho^0 \pi^+ \pi^-, \text{ no } K^*(892)^-$	$(1.1 \pm 0.7) \times 10^{-3}$	—
$K^*(892)^- 2\pi^+ \pi^-,$ $K^*(892)^- \rightarrow K_S^0 \pi^-,$ no ρ^0	$(5 \pm 7) \times 10^{-4}$	642
$K^*(892)^- \rho^0 \pi^+,$ $K^*(892)^- \rightarrow K_S^0 \pi^-$	$(1.6 \pm 0.6) \times 10^{-3}$	230
$K_S^0 2\pi^+ 2\pi^- \text{ nonresonant}$	$< 1.2 \times 10^{-3}$	CL=90% 768
$K^- 3\pi^+ 2\pi^-$	$(2.2 \pm 0.6) \times 10^{-4}$	713

Fractions of some of the following modes with resonances have already appeared above as submodes of particular charged-particle modes. These nine modes below are all corrected for unseen decays of the resonances.

$K_S^0 \eta$	$(5.09 \pm 0.13) \times 10^{-3}$	772
$K_S^0 \omega$	$(1.11 \pm 0.06) \%$	670
$K_S^0 \eta'(958)$	$(9.49 \pm 0.32) \times 10^{-3}$	565
$\overline{K}^{*0}(892)^0 \pi^+ \pi^- \pi^0$	$(1.9 \pm 0.9) \%$	643
$K^- \pi^+ \omega$	$(3.1 \pm 0.6) \%$	605
$\overline{K}^{*0}(892)^0 \omega$	$(1.1 \pm 0.5) \%$	410
$K^- \pi^+ \eta'(958)$	$(6.43 \pm 0.34) \times 10^{-3}$	479
$K_S^0 \eta'(958) \pi^0$	$(2.52 \pm 0.27) \times 10^{-3}$	479
$\overline{K}^{*0}(892)^0 \eta'(958)$	$< 1.0 \times 10^{-3}$	CL=90% 119

Hadronic modes with three K's

$K_S^0 K^+ K^-$	$(4.42 \pm 0.32) \times 10^{-3}$	544
$K_S^0 a_0(980)^0, a_0^0 \rightarrow K^+ K^-$	$(2.9 \pm 0.4) \times 10^{-3}$	—
$K^- a_0(980)^+, a_0^+ \rightarrow$ $K^+ K_S^0$	$(5.9 \pm 1.8) \times 10^{-4}$	—
$K^+ a_0(980)^-, a_0^- \rightarrow$ $K^- K_S^0$	$< 1.1 \times 10^{-4}$	CL=95% —
$K_S^0 f_0(980), f_0 \rightarrow K^+ K^-$	$< 9 \times 10^{-5}$	CL=95% —
$K_S^0 \phi, \phi \rightarrow K^+ K^-$	$(2.03 \pm 0.15) \times 10^{-3}$	520
$K_S^0 f_0(1370), f_0 \rightarrow K^+ K^-$	$(1.7 \pm 1.1) \times 10^{-4}$	—
$3K_S^0$	$(7.5 \pm 0.7) \times 10^{-4}$	S=1.4 539
$K^+ 2K^- \pi^+$	$(2.25 \pm 0.32) \times 10^{-4}$	434
$K^+ K^- \overline{K}^{*0}(892)^0, \overline{K}^{*0} \rightarrow$ $K^- \pi^+$	$(4.5 \pm 1.8) \times 10^{-5}$	†
$K^- \pi^+ \phi, \phi \rightarrow K^+ K^-$	$(4.1 \pm 1.7) \times 10^{-5}$	422
$\phi \overline{K}^{*0}(892)^0, \phi \rightarrow K^+ K^-,$ $\overline{K}^{*0} \rightarrow K^- \pi^+$	$(1.08 \pm 0.21) \times 10^{-4}$	†
$K^+ 2K^- \pi^+ \text{ nonresonant}$	$(3.4 \pm 1.5) \times 10^{-5}$	434
$2K_S^0 K^\pm \pi^\mp$	$(5.9 \pm 1.3) \times 10^{-4}$	427

Pionic modes

$\pi^+\pi^-\pi^0$	$(1.455 \pm 0.024) \times 10^{-3}$	S=1.3	922
$2\pi^0$	$(8.26 \pm 0.25) \times 10^{-4}$		923
$\pi^+\pi^-\pi^0$	$(1.49 \pm 0.06) \%$	S=2.1	907
$\rho^+\pi^-$	$(1.01 \pm 0.04) \%$		764
$\rho^0\pi^0$	$(3.86 \pm 0.23) \times 10^{-3}$		764
$\rho^-\pi^+$	$(5.15 \pm 0.25) \times 10^{-3}$		764
$\rho(1450)^+\pi^-, \rho^+ \rightarrow \pi^+\pi^0$	$(1.6 \pm 2.1) \times 10^{-5}$		–
$\rho(1450)^0\pi^0, \rho^0 \rightarrow \pi^+\pi^-$	$(4.5 \pm 2.0) \times 10^{-5}$		–
$\rho(1450)^-\pi^+, \rho^- \rightarrow \pi^-\pi^0$	$(2.7 \pm 0.4) \times 10^{-4}$		–
$\rho(1700)^+\pi^-, \rho^+ \rightarrow \pi^+\pi^0$	$(6.1 \pm 1.5) \times 10^{-4}$		–
$\rho(1700)^0\pi^0, \rho^0 \rightarrow \pi^+\pi^-$	$(7.4 \pm 1.8) \times 10^{-4}$		–
$\rho(1700)^-\pi^+, \rho^- \rightarrow \pi^-\pi^0$	$(4.8 \pm 1.1) \times 10^{-4}$		–
$f_0(980)\pi^0, f_0 \rightarrow \pi^+\pi^-$	$(3.7 \pm 0.9) \times 10^{-5}$		–
$f_0(500)\pi^0, f_0 \rightarrow \pi^+\pi^-$	$(1.22 \pm 0.22) \times 10^{-4}$		–
$f_0(1370)\pi^0, f_0 \rightarrow \pi^+\pi^-$	$(5.5 \pm 2.1) \times 10^{-5}$		–
$f_0(1500)\pi^0, f_0 \rightarrow \pi^+\pi^-$	$(5.8 \pm 1.6) \times 10^{-5}$		–
$f_0(1710)\pi^0, f_0 \rightarrow \pi^+\pi^-$	$(4.6 \pm 1.6) \times 10^{-5}$		–
$f_2(1270)\pi^0, f_2 \rightarrow \pi^+\pi^-$	$(1.97 \pm 0.21) \times 10^{-4}$		–
$\pi^+\pi^-\pi^0$ nonresonant	$(1.3 \pm 0.4) \times 10^{-4}$		907
$3\pi^0$	$(2.0 \pm 0.5) \times 10^{-4}$		908
$2\pi^+2\pi^-$	$(7.56 \pm 0.20) \times 10^{-3}$		880
$a_1(1260)^+\pi^-, a_1^+ \rightarrow$ $2\pi^+\pi^-$ total	$(4.54 \pm 0.31) \times 10^{-3}$		–
$a_1(1260)^+\pi^-, a_1^+ \rightarrow$ $\rho^0\pi^+$ S-wave	$(3.14 \pm 0.21) \times 10^{-3}$		–
$a_1(1260)^+\pi^-, a_1^+ \rightarrow$ $\rho^0\pi^+$ D-wave	$(1.9 \pm 0.5) \times 10^{-4}$		–
$a_1(1260)^+\pi^-, a_1^+ \rightarrow$ $\sigma\pi^+$	$(6.4 \pm 0.7) \times 10^{-4}$		–
$a_1(1260)^-\pi^+, a_1^- \rightarrow$ $\rho^0\pi^-$ S-wave	$(2.3 \pm 0.9) \times 10^{-4}$		–
$a_1(1260)^-\pi^+, a_1^- \rightarrow$ $\sigma\pi^-$	$(6.1 \pm 3.4) \times 10^{-5}$		–
$\pi(1300)^+\pi^-, \pi(1300)^+ \rightarrow$ $\sigma\pi^+$	$(5.1 \pm 2.7) \times 10^{-4}$		–
$\pi(1300)^-\pi^+, \pi(1300)^- \rightarrow$ $\sigma\pi^-$	$(2.3 \pm 2.2) \times 10^{-4}$		–
$a_1(1640)^+\pi^-, a_1^+ \rightarrow$ $\rho^0\pi^+$ D-wave	$(3.2 \pm 1.6) \times 10^{-4}$		–
$a_1(1640)^+\pi^-, a_1^+ \rightarrow$ $\sigma\pi^+$	$(1.8 \pm 1.4) \times 10^{-4}$		–
$\pi_2(1670)^+\pi^-, \pi_2^+ \rightarrow$ $f_2(1270)^0\pi^+, f_2^0 \rightarrow$ $\pi^+\pi^-$	$(2.0 \pm 0.9) \times 10^{-4}$		–
$\pi_2(1670)^+\pi^-, \pi_2^+ \rightarrow$ $\sigma\pi^+$	$(2.6 \pm 1.0) \times 10^{-4}$		–

$2\rho^0$ total		$(1.85 \pm 0.13) \times 10^{-3}$		518
$2\rho^0$, parallel helicities		$(8.3 \pm 3.2) \times 10^{-5}$		—
$2\rho^0$, perpendicular helicities		$(4.8 \pm 0.6) \times 10^{-4}$		—
$2\rho^0$, longitudinal helicities		$(1.27 \pm 0.10) \times 10^{-3}$		—
$2\rho(770)^0$, S-wave		$(1.8 \pm 1.3) \times 10^{-4}$		—
$2\rho(770)^0$, P-wave		$(5.3 \pm 1.3) \times 10^{-4}$		—
$2\rho(770)^0$, D-wave		$(6.2 \pm 3.0) \times 10^{-4}$		—
Resonant $(\pi^+\pi^-)\pi^+\pi^-$		$(1.51 \pm 0.12) \times 10^{-3}$		—
3-body total				
$\sigma\pi^+\pi^-$		$(6.2 \pm 0.9) \times 10^{-4}$		—
$\sigma\rho(770)^0$		$(5.0 \pm 2.5) \times 10^{-4}$		—
$f_0(980)\pi^+\pi^-$, $f_0 \rightarrow \pi^+\pi^-$		$(1.8 \pm 0.5) \times 10^{-4}$		—
$f_2(1270)\pi^+\pi^-$, $f_2 \rightarrow \pi^+\pi^-$		$(3.7 \pm 0.6) \times 10^{-4}$		—
$2f_2(1270)$, $f_2 \rightarrow \pi^+\pi^-$		$(1.6 \pm 1.8) \times 10^{-4}$		—
$f_0(1370)\sigma$, $f_0 \rightarrow \pi^+\pi^-$		$(1.6 \pm 0.5) \times 10^{-3}$		—
$\pi^+\pi^-2\pi^0$		$(1.02 \pm 0.09) \%$		882
$\eta\pi^0$	[bbb]	$(6.3 \pm 0.6) \times 10^{-4}$	S=1.1	846
$\omega\pi^0$	[bbb]	$(1.17 \pm 0.35) \times 10^{-4}$		761
$\omega\eta$		$(1.98 \pm 0.18) \times 10^{-3}$	S=1.1	648
$2\pi^+2\pi^-\pi^0$		$(4.2 \pm 0.5) \times 10^{-3}$		844
$\eta\pi^+\pi^-$	[bbb]	$(1.09 \pm 0.16) \times 10^{-3}$		827
$\omega\pi^+\pi^-$	[bbb]	$(1.6 \pm 0.5) \times 10^{-3}$		738
$\eta2\pi^0$		$(3.8 \pm 1.3) \times 10^{-4}$		829
$3\pi^+3\pi^-$		$(4.3 \pm 1.2) \times 10^{-4}$		795
$\eta'(958)\pi^0$		$(9.2 \pm 1.0) \times 10^{-4}$		678
$\eta'(958)\pi^+\pi^-$		$(4.5 \pm 1.7) \times 10^{-4}$		650
2η		$(2.11 \pm 0.19) \times 10^{-3}$	S=2.2	754
$2\eta\pi^0$		$(7.3 \pm 2.2) \times 10^{-4}$		699
3η		$< 1.3 \times 10^{-4}$	CL=90%	421
$\eta\eta'(958)$		$(1.01 \pm 0.19) \times 10^{-3}$		537

Hadronic modes with a $K\bar{K}$ pair

K^+K^-		$(4.08 \pm 0.06) \times 10^{-3}$	S=1.6	791
$2K_S^0$		$(1.41 \pm 0.05) \times 10^{-4}$	S=1.1	789
$K_S^0K^-\pi^+$		$(3.3 \pm 0.5) \times 10^{-3}$	S=1.1	739
$\bar{K}^*(892)^0K_S^0$, $\bar{K}^{*0} \rightarrow K^-\pi^+$		$(8.2 \pm 1.6) \times 10^{-5}$		608
$K^*(892)^+K^-$, $K^{*+} \rightarrow K_S^0\pi^+$		$(1.89 \pm 0.30) \times 10^{-3}$		—
$\bar{K}^*(1410)^0K_S^0$, $\bar{K}^{*0} \rightarrow K^-\pi^+$		$(1.3 \pm 1.9) \times 10^{-4}$		—

$K^*(1410)^+ K^-$, $K^{*+} \rightarrow K_S^0 \pi^+$	$(3.2 \pm 1.9) \times 10^{-4}$	—
$(K^- \pi^+)_{S\text{-wave}} K_S^0$	$(6.0 \pm 2.9) \times 10^{-4}$	739
$(K_S^0 \pi^+)_{S\text{-wave}} K^-$	$(3.9 \pm 1.0) \times 10^{-4}$	739
$a_0(980)^- \pi^+$, $a_0^- \rightarrow K_S^0 K^-$	$(1.3 \pm 1.4) \times 10^{-4}$	—
$a_0(1450)^- \pi^+$, $a_0^- \rightarrow K_S^0 K^-$	$(2.5 \pm 2.0) \times 10^{-5}$	—
$a_2(1320)^- \pi^+$, $a_2^- \rightarrow K_S^0 K^-$	$(5 \pm 5) \times 10^{-6}$	—
$\rho(1450)^- \pi^+$, $\rho^- \rightarrow K_S^0 K^-$	$(4.6 \pm 2.5) \times 10^{-5}$	—
$K_S^0 K^+ \pi^-$	$(2.17 \pm 0.34) \times 10^{-3}$	S=1.1 739
$K^*(892)^0 K_S^0$, $K^{*0} \rightarrow K^+ \pi^-$	$(1.12 \pm 0.21) \times 10^{-4}$	608
$K^*(892)^- K^+$, $K^{*-} \rightarrow K_S^0 \pi^-$	$(6.2 \pm 1.0) \times 10^{-4}$	—
$K^*(1410)^0 K_S^0$, $K^{*0} \rightarrow K^+ \pi^+$	$(5 \pm 8) \times 10^{-5}$	—
$K^*(1410)^- K^+$, $K^{*-} \rightarrow K_S^0 \pi^-$	$(2.6 \pm 2.0) \times 10^{-4}$	—
$(K^+ \pi^-)_{S\text{-wave}} K_S^0$	$(3.7 \pm 1.9) \times 10^{-4}$	739
$(K_S^0 \pi^-)_{S\text{-wave}} K^+$	$(1.4 \pm 0.6) \times 10^{-4}$	739
$a_0(980)^+ \pi^-$, $a_0^+ \rightarrow K_S^0 K^+$	$(6 \pm 4) \times 10^{-4}$	—
$a_0(1450)^+ \pi^-$, $a_0^+ \rightarrow K_S^0 K^+$	$(3.2 \pm 2.5) \times 10^{-5}$	—
$\rho(1700)^+ \pi^-$, $\rho^+ \rightarrow K_S^0 K^+$	$(1.1 \pm 0.6) \times 10^{-5}$	—
$K^+ K^- \pi^0$	$(3.42 \pm 0.14) \times 10^{-3}$	743
$K^*(892)^+ K^-$, $K^*(892)^+ \rightarrow K^+ \pi^0$	$(1.52 \pm 0.07) \times 10^{-3}$	—
$K^*(892)^- K^+$, $K^*(892)^- \rightarrow K^- \pi^0$	$(5.4 \pm 0.4) \times 10^{-4}$	—
$(K^+ \pi^0)_{S\text{-wave}} K^-$	$(2.43 \pm 0.18) \times 10^{-3}$	743
$(K^- \pi^0)_{S\text{-wave}} K^+$	$(1.3 \pm 0.5) \times 10^{-4}$	743
$f_0(980) \pi^0$, $f_0 \rightarrow K^+ K^-$	$(3.6 \pm 0.6) \times 10^{-4}$	—
$\phi \pi^0$, $\phi \rightarrow K^+ K^-$	$(6.6 \pm 0.4) \times 10^{-4}$	—
$2K_S^0 \pi^0$	$< 5.9 \times 10^{-4}$	740
$K^+ K^- \pi^+ \pi^-$	$(2.47 \pm 0.11) \times 10^{-3}$	677
$\phi(\pi^+ \pi^-)_{S\text{-wave}}$, $\phi \rightarrow K^+ K^-$	$(10 \pm 5) \times 10^{-5}$	614
$(\phi \rho^0)_{S\text{-wave}}$, $\phi \rightarrow K^+ K^-$	$(6.9 \pm 0.6) \times 10^{-4}$	250
$(\phi \rho^0)_{P\text{-wave}}$, $\phi \rightarrow K^+ K^-$	$(4.0 \pm 1.9) \times 10^{-5}$	—
$(\phi \rho^0)_{D\text{-wave}}$, $\phi \rightarrow K^+ K^-$	$(4.2 \pm 1.4) \times 10^{-5}$	—
$(K^*(892)^0 K^*(892)^0)_{S\text{-wave}}$, $K^{*0} \rightarrow K^\pm \pi^\mp$	$(2.24 \pm 0.13) \times 10^{-4}$	—

$(K^*(892)^0 \bar{K}^*(892)^0)_{P\text{-wave}},$ $K^* \rightarrow K^\pm \pi^\mp$	$(1.20 \pm 0.08) \times 10^{-4}$	—
$(K^*(892)^0 \bar{K}^*(892)^0)_{D\text{-wave}},$ $K^* \rightarrow K^\pm \pi^\mp$	$(4.7 \pm 0.4) \times 10^{-5}$	—
$K^*(892)^0 (K^- \pi^+)_{S\text{-wave}}$ 3-body, $K^{*0} \rightarrow K^+ \pi^-$	$(1.4 \pm 0.6) \times 10^{-4}$	—
$K_1(1270)^+ K^-, K_1^+ \rightarrow$ $K^{*0} \pi^+$	$(1.4 \pm 0.9) \times 10^{-4}$	—
$K_1(1270)^+ K^-, K_1^+ \rightarrow$ $K^*(1430)^0 \pi^+, K^{*0} \rightarrow$ $K^+ \pi^-$	$(1.5 \pm 0.5) \times 10^{-4}$	—
$K_1(1270)^+ K^-, K_1^+ \rightarrow$ $\rho^0 K^+$	$(2.2 \pm 0.6) \times 10^{-4}$	—
$K_1(1270)^+ K^-, K_1^+ \rightarrow$ $\omega(782) K^+, \omega \rightarrow \pi^+ \pi^-$	$(1.5 \pm 1.2) \times 10^{-5}$	—
$K_1(1270)^- K^+, K_1^- \rightarrow$ $\rho^0 K^-$	$(1.3 \pm 0.4) \times 10^{-4}$	—
$K_1(1400)^+ K^-, K_1^+ \rightarrow$ $K^*(892)^0 \pi^+, K^{*0} \rightarrow$ $K^+ \pi^-$	$(4.6 \pm 0.4) \times 10^{-4}$	—
$K^*(1410)^- K^+, K^{*-} \rightarrow$ $\bar{K}^{*0} \pi^-$	$(7.0 \pm 1.1) \times 10^{-5}$	—
$K_1(1680)^+ K^-, K_1^+ \rightarrow$ $K^{*0} \pi^+, K^{*0} \rightarrow K^+ \pi^-$	$(8.9 \pm 3.2) \times 10^{-5}$	—
$K^+ K^- \pi^+ \pi^-$ non-resonant	$(2.7 \pm 0.6) \times 10^{-4}$	—
$2K_S^0 \pi^+ \pi^-$	$(1.22 \pm 0.23) \times 10^{-3}$	673
$K_S^0 K^- 2\pi^+ \pi^-$	$< 1.4 \times 10^{-4}$	CL=90% 595
$K^+ K^- \pi^+ \pi^- \pi^0$	$(3.1 \pm 2.0) \times 10^{-3}$	600
Other $K\bar{K}X$ modes. They include all decay modes of the ϕ , η , and ω .		
$\phi \pi^0$	$(1.17 \pm 0.04) \times 10^{-3}$	645
$\phi \eta$	$(1.8 \pm 0.5) \times 10^{-4}$	489
$\phi \omega$	$< 2.1 \times 10^{-3}$	CL=90% 238
Radiative modes		
$\rho^0 \gamma$	$(1.82 \pm 0.32) \times 10^{-5}$	771
$\omega \gamma$	$< 2.4 \times 10^{-4}$	CL=90% 768
$\phi \gamma$	$(2.81 \pm 0.19) \times 10^{-5}$	654
$\bar{K}^*(892)^0 \gamma$	$(4.2 \pm 0.7) \times 10^{-4}$	719

**Doubly Cabibbo suppressed (DC) modes or
 $\Delta C = 2$ forbidden via mixing (C2M) modes**

$K^+ \ell^- \bar{\nu}_\ell$ via \bar{D}^0		< 2.2	$\times 10^{-5}$	CL=90%	–
K^+ or $K^*(892)^+$ $e^- \bar{\nu}_e$ via \bar{D}^0		< 6	$\times 10^{-5}$	CL=90%	–
$K^+ \pi^-$	DC	(1.50 ± 0.07)	$\times 10^{-4}$	S=3.0	861
$K^+ \pi^-$ via DCS		(1.364 ± 0.026)	$\times 10^{-4}$		–
$K^+ \pi^-$ via \bar{D}^0		< 1.6	$\times 10^{-5}$	CL=95%	861
$K_S^0 \pi^+ \pi^-$ in $D^0 \rightarrow \bar{D}^0$		< 1.8	$\times 10^{-4}$	CL=95%	–
$K^*(892)^+ \pi^-$, $K^{*+} \rightarrow K_S^0 \pi^+$	DC	$(1.13 \pm_{-0.34}^{+0.60})$	$\times 10^{-4}$		711
$K_0^*(1430)^+ \pi^-$, $K_0^{*+} \rightarrow K_S^0 \pi^+$	DC	< 1.4	$\times 10^{-5}$		–
$K_2^*(1430)^+ \pi^-$, $K_2^{*+} \rightarrow K_S^0 \pi^+$	DC	< 3.4	$\times 10^{-5}$		–
$K^+ \pi^- \pi^0$	DC	(3.06 ± 0.15)	$\times 10^{-4}$		844
$K^+ \pi^- \pi^0$ via \bar{D}^0		$(7.6 \pm_{-0.6}^{+0.5})$	$\times 10^{-4}$		–
$K^+ \pi^+ 2\pi^-$ via DCS		(2.49 ± 0.07)	$\times 10^{-4}$		–
$K^+ \pi^+ 2\pi^-$	DC	(2.65 ± 0.06)	$\times 10^{-4}$		813
$K^+ \pi^+ 2\pi^-$ via \bar{D}^0		(7.9 ± 3.0)	$\times 10^{-6}$		812
μ^- anything via \bar{D}^0		< 4	$\times 10^{-4}$	CL=90%	–

**$\Delta C = 1$ weak neutral current (C1) modes,
 Lepton Family number (LF) violating modes,
 Lepton (L) or Baryon (B) number violating modes**

$\gamma\gamma$	C1	< 8.5	$\times 10^{-7}$	CL=90%	932
$e^+ e^-$	C1	< 7.9	$\times 10^{-8}$	CL=90%	932
$\mu^+ \mu^-$	C1	< 6.2	$\times 10^{-9}$	CL=90%	926
$\pi^0 e^+ e^-$	C1	< 4	$\times 10^{-6}$	CL=90%	928
$\pi^0 \mu^+ \mu^-$	C1	< 1.8	$\times 10^{-4}$	CL=90%	915
$\eta e^+ e^-$	C1	< 3	$\times 10^{-6}$	CL=90%	852
$\eta \mu^+ \mu^-$	C1	< 5.3	$\times 10^{-4}$	CL=90%	838
$\pi^+ \pi^- e^+ e^-$	C1	< 7	$\times 10^{-6}$	CL=90%	922
$\rho^0 e^+ e^-$	C1	< 1.0	$\times 10^{-4}$	CL=90%	771
$\pi^+ \pi^- \mu^+ \mu^-$	C1	(9.6 ± 1.2)	$\times 10^{-7}$		894
$\pi^+ \pi^- \mu^+ \mu^-$ (non-res)		< 5.5	$\times 10^{-7}$	CL=90%	–
$\rho^0 \mu^+ \mu^-$	C1	< 2.2	$\times 10^{-5}$	CL=90%	754
$\omega e^+ e^-$	C1	< 6	$\times 10^{-6}$	CL=90%	768
$\omega \mu^+ \mu^-$	C1	< 8.3	$\times 10^{-4}$	CL=90%	751
$K^- K^+ e^+ e^-$	C1	< 1.1	$\times 10^{-5}$	CL=90%	791
$\phi e^+ e^-$	C1	< 5.2	$\times 10^{-5}$	CL=90%	654
$K^- K^+ \mu^+ \mu^-$	C1	(1.54 ± 0.32)	$\times 10^{-7}$		710
$K^- K^+ \mu^+ \mu^-$ (non-res)		< 3.3	$\times 10^{-5}$	CL=90%	–

$\phi\mu^+\mu^-$	<i>C1</i>	< 3.1	$\times 10^{-5}$	CL=90%	631
$\overline{K}^0 e^+ e^-$	[<i>ss</i>]	< 2.4	$\times 10^{-5}$	CL=90%	866
$\overline{K}^0 \mu^+ \mu^-$	[<i>ss</i>]	< 2.6	$\times 10^{-4}$	CL=90%	852
$K^-\pi^+e^+e^-, 675 < m_{ee} < 875 \text{ MeV}$		(4.0 \pm 0.5)	$\times 10^{-6}$		–
$K^-\pi^+e^+e^-, 1.005 < m_{ee} < 1.035 \text{ GeV}$		< 5	$\times 10^{-7}$	CL=90%	–
$\overline{K}^*(892)^0 e^+ e^-$	[<i>ss</i>]	< 4.7	$\times 10^{-5}$	CL=90%	719
$K^-\pi^+\mu^+\mu^-$	<i>C1</i>	< 3.59	$\times 10^{-4}$	CL=90%	829
$K^-\pi^+\mu^+\mu^-, 675 < m_{\mu\mu} < 875 \text{ MeV}$		(4.2 \pm 0.4)	$\times 10^{-6}$		–
$\overline{K}^*(892)^0 \mu^+ \mu^-$	[<i>ss</i>]	< 2.4	$\times 10^{-5}$	CL=90%	700
$\pi^+\pi^-\pi^0\mu^+\mu^-$	<i>C1</i>	< 8.1	$\times 10^{-4}$	CL=90%	863
$\mu^\pm e^\mp$	<i>LF</i> [<i>bb</i>]	< 1.3	$\times 10^{-8}$	CL=90%	929
$\pi^0 e^\pm \mu^\mp$	<i>LF</i> [<i>bb</i>]	< 8.6	$\times 10^{-5}$	CL=90%	924
$\eta e^\pm \mu^\mp$	<i>LF</i> [<i>bb</i>]	< 1.0	$\times 10^{-4}$	CL=90%	848
$\pi^+\pi^-e^\pm\mu^\mp$	<i>LF</i> [<i>bb</i>]	< 1.5	$\times 10^{-5}$	CL=90%	911
$\rho^0 e^\pm \mu^\mp$	<i>LF</i> [<i>bb</i>]	< 4.9	$\times 10^{-5}$	CL=90%	767
$\omega e^\pm \mu^\mp$	<i>LF</i> [<i>bb</i>]	< 1.2	$\times 10^{-4}$	CL=90%	764
$K^-K^+e^\pm\mu^\mp$	<i>LF</i> [<i>bb</i>]	< 1.8	$\times 10^{-4}$	CL=90%	754
$\phi e^\pm \mu^\mp$	<i>LF</i> [<i>bb</i>]	< 3.4	$\times 10^{-5}$	CL=90%	648
$\overline{K}^0 e^\pm \mu^\mp$	<i>LF</i> [<i>bb</i>]	< 1.0	$\times 10^{-4}$	CL=90%	863
$K^-\pi^+e^\pm\mu^\mp$	<i>LF</i> [<i>bb</i>]	< 5.53	$\times 10^{-4}$	CL=90%	848
$\overline{K}^*(892)^0 e^\pm \mu^\mp$	<i>LF</i> [<i>bb</i>]	< 8.3	$\times 10^{-5}$	CL=90%	714
$2\pi^-2e^+ + \text{c.c.}$	<i>L</i>	< 1.12	$\times 10^{-4}$	CL=90%	922
$2\pi^-2\mu^+ + \text{c.c.}$	<i>L</i>	< 2.9	$\times 10^{-5}$	CL=90%	894
$K^-\pi^-2e^+$		< 2.8	$\times 10^{-6}$	CL=90%	861
$K^-\pi^-2\mu^+ + \text{c.c.}$	<i>L</i>	< 3.9	$\times 10^{-4}$	CL=90%	829
$2K^-2e^+ + \text{c.c.}$	<i>L</i>	< 1.52	$\times 10^{-4}$	CL=90%	791
$2K^-2\mu^+ + \text{c.c.}$	<i>L</i>	< 9.4	$\times 10^{-5}$	CL=90%	710
$\pi^-\pi^-e^+\mu^+ + \text{c.c.}$	<i>L</i>	< 7.9	$\times 10^{-5}$	CL=90%	911
$K^-\pi^-e^+\mu^+ + \text{c.c.}$	<i>L</i>	< 2.18	$\times 10^{-4}$	CL=90%	848
$2K^-e^+\mu^+ + \text{c.c.}$	<i>L</i>	< 5.7	$\times 10^{-5}$	CL=90%	754
pe^-	<i>L,B</i> [<i>ccc</i>]	< 1.0	$\times 10^{-5}$	CL=90%	696
$\overline{p}e^+$	<i>L,B</i> [<i>ddd</i>]	< 1.1	$\times 10^{-5}$	CL=90%	696

$D^*(2007)^0$

$$I(J^P) = \frac{1}{2}(1^-)$$

I, J, P need confirmation.

Mass $m = 2006.85 \pm 0.05 \text{ MeV}$ ($S = 1.1$)

$m_{D^*0} - m_{D^0} = 142.014 \pm 0.030 \text{ MeV}$ ($S = 1.5$)

Full width $\Gamma < 2.1 \text{ MeV}$, CL = 90%

$\bar{D}^*(2007)^0$ modes are charge conjugates of modes below.

$D^*(2007)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0 \pi^0$	(64.7±0.9) %	43
$D^0 \gamma$	(35.3±0.9) %	137

$D^*(2010)^\pm$

$$I(J^P) = \frac{1}{2}(1^-)$$

I, J, P need confirmation.

Mass $m = 2010.26 \pm 0.05$ MeV

$$m_{D^*(2010)^+} - m_{D^+} = 140.603 \pm 0.015 \text{ MeV}$$

$$m_{D^*(2010)^+} - m_{D^0} = 145.4257 \pm 0.0017 \text{ MeV}$$

Full width $\Gamma = 83.4 \pm 1.8$ keV

$D^*(2010)^-$ modes are charge conjugates of the modes below.

$D^*(2010)^\pm$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0 \pi^+$	(67.7±0.5) %	39
$D^+ \pi^0$	(30.7±0.5) %	38
$D^+ \gamma$	(1.6±0.4) %	136

$D_0^*(2300)^0$

$$I(J^P) = \frac{1}{2}(0^+)$$

was $D_0^*(2400)^0$

Mass $m = 2300 \pm 19$ MeV

Full width $\Gamma = 274 \pm 40$ MeV

$D_0^*(2300)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^+ \pi^-$	seen	369

$D_1(2420)^0$

$$I(J^P) = \frac{1}{2}(1^+)$$

Mass $m = 2420.8 \pm 0.5$ MeV ($S = 1.3$)

$$m_{D_1^0} - m_{D^{*+}} = 410.6 \pm 0.5 \text{ MeV} \quad (S = 1.3)$$

Full width $\Gamma = 31.7 \pm 2.5$ MeV ($S = 3.5$)

$\bar{D}_1(2420)^0$ modes are charge conjugates of modes below.

$D_1(2420)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^*(2010)^+ \pi^-$	seen	353
$D^0 \pi^+ \pi^-$	seen	425
$D^+ \pi^-$	not seen	472
$D^{*0} \pi^+ \pi^-$	not seen	279

$D_2^*(2460)^0$

$$I(J^P) = \frac{1}{2}(2^+)$$

$J^P = 2^+$ assignment strongly favored.

$$\text{Mass } m = 2460.7 \pm 0.4 \text{ MeV} \quad (S = 3.1)$$

$$m_{D_2^{*0}} - m_{D^+} = 591.0 \pm 0.4 \text{ MeV} \quad (S = 2.9)$$

$$m_{D_2^{*0}} - m_{D^{*+}} = 450.4 \pm 0.4 \text{ MeV} \quad (S = 2.9)$$

$$\text{Full width } \Gamma = 47.5 \pm 1.1 \text{ MeV} \quad (S = 1.8)$$

$\bar{D}_2^*(2460)^0$ modes are charge conjugates of modes below.

$D_2^*(2460)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^+ \pi^-$	seen	505
$D^*(2010)^+ \pi^-$	seen	389
$D^0 \pi^+ \pi^-$	not seen	462
$D^{*0} \pi^+ \pi^-$	not seen	324

$D_2^*(2460)^\pm$

$$I(J^P) = \frac{1}{2}(2^+)$$

$J^P = 2^+$ assignment strongly favored.

$$\text{Mass } m = 2465.4 \pm 1.3 \text{ MeV} \quad (S = 3.1)$$

$$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0} = 2.4 \pm 1.7 \text{ MeV}$$

$$\text{Full width } \Gamma = 46.7 \pm 1.2 \text{ MeV}$$

$D_2^*(2460)^-$ modes are charge conjugates of modes below.

$D_2^*(2460)^\pm$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0 \pi^+$	seen	513
$D^{*0} \pi^+$	seen	396
$D^+ \pi^+ \pi^-$	not seen	462
$D^{*+} \pi^+ \pi^-$	not seen	326

CHARMED, STRANGE MESONS ($C = S = \pm 1$)

$$D_s^+ = c\bar{s}, D_s^- = \bar{c}s, \quad \text{similarly for } D_s^{*'}s$$

D_s^\pm

$$I(J^P) = 0(0^-)$$

Mass $m = 1968.34 \pm 0.07$ MeV

$$m_{D_s^\pm} - m_{D^\pm} = 98.69 \pm 0.05 \text{ MeV}$$

Mean life $\tau = (504 \pm 4) \times 10^{-15}$ s ($S = 1.2$)

$$c\tau = 151.2 \text{ } \mu\text{m}$$

CP-violating decay-rate asymmetries

$$A_{CP}(\mu^\pm \nu) = (5 \pm 6)\%$$

$$A_{CP}(K^\pm K_S^0) = (0.09 \pm 0.26)\%$$

$$A_{CP}(K^\pm K_L^0) \text{ in } D_s^\pm \rightarrow K^\pm K_L^0 = (-1.1 \pm 2.7) \times 10^{-2}$$

$$A_{CP}(K^+ K^- \pi^\pm) = (-0.5 \pm 0.9)\%$$

$$A_{CP}(\phi \pi^\pm) = (-0.38 \pm 0.27)\%$$

$$A_{CP}(K^\pm K_S^0 \pi^0) = (-2 \pm 6)\%$$

$$A_{CP}(2K_S^0 \pi^\pm) = (3 \pm 5)\%$$

$$A_{CP}(K^+ K^- \pi^\pm \pi^0) = (0.0 \pm 3.0)\%$$

$$A_{CP}(K^\pm K_S^0 \pi^+ \pi^-) = (-6 \pm 5)\%$$

$$A_{CP}(K_S^0 K^\mp 2\pi^\pm) = (4.1 \pm 2.8)\%$$

$$A_{CP}(\pi^+ \pi^- \pi^\pm) = (-0.7 \pm 3.1)\%$$

$$A_{CP}(\pi^\pm \eta) = (1.1 \pm 3.1)\%$$

$$A_{CP}(\pi^\pm \eta')$$

$$A_{CP}(\eta \pi^\pm \pi^0) = (-1 \pm 4)\%$$

$$A_{CP}(\eta' \pi^\pm \pi^0) = (0 \pm 8)\%$$

$$A_{CP}(K^\pm \pi^0) = (-27 \pm 24)\%$$

$$A_{CP}(\bar{K}^0 / K^0 \pi^\pm) = (0.4 \pm 0.5)\%$$

$$A_{CP}(K_S^0 \pi^\pm) = (0.20 \pm 0.18)\%$$

$$A_{CP}(K^\pm \pi^+ \pi^-) = (4 \pm 5)\%$$

$$A_{CP}(K^\pm \eta) = (9 \pm 15)\%$$

$$A_{CP}(K^\pm \eta'(958)) = (6 \pm 19)\%$$

CP violating asymmetries of P-odd (T-odd) moments

$$A_T(K_S^0 K^\pm \pi^+ \pi^-) = (-14 \pm 8) \times 10^{-3} [1]$$

$D_s^+ \rightarrow \phi \ell^+ \nu_\ell$ form factors

$$r_2 = 0.84 \pm 0.11 \quad (S = 2.4)$$

$$r_V = 1.80 \pm 0.08$$

$$\Gamma_L/\Gamma_T = 0.72 \pm 0.18$$

$$f_+(0) |V_{cs}| \text{ in } D_s^+ \rightarrow \eta e^+ \nu_e = 0.446 \pm 0.007$$

$$f_+(0) |V_{cs}| \text{ in } D_s^+ \rightarrow \eta' e^+ \nu_e = 0.48 \pm 0.05$$

CP violating asymmetries of P-odd (T-odd) moments

$$f_+(0) |V_{cd}| \text{ in } D_s^+ \rightarrow K^0 e^+ \nu_e = 0.162 \pm 0.019$$

$$r_V \equiv V(0)/A_1(0) \text{ in } D_s^+ \rightarrow K^*(892)^0 e^+ \nu_e = 1.7 \pm 0.4$$

$$r_2 \equiv A_2(0)/A_1(0) \text{ in } D_s^+ \rightarrow K^*(892)^0 e^+ \nu_e = 0.77 \pm 0.29$$

$$f_{D_s^+} |V_{cs}| \text{ in } D_s^+ \rightarrow \mu^+ \nu_\mu = 246 \pm 5 \text{ MeV}$$

Unless otherwise noted, the branching fractions for modes with a resonance in the final state include all the decay modes of the resonance. D_s^- modes are charge conjugates of the modes below.

D_s^+ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Inclusive modes			
e^+ semileptonic	[eee] (6.5 ± 0.4) %		—
π^+ anything	(119.3 ± 1.4) %		—
π^- anything	(43.2 ± 0.9) %		—
π^0 anything	(123 ± 7) %		—
K^- anything	(18.7 ± 0.5) %		—
K^+ anything	(28.9 ± 0.7) %		—
K_S^0 anything	(19.0 ± 1.1) %		—
η anything	[fff] (29.9 ± 2.8) %		—
ω anything	(6.1 ± 1.4) %		—
η' anything	[ggg] (10.3 ± 1.4) %	S=1.1	—
$f_0(980)$ anything, $f_0 \rightarrow \pi^+ \pi^-$	< 1.3 %	CL=90%	—
ϕ anything	(15.7 ± 1.0) %		—
$K^+ K^-$ anything	(15.8 ± 0.7) %		—
$K_S^0 K^+$ anything	(5.8 ± 0.5) %		—
$K_S^0 K^-$ anything	(1.9 ± 0.4) %		—
$2K_S^0$ anything	(1.70 ± 0.32) %		—
$2K^+$ anything	< 2.6 × 10 ⁻³	CL=90%	—
$2K^-$ anything	< 6 × 10 ⁻⁴	CL=90%	—

Leptonic and semileptonic modes

$e^+ \nu_e$	$< 8.3 \times 10^{-5}$	CL=90%	984
$\mu^+ \nu_\mu$	$(5.49 \pm 0.16) \times 10^{-3}$		981
$\tau^+ \nu_\tau$	$(5.48 \pm 0.23) \%$		182
$\gamma e^+ \nu_e$	$< 1.3 \times 10^{-4}$	CL=90%	984
$K^+ K^- e^+ \nu_e$	—		851
$\phi e^+ \nu_e$	[hhh] $(2.39 \pm 0.16) \%$	S=1.3	720
$\phi \mu^+ \nu_\mu$	$(1.9 \pm 0.5) \%$		715
$\eta e^+ \nu_e + \eta'(958) e^+ \nu_e$	[hhh] $(3.03 \pm 0.24) \%$		—
$\eta e^+ \nu_e$	[hhh] $(2.32 \pm 0.08) \%$		908
$\eta'(958) e^+ \nu_e$	[hhh] $(8.0 \pm 0.7) \times 10^{-3}$		751
$\eta \mu^+ \nu_\mu$	$(2.4 \pm 0.5) \%$		905
$\eta'(958) \mu^+ \nu_\mu$	$(1.1 \pm 0.5) \%$		747
$\omega e^+ \nu_e$	[iii] $< 2.0 \times 10^{-3}$	CL=90%	829
$K^0 e^+ \nu_e$	$(3.4 \pm 0.4) \times 10^{-3}$		921
$K^*(892)^0 e^+ \nu_e$	[hhh] $(2.15 \pm 0.28) \times 10^{-3}$	S=1.1	782

Hadronic modes with a $K\bar{K}$ pair

$K^+ K_S^0$	$(1.46 \pm 0.04) \%$	S=1.1	850
$K^+ K_L^0$	$(1.49 \pm 0.06) \%$		850
$K^+ \bar{K}^0$	$(2.95 \pm 0.14) \%$		850
$K^+ K^- \pi^+$	[nn] $(5.39 \pm 0.15) \%$	S=1.2	805
$\phi \pi^+$	[hhh, jji] $(4.5 \pm 0.4) \%$		712
$\phi \pi^+, \phi \rightarrow K^+ K^-$	[jji] $(2.24 \pm 0.08) \%$		712
$K^+ \bar{K}^*(892)^0, \bar{K}^{*0} \rightarrow K^- \pi^+$	$(2.58 \pm 0.08) \%$		416
$f_0(980) \pi^+, f_0 \rightarrow K^+ K^-$	$(1.14 \pm 0.31) \%$		732
$f_0(1370) \pi^+, f_0 \rightarrow K^+ K^-$	$(7 \pm 5) \times 10^{-4}$		—
$f_0(1710) \pi^+, f_0 \rightarrow K^+ K^-$	$(6.6 \pm 2.8) \times 10^{-4}$		198
$K^+ \bar{K}_0^*(1430)^0, \bar{K}_0^* \rightarrow K^- \pi^+$	$(1.8 \pm 0.4) \times 10^{-3}$		218
$K^+ K_S^0 \pi^0$	$(1.52 \pm 0.22) \%$		805
$2K_S^0 \pi^+$	$(7.7 \pm 0.6) \times 10^{-3}$		802
$K^0 \bar{K}^0 \pi^+$	—		802
$K^*(892)^+ \bar{K}^0$	[hhh] $(5.4 \pm 1.2) \%$		683
$K^+ K^- \pi^+ \pi^0$	$(6.2 \pm 0.6) \%$	S=1.1	748
$\phi \rho^+$	[hhh] $(8.4 \pm 1.9 - 2.3) \%$		401
$K_S^0 K^- 2\pi^+$	$(1.65 \pm 0.10) \%$		744
$K^*(892)^+ \bar{K}^*(892)^0$	[hhh] $(7.2 \pm 2.6) \%$		417
$K^+ K_S^0 \pi^+ \pi^-$	$(9.9 \pm 0.8) \times 10^{-3}$		744
$K^+ K^- 2\pi^+ \pi^-$	$(8.6 \pm 1.5) \times 10^{-3}$		673
$\phi 2\pi^+ \pi^-$	[hhh] $(1.21 \pm 0.16) \%$		640
$\phi \rho^0 \pi^+, \phi \rightarrow K^+ K^-$	$(6.5 \pm 1.3) \times 10^{-3}$		181

$\phi a_1(1260)^+, \phi \rightarrow$	$(7.4 \pm 1.2) \times 10^{-3}$		†
$K^+ K^-, a_1^+ \rightarrow$			
$\rho^0 \pi^+$			
$\phi 2\pi^+ \pi^- \text{non-}\rho, \phi \rightarrow$	$(1.8 \pm 0.7) \times 10^{-3}$		–
$K^+ K^-$			
$K^+ K^- \rho^0 \pi^+ \text{non-}\phi$	$< 2.6 \times 10^{-4}$	CL=90%	249
$K^+ K^- 2\pi^+ \pi^- \text{nonresonant}$	$(9 \pm 7) \times 10^{-4}$		673
$2K_S^0 2\pi^+ \pi^-$	$(8.4 \pm 3.5) \times 10^{-4}$		669

Hadronic modes without K's

$\pi^+ \pi^0$	$< 3.4 \times 10^{-4}$	CL=90%	975
$2\pi^+ \pi^-$	$(1.08 \pm 0.04) \%$	S=1.1	959
$\rho^0 \pi^+$	$(1.9 \pm 1.2) \times 10^{-4}$		825
$\pi^+ (\pi^+ \pi^-)_{S\text{-wave}}$	[kkk] $(9.0 \pm 0.4) \times 10^{-3}$		959
$f_2(1270)\pi^+, f_2 \rightarrow \pi^+ \pi^-$	$(1.09 \pm 0.20) \times 10^{-3}$		559
$\rho(1450)^0 \pi^+, \rho^0 \rightarrow \pi^+ \pi^-$	$(3.0 \pm 1.9) \times 10^{-4}$		421
$\pi^+ 2\pi^0$	$(6.5 \pm 1.3) \times 10^{-3}$		961
$2\pi^+ \pi^- \pi^0$	–		935
$\eta \pi^+$	[hhh] $(1.68 \pm 0.10) \%$	S=1.2	902
$\omega \pi^+$	[hhh] $(1.92 \pm 0.30) \times 10^{-3}$		822
$3\pi^+ 2\pi^-$	$(7.9 \pm 0.8) \times 10^{-3}$		899
$2\pi^+ \pi^- 2\pi^0$	–		902
$\eta \rho^+$	[hhh] $(8.9 \pm 0.8) \%$		724
$\eta \pi^+ \pi^0$	$(9.5 \pm 0.5) \%$		885
$\eta (\pi^+ \pi^0)_{P\text{-wave}}$	$(5.1 \pm 3.1) \times 10^{-3}$		885
$a_0(980)^+ \pi^0, a_0(980)^+ \rightarrow \eta \pi^+ \pi^0$	$(2.2 \pm 0.4) \%$		–
$\omega \pi^+ \pi^0$	[hhh] $(2.8 \pm 0.7) \%$		802
$3\pi^+ 2\pi^- \pi^0$	$(4.9 \pm 3.2) \%$		856
$\omega 2\pi^+ \pi^-$	[hhh] $(1.6 \pm 0.5) \%$		766
$\eta'(958)\pi^+$	[ggg, hhh] $(3.94 \pm 0.25) \%$		743
$3\pi^+ 2\pi^- 2\pi^0$	–		803
$\omega \eta \pi^+$	[hhh] $< 2.13 \%$	CL=90%	654
$\eta'(958)\rho^+$	[ggg, hhh] $(5.8 \pm 1.5) \%$		465
$\eta'(958)\pi^+ \pi^0$	$(5.6 \pm 0.8) \%$		720
$\eta'(958)\pi^+ \pi^0 \text{nonresonant}$	$< 5.1 \%$	CL=90%	720

Modes with one or three K's

$K^+ \pi^0$	$(6.1 \pm 2.1) \times 10^{-4}$		917
$K_S^0 \pi^+$	$(1.19 \pm 0.05) \times 10^{-3}$		916
$K^+ \eta$	[hhh] $(1.72 \pm 0.34) \times 10^{-3}$		835
$K^+ \omega$	[hhh] $(8.7 \pm 2.5) \times 10^{-4}$		741
$K^+ \eta'(958)$	[hhh] $(1.7 \pm 0.5) \times 10^{-3}$		646
$K^+ \pi^+ \pi^-$	$(6.5 \pm 0.4) \times 10^{-3}$		900
$K^+ \rho^0$	$(2.5 \pm 0.4) \times 10^{-3}$		745

$K^+ \rho(1450)^0, \rho^0 \rightarrow \pi^+ \pi^-$	$(6.9 \pm 2.4) \times 10^{-4}$	—
$K^*(892)^0 \pi^+, K^{*0} \rightarrow$	$(1.41 \pm 0.24) \times 10^{-3}$	775
$K^+ \pi^-$		
$K^*(1410)^0 \pi^+, K^{*0} \rightarrow$	$(1.23 \pm 0.28) \times 10^{-3}$	—
$K^+ \pi^-$		
$K^*(1430)^0 \pi^+, K^{*0} \rightarrow$	$(5.0 \pm 3.5) \times 10^{-4}$	—
$K^+ \pi^-$		
$K^+ \pi^+ \pi^-$ nonresonant	$(1.03 \pm 0.34) \times 10^{-3}$	900
$K^0 \pi^+ \pi^0$	$(1.00 \pm 0.18) \%$	899
$K_S^0 2\pi^+ \pi^-$	$(3.0 \pm 1.1) \times 10^{-3}$	870
$K^+ \omega \pi^0$	$[hhh] < 8.2 \times 10^{-3}$	CL=90% 684
$K^+ \omega \pi^+ \pi^-$	$[hhh] < 5.4 \times 10^{-3}$	CL=90% 603
$K^+ \omega \eta$	$[hhh] < 7.9 \times 10^{-3}$	CL=90% 366
$2K^+ K^-$	$(2.16 \pm 0.20) \times 10^{-4}$	628
$\phi K^+, \phi \rightarrow K^+ K^-$	$(8.8 \pm 2.0) \times 10^{-5}$	—

Doubly Cabibbo-suppressed modes

$2K^+ \pi^-$	$(1.28 \pm 0.04) \times 10^{-4}$	805
$K^+ K^*(892)^0, K^{*0} \rightarrow$	$(6.0 \pm 3.4) \times 10^{-5}$	—
$K^+ \pi^-$		

Baryon-antibaryon mode

$p\bar{n}$	$(1.22 \pm 0.11) \times 10^{-3}$	295
$p\bar{p}e^+ \nu_e$	$< 2.0 \times 10^{-4}$	CL=90% 296

$\Delta C = 1$ weak neutral current (C1) modes, Lepton family number (LF), or Lepton number (L) violating modes

$\pi^+ e^+ e^-$	$[ss] < 1.3 \times 10^{-5}$	CL=90% 979
$\pi^+ \phi, \phi \rightarrow e^+ e^-$	$[rr] (6 \begin{smallmatrix} +8 \\ -4 \end{smallmatrix}) \times 10^{-6}$	—
$\pi^+ \mu^+ \mu^-$	$[ss] < 4.1 \times 10^{-7}$	CL=90% 968
$K^+ e^+ e^-$	C1 $< 3.7 \times 10^{-6}$	CL=90% 922
$K^+ \mu^+ \mu^-$	C1 $< 2.1 \times 10^{-5}$	CL=90% 909
$K^*(892)^+ \mu^+ \mu^-$	C1 $< 1.4 \times 10^{-3}$	CL=90% 765
$\pi^+ e^+ \mu^-$	LF $< 1.2 \times 10^{-5}$	CL=90% 976
$\pi^+ e^- \mu^+$	LF $< 2.0 \times 10^{-5}$	CL=90% 976
$K^+ e^+ \mu^-$	LF $< 1.4 \times 10^{-5}$	CL=90% 919
$K^+ e^- \mu^+$	LF $< 9.7 \times 10^{-6}$	CL=90% 919
$\pi^- 2e^+$	L $< 4.1 \times 10^{-6}$	CL=90% 979
$\pi^- 2\mu^+$	L $< 1.2 \times 10^{-7}$	CL=90% 968
$\pi^- e^+ \mu^+$	L $< 8.4 \times 10^{-6}$	CL=90% 976
$K^- 2e^+$	L $< 5.2 \times 10^{-6}$	CL=90% 922
$K^- 2\mu^+$	L $< 1.3 \times 10^{-5}$	CL=90% 909
$K^- e^+ \mu^+$	L $< 6.1 \times 10^{-6}$	CL=90% 919
$K^*(892)^- 2\mu^+$	L $< 1.4 \times 10^{-3}$	CL=90% 765

$D_s^{*\pm}$

$$I(J^P) = 0(?^?)$$

J^P is natural, width and decay modes consistent with 1^- .

Mass $m = 2112.2 \pm 0.4$ MeV

$m_{D_s^{*\pm}} - m_{D_s^\pm} = 143.8 \pm 0.4$ MeV

Full width $\Gamma < 1.9$ MeV, CL = 90%

D_s^{*-} modes are charge conjugates of the modes below.

D_s^{*+} DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D_s^+ \gamma$	$(93.5 \pm 0.7) \%$	139
$D_s^+ \pi^0$	$(5.8 \pm 0.7) \%$	48
$D_s^+ e^+ e^-$	$(6.7 \pm 1.6) \times 10^{-3}$	139

$D_{s0}^{*}(2317)^\pm$

$$I(J^P) = 0(0^+)$$

J, P need confirmation.

J^P is natural, low mass consistent with 0^+ .

Mass $m = 2317.8 \pm 0.5$ MeV

$m_{D_{s0}^{*}(2317)^\pm} - m_{D_s^\pm} = 349.4 \pm 0.5$ MeV

Full width $\Gamma < 3.8$ MeV, CL = 95%

$D_{s0}^{*}(2317)^-$ modes are charge conjugates of modes below.

$D_{s0}^{*}(2317)^\pm$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$D_s^+ \pi^0$	$(100_{-20}^{+0}) \%$		298
$D_s^+ \gamma$	$< 5 \%$	90%	323
$D_s^{*}(2112)^+ \gamma$	$< 6 \%$	90%	—
$D_s^+ \gamma \gamma$	$< 18 \%$	95%	323
$D_s^{*}(2112)^+ \pi^0$	$< 11 \%$	90%	—
$D_s^+ \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%	194
$D_s^+ \pi^0 \pi^0$	not seen		205

$D_{s1}(2460)^\pm$

$$I(J^P) = 0(1^+)$$

Mass $m = 2459.5 \pm 0.6$ MeV ($S = 1.1$)

$m_{D_{s1}(2460)^\pm} - m_{D_s^{*\pm}} = 347.3 \pm 0.7$ MeV ($S = 1.2$)

$m_{D_{s1}(2460)^\pm} - m_{D_s^\pm} = 491.2 \pm 0.6$ MeV ($S = 1.1$)

Full width $\Gamma < 3.5$ MeV, CL = 95%

$D_{s1}(2460)^-$ modes are charge conjugates of the modes below.

$D_{s1}(2460)^+$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$D_s^{*+} \pi^0$	(48 ± 11) %		297
$D_s^+ \gamma$	(18 ± 4) %		442
$D_s^+ \pi^+ \pi^-$	(4.3 ± 1.3) %	S=1.1	363
$D_s^{*+} \gamma$	< 8 %	CL=90%	323
$D_{s0}^*(2317)^+ \gamma$	(3.7 ⁺ ₋ 5.0 _{-2.4}) %		138

$D_{s1}(2536)^\pm$

$I(J^P) = 0(1^+)$
 J, P need confirmation.

Mass $m = 2535.11 \pm 0.06$ MeV

Full width $\Gamma = 0.92 \pm 0.05$ MeV

$D_{s1}(2536)^-$ modes are charge conjugates of the modes below.

$D_{s1}(2536)^+$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$D^*(2010)^+ K^0$	0.85 ± 0.12		149
$(D^*(2010)^+ K^0)_{S-wave}$	0.61 ± 0.09		149
$D^+ \pi^- K^+$	0.028 ± 0.005		176
$D^*(2007)^0 K^+$	DEFINED AS 1		167
$D^+ K^0$	< 0.34	90%	381
$D^0 K^+$	< 0.12	90%	391
$D_s^{*+} \gamma$	possibly seen		388
$D_s^+ \pi^+ \pi^-$	seen		437

$D_{s2}^*(2573)$

$I(J^P) = 0(2^+)$

J^P is natural, width and decay modes consistent with 2^+ .

Mass $m = 2569.1 \pm 0.8$ MeV (S = 2.4)

Full width $\Gamma = 16.9 \pm 0.7$ MeV

$D_{s2}^*(2573)^-$ modes are charge conjugates of the modes below.

$D_{s2}^*(2573)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0 K^+$	seen	431
$D^*(2007)^0 K^+$	not seen	238

$D_{s1}^*(2700)^\pm$

$$I(J^P) = 0(1^-)$$

Mass $m = 2708.3^{+4.0}_{-3.4}$ MeV

Full width $\Gamma = 120 \pm 11$ MeV

BOTTOM MESONS ($B = \pm 1$)

$$B^+ = u\bar{b}, B^0 = d\bar{b}, \bar{B}^0 = \bar{d}b, B^- = \bar{u}b, \text{ similarly for } B^{*'}s$$

B-particle organization

Many measurements of B decays involve admixtures of B hadrons. Previously we arbitrarily included such admixtures in the B^\pm section, but because of their importance we have created two new sections: “ B^\pm/B^0 Admixture” for $\Upsilon(4S)$ results and “ $B^\pm/B^0/B_s^0/b$ -baryon Admixture” for results at higher energies. Most inclusive decay branching fractions and χ_b at high energy are found in the Admixture sections. B^0 - \bar{B}^0 mixing data are found in the B^0 section, while B_s^0 - \bar{B}_s^0 mixing data and B - \bar{B} mixing data for a B^0/B_s^0 admixture are found in the B_s^0 section. CP -violation data are found in the B^\pm , B^0 , and B^\pm/B^0 Admixture sections. b -baryons are found near the end of the Baryon section.

The organization of the B sections is now as follows, where bullets indicate particle sections and brackets indicate reviews.

- B^\pm
mass, mean life, CP violation, branching fractions
- B^0
mass, mean life, B^0 - \bar{B}^0 mixing, CP violation, branching fractions
- B^\pm/B^0 Admixtures
 CP violation, branching fractions
- $B^\pm/B^0/B_s^0/b$ -baryon Admixtures
mean life, production fractions, branching fractions

- B^*
mass
- $B_1(5721)^+$
mass
- $B_1(5721)^0$
mass
- $B_2^*(5747)^+$
mass
- $B_2^*(5747)^0$
mass
- $B_J^*(5970)^+$
mass
- $B_J^*(5970)^0$
mass
- B_s^0
mass, mean life, $B_s^0-\bar{B}_s^0$ mixing, CP violation,
branching fractions
- B_s^*
mass
- $B_{s1}(5830)^0$
mass
- $B_{s2}^*(5840)^0$
mass
- B_c^\pm
mass, mean life, branching fractions

At the end of Baryon Listings:

- Λ_b
mass, mean life, branching fractions
- $\Lambda_b(5912)^0$
mass, mean life
- $\Lambda_b(5920)^0$
mass, mean life
- Σ_b
mass

- Σ_b^*
mass
- Ξ_b^0, Ξ_b^-
mass, mean life, branching fractions
- $\Xi_b'(5935)^-$
mass
- $\Xi_b(5945)^0$
mass
- $\Xi_b^*(5955)^-$
mass
- Ω_b^-
mass, branching fractions
- b -baryon Admixture
mean life, branching fractions

B^\pm

$$I(J^P) = \frac{1}{2}(0^-)$$

I, J, P need confirmation. Quantum numbers shown are quark-model predictions.

$$\text{Mass } m_{B^\pm} = 5279.34 \pm 0.12 \text{ MeV}$$

$$\text{Mean life } \tau_{B^\pm} = (1.638 \pm 0.004) \times 10^{-12} \text{ s}$$

$$c\tau = 491.1 \text{ } \mu\text{m}$$

CP violation

$$A_{CP}(B^+ \rightarrow J/\psi(1S)K^+) = (1.8 \pm 3.0) \times 10^{-3} \quad (S = 1.5)$$

$$A_{CP}(B^+ \rightarrow J/\psi(1S)\pi^+) = (1.8 \pm 1.2) \times 10^{-2} \quad (S = 1.3)$$

$$A_{CP}(B^+ \rightarrow J/\psi\rho^+) = -0.05 \pm 0.05$$

$$A_{CP}(B^+ \rightarrow J/\psi K^*(892)^+) = -0.048 \pm 0.033$$

$$A_{CP}(B^+ \rightarrow \eta_c K^+) = 0.01 \pm 0.07 \quad (S = 2.2)$$

$$A_{CP}(B^+ \rightarrow \psi(2S)\pi^+) = 0.03 \pm 0.06$$

$$A_{CP}(B^+ \rightarrow \psi(2S)K^+) = 0.012 \pm 0.020 \quad (S = 1.5)$$

$$A_{CP}(B^+ \rightarrow \psi(2S)K^*(892)^+) = 0.08 \pm 0.21$$

$$A_{CP}(B^+ \rightarrow \chi_{c1}(1P)\pi^+) = 0.07 \pm 0.18$$

$$A_{CP}(B^+ \rightarrow \chi_{c0}K^+) = -0.20 \pm 0.18 \quad (S = 1.5)$$

$$A_{CP}(B^+ \rightarrow \chi_{c1}K^+) = -0.009 \pm 0.033$$

$$A_{CP}(B^+ \rightarrow \chi_{c1}K^*(892)^+) = 0.5 \pm 0.5$$

$$A_{CP}(B^+ \rightarrow D^0 \ell^+ \nu_\ell) = (-0.14 \pm 0.20) \times 10^{-2}$$

$$A_{CP}(B^+ \rightarrow \bar{D}^0 \pi^+) = -0.007 \pm 0.007$$

$$\begin{aligned}
A_{CP}(B^+ \rightarrow D_{CP(+1)}\pi^+) &= -0.0080 \pm 0.0026 \\
A_{CP}(B^+ \rightarrow D_{CP(-1)}\pi^+) &= 0.017 \pm 0.026 \\
A_{CP}([K^\mp\pi^\pm\pi^+\pi^-]_D\pi^+) &= 0.02 \pm 0.05 \\
A_{CP}(B^+ \rightarrow [\pi^+\pi^+\pi^-\pi^-]_D K^+) &= 0.10 \pm 0.04 \\
A_{CP}(B^+ \rightarrow [\pi^+\pi^-\pi^+\pi^-]_D K^*(892)^+) &= 0.02 \pm 0.11 \\
A_{CP}(B^+ \rightarrow \bar{D}^0 K^+) &= -0.017 \pm 0.005 \\
A_{CP}([K^\mp\pi^\pm\pi^+\pi^-]_D K^+) &= -0.31 \pm 0.11 \\
A_{CP}(B^+ \rightarrow [\pi^+\pi^+\pi^-\pi^-]_D \pi^+) &= (-4 \pm 8) \times 10^{-3} \\
A_{CP}(B^+ \rightarrow [K^-\pi^+]_D K^+) &= -0.58 \pm 0.21 \\
A_{CP}(B^+ \rightarrow [K^-\pi^+\pi^0]_D K^+) &= 0.07 \pm 0.30 \quad (S = 1.5) \\
A_{CP}(B^+ \rightarrow [K^+K^-\pi^0]_D K^+) &= 0.30 \pm 0.20 \\
A_{CP}(B^+ \rightarrow [\pi^+\pi^-\pi^0]_D K^+) &= 0.05 \pm 0.09 \\
A_{CP}(B^+ \rightarrow \bar{D}^0 K^*(892)^+) &= -0.007 \pm 0.019 \\
A_{CP}(B^+ \rightarrow [K^-\pi^+]_{\bar{D}} K^*(892)^+) &= -0.75 \pm 0.16 \\
A_{CP}(B^+ \rightarrow [K^-\pi^+\pi^-\pi^+]_{\bar{D}} K^*(892)^+) &= -0.45 \pm 0.25 \\
A_{CP}(B^+ \rightarrow [K^-\pi^+]_D \pi^+) &= 0.00 \pm 0.09 \\
A_{CP}(B^+ \rightarrow [K^-\pi^+\pi^0]_D \pi^+) &= 0.35 \pm 0.16 \\
A_{CP}(B^+ \rightarrow [K^+K^-\pi^0]_D \pi^+) &= -0.03 \pm 0.04 \\
A_{CP}(B^+ \rightarrow [\pi^+\pi^-\pi^0]_D \pi^+) &= -0.016 \pm 0.020 \\
A_{CP}(B^+ \rightarrow [K^-\pi^+]_{(D\pi)} \pi^+) &= -0.09 \pm 0.27 \\
A_{CP}(B^+ \rightarrow [K^-\pi^+]_{(D\gamma)} \pi^+) &= -0.7 \pm 0.6 \\
A_{CP}(B^+ \rightarrow [K^-\pi^+]_{(D\pi)} K^+) &= 0.8 \pm 0.4 \\
A_{CP}(B^+ \rightarrow [K^-\pi^+]_{(D\gamma)} K^+) &= 0.4 \pm 1.0 \\
A_{CP}(B^+ \rightarrow [\pi^+\pi^-\pi^0]_D K^+) &= -0.02 \pm 0.15 \\
A_{CP}(B^+ \rightarrow [K_S^0 K^+\pi^-]_D K^+) &= 0.04 \pm 0.09 \\
A_{CP}(B^+ \rightarrow [K_S^0 K^-\pi^+]_D K^+) &= 0.23 \pm 0.13 \\
A_{CP}(B^+ \rightarrow [K_S^0 K^-\pi^+]_D \pi^+) &= -0.052 \pm 0.034 \\
A_{CP}(B^+ \rightarrow [K_S^0 K^+\pi^-]_D \pi^+) &= -0.025 \pm 0.026 \\
A_{CP}(B^+ \rightarrow [K^*(892)^- K^+]_D K^+) &= 0.03 \pm 0.11 \\
A_{CP}(B^+ \rightarrow [K^*(892)^+ K^-]_D K^+) &= 0.34 \pm 0.21 \\
A_{CP}(B^+ \rightarrow [K^*(892)^+ K^-]_D \pi^+) &= -0.05 \pm 0.05 \\
A_{CP}(B^+ \rightarrow [K^*(892)^- K^+]_D \pi^+) &= -0.012 \pm 0.030 \\
\mathbf{A_{CP}(B^+ \rightarrow D_{CP(+1)}K^+) = 0.120 \pm 0.014} \quad (S = 1.4) \\
A_{ADS}(B^+ \rightarrow DK^+) &= -0.40 \pm 0.06 \\
A_{ADS}(B^+ \rightarrow D\pi^+) &= 0.100 \pm 0.032 \\
A_{ADS}(B^+ \rightarrow [K^-\pi^+]_D K^+\pi^-\pi^+) &= -0.33 \pm 0.35 \\
A_{ADS}(B^+ \rightarrow [K^-\pi^+]_D \pi^+\pi^-\pi^+) &= -0.01 \pm 0.09 \\
A_{CP}(B^+ \rightarrow D_{CP(-1)}K^+) &= -0.10 \pm 0.07 \\
A_{CP}(B^+ \rightarrow [K^+K^-]_D K^+\pi^-\pi^+) &= -0.04 \pm 0.06 \\
A_{CP}(B^+ \rightarrow [\pi^+\pi^-]_D K^+\pi^-\pi^+) &= -0.05 \pm 0.10 \\
A_{CP}(B^+ \rightarrow [K^-\pi^+]_D K^+\pi^-\pi^+) &= 0.013 \pm 0.023
\end{aligned}$$

$$\begin{aligned}
 A_{CP}(B^+ \rightarrow [K^+ K^-]_D \pi^+ \pi^- \pi^+) &= -0.019 \pm 0.015 \\
 A_{CP}(B^+ \rightarrow [\pi^+ \pi^-]_D \pi^+ \pi^- \pi^+) &= -0.013 \pm 0.019 \\
 A_{CP}(B^+ \rightarrow [K^- \pi^+]_D \pi^+ \pi^- \pi^+) &= -0.002 \pm 0.011 \\
 A_{CP}(B^+ \rightarrow \bar{D}^{*0} \pi^+) &= 0.0010 \pm 0.0028 \\
 A_{CP}(B^+ \rightarrow (D_{CP(+1)}^*)^0 \pi^+) &= 0.016 \pm 0.010 \quad (S = 1.2) \\
 A_{CP}(B^+ \rightarrow (D_{CP(-1)}^*)^0 \pi^+) &= -0.09 \pm 0.05 \\
 A_{CP}(B^+ \rightarrow D^{*0} K^+) &= -0.001 \pm 0.011 \quad (S = 1.1) \\
 A_{CP}(B^+ \rightarrow D_{CP(+1)}^{*0} K^+) &= -0.11 \pm 0.08 \quad (S = 2.7) \\
 A_{CP}(B^+ \rightarrow D_{CP(-1)}^* K^+) &= 0.07 \pm 0.10 \\
 A_{CP}(B^+ \rightarrow D_{CP(+1)} K^*(892)^+) &= 0.08 \pm 0.06 \\
 A_{CP}(B^+ \rightarrow D_{CP(-1)} K^*(892)^+) &= -0.23 \pm 0.22 \\
 A_{CP}(B^+ \rightarrow D_s^+ \phi) &= 0.0 \pm 0.4 \\
 A_{CP}(B^+ \rightarrow D_s^+ \bar{D}^0) &= (-0.4 \pm 0.7)\% \\
 A_{CP}(B^+ \rightarrow D^{*+} \bar{D}^{*0}) &= -0.15 \pm 0.11 \\
 A_{CP}(B^+ \rightarrow D^{*+} \bar{D}^0) &= -0.06 \pm 0.13 \\
 A_{CP}(B^+ \rightarrow D^+ \bar{D}^{*0}) &= 0.13 \pm 0.18 \\
 A_{CP}(B^+ \rightarrow D^+ \bar{D}^0) &= 0.016 \pm 0.025 \\
 A_{CP}(B^+ \rightarrow K_S^0 \pi^+) &= -0.017 \pm 0.016 \\
 A_{CP}(B^+ \rightarrow K^+ \pi^0) &= 0.037 \pm 0.021 \\
 A_{CP}(B^+ \rightarrow \eta' K^+) &= 0.004 \pm 0.011 \\
 A_{CP}(B^+ \rightarrow \eta' K^*(892)^+) &= -0.26 \pm 0.27 \\
 A_{CP}(B^+ \rightarrow \eta' K_0^*(1430)^+) &= 0.06 \pm 0.20 \\
 A_{CP}(B^+ \rightarrow \eta' K_2^*(1430)^+) &= 0.15 \pm 0.13 \\
 \mathbf{A_{CP}(B^+ \rightarrow \eta K^+)} &= -0.37 \pm 0.08 \\
 A_{CP}(B^+ \rightarrow \eta K^*(892)^+) &= 0.02 \pm 0.06 \\
 A_{CP}(B^+ \rightarrow \eta K_0^*(1430)^+) &= 0.05 \pm 0.13 \\
 A_{CP}(B^+ \rightarrow \eta K_2^*(1430)^+) &= -0.45 \pm 0.30 \\
 A_{CP}(B^+ \rightarrow \omega K^+) &= -0.02 \pm 0.04 \\
 A_{CP}(B^+ \rightarrow \omega K^{*+}) &= 0.29 \pm 0.35 \\
 A_{CP}(B^+ \rightarrow \omega (K\pi)_0^{*+}) &= -0.10 \pm 0.09 \\
 A_{CP}(B^+ \rightarrow \omega K_2^*(1430)^+) &= 0.14 \pm 0.15 \\
 A_{CP}(B^+ \rightarrow K^{*0} \pi^+) &= -0.04 \pm 0.09 \quad (S = 2.1) \\
 A_{CP}(B^+ \rightarrow K^*(892)^+ \pi^0) &= -0.39 \pm 0.21 \quad (S = 1.6) \\
 \mathbf{A_{CP}(B^+ \rightarrow K^+ \pi^- \pi^+)} &= 0.027 \pm 0.008 \\
 A_{CP}(B^+ \rightarrow K^+ K^- K^+ \text{ nonresonant}) &= 0.06 \pm 0.05 \\
 A_{CP}(B^+ \rightarrow f(980)^0 K^+) &= -0.08 \pm 0.09 \\
 \mathbf{A_{CP}(B^+ \rightarrow f_2(1270) K^+)} &= -0.68^{+0.19}_{-0.17} \\
 A_{CP}(B^+ \rightarrow f_0(1500) K^+) &= 0.28 \pm 0.30 \\
 A_{CP}(B^+ \rightarrow f_2'(1525)^0 K^+) &= -0.08^{+0.05}_{-0.04} \\
 \mathbf{A_{CP}(B^+ \rightarrow \rho^0 K^+)} &= 0.37 \pm 0.10
 \end{aligned}$$

$$\begin{aligned}
A_{CP}(B^+ \rightarrow K^0 \pi^+ \pi^0) &= 0.07 \pm 0.06 \\
A_{CP}(B^+ \rightarrow K_0^*(1430)^0 \pi^+) &= 0.061 \pm 0.032 \\
A_{CP}(B^+ \rightarrow K_0^*(1430)^+ \pi^0) &= 0.26^{+0.18}_{-0.14} \\
A_{CP}(B^+ \rightarrow K_2^*(1430)^0 \pi^+) &= 0.05^{+0.29}_{-0.24} \\
A_{CP}(B^+ \rightarrow K^+ \pi^0 \pi^0) &= -0.06 \pm 0.07 \\
A_{CP}(B^+ \rightarrow K^0 \rho^+) &= -0.03 \pm 0.15 \\
A_{CP}(B^+ \rightarrow K^{*+} \pi^+ \pi^-) &= 0.07 \pm 0.08 \\
A_{CP}(B^+ \rightarrow \rho^0 K^*(892)^+) &= 0.31 \pm 0.13 \\
A_{CP}(B^+ \rightarrow K^*(892)^+ f_0(980)) &= -0.15 \pm 0.12 \\
A_{CP}(B^+ \rightarrow a_1^+ K^0) &= 0.12 \pm 0.11 \\
A_{CP}(B^+ \rightarrow b_1^+ K^0) &= -0.03 \pm 0.15 \\
A_{CP}(B^+ \rightarrow K^*(892)^0 \rho^+) &= -0.01 \pm 0.16 \\
A_{CP}(B^+ \rightarrow b_1^0 K^+) &= -0.46 \pm 0.20 \\
A_{CP}(B^+ \rightarrow K^0 K^+) &= 0.04 \pm 0.14 \\
A_{CP}(B^+ \rightarrow K_S^0 K^+) &= -0.21 \pm 0.14 \\
A_{CP}(B^+ \rightarrow K^+ K_S^0 K_S^0) &= 0.025 \pm 0.031 \\
\mathbf{A_{CP}(B^+ \rightarrow K^+ K^- \pi^+)} &= -0.122 \pm 0.021 \\
A_{CP}(B^+ \rightarrow K^+ K^- \pi^+ \text{ nonresonant}) &= -0.11 \pm 0.06 \\
A_{CP}(B^+ \rightarrow K^+ \bar{K}^*(892)^0) &= 0.12 \pm 0.10 \\
A_{CP}(B^+ \rightarrow K^+ \bar{K}_0^*(1430)^0) &= 0.10 \pm 0.17 \\
A_{CP}(B^+ \rightarrow \phi \pi^+) &= 0.1 \pm 0.5 \\
A_{CP}(B^+ \rightarrow \pi^+ (K^+ K^-)_{S\text{-wave}}) &= -0.66 \pm 0.04 \\
\mathbf{A_{CP}(B^+ \rightarrow K^+ K^- K^+)} &= -0.033 \pm 0.008 \\
A_{CP}(B^+ \rightarrow \phi K^+) &= 0.024 \pm 0.028 \quad (S = 2.3) \\
A_{CP}(B^+ \rightarrow X_0(1550) K^+) &= -0.04 \pm 0.07 \\
A_{CP}(B^+ \rightarrow K^{*+} K^+ K^-) &= 0.11 \pm 0.09 \\
A_{CP}(B^+ \rightarrow \phi K^*(892)^+) &= -0.01 \pm 0.08 \\
A_{CP}(B^+ \rightarrow \phi (K\pi)_0^{*+}) &= 0.04 \pm 0.16 \\
A_{CP}(B^+ \rightarrow \phi K_1(1270)^+) &= 0.15 \pm 0.20 \\
A_{CP}(B^+ \rightarrow \phi K_2^*(1430)^+) &= -0.23 \pm 0.20 \\
A_{CP}(B^+ \rightarrow K^+ \phi \phi) &= -0.10 \pm 0.08 \\
A_{CP}(B^+ \rightarrow K^+ [\phi \phi]_{\eta_c}) &= 0.09 \pm 0.10 \\
A_{CP}(B^+ \rightarrow K^*(892)^+ \gamma) &= 0.014 \pm 0.018 \\
A_{CP}(B^+ \rightarrow X_S \gamma) &= 0.028 \pm 0.019 \\
A_{CP}(B^+ \rightarrow \eta K^+ \gamma) &= -0.12 \pm 0.07 \\
A_{CP}(B^+ \rightarrow \phi K^+ \gamma) &= -0.13 \pm 0.11 \quad (S = 1.1) \\
A_{CP}(B^+ \rightarrow \rho^+ \gamma) &= -0.11 \pm 0.33 \\
A_{CP}(B^+ \rightarrow \pi^+ \pi^0) &= 0.03 \pm 0.04 \\
\mathbf{A_{CP}(B^+ \rightarrow \pi^+ \pi^- \pi^+)} &= 0.057 \pm 0.013 \\
A_{CP}(B^+ \rightarrow \rho^0 \pi^+) &= 0.009 \pm 0.019 \\
A_{CP}(B^+ \rightarrow f_2(1270) \pi^+) &= 0.40 \pm 0.06
\end{aligned}$$

$$\begin{aligned}
 A_{CP}(B^+ \rightarrow \rho^0(1450)\pi^+) &= -0.11 \pm 0.05 \\
 A_{CP}(B^+ \rightarrow \rho_3(1690)\pi^+) &= -0.80 \pm 0.28 \\
 \mathbf{A}_{CP}(B^+ \rightarrow \mathbf{f}_0(1370)\pi^+) &= 0.72 \pm 0.22 \\
 A_{CP}(B^+ \rightarrow \pi^+ \pi^- \pi^+ \text{ nonresonant}) &= -0.14^{+0.23}_{-0.16} \\
 A_{CP}(B^+ \rightarrow \rho^+ \pi^0) &= 0.02 \pm 0.11 \\
 A_{CP}(B^+ \rightarrow \rho^+ \rho^0) &= -0.05 \pm 0.05 \\
 A_{CP}(B^+ \rightarrow \omega \pi^+) &= -0.04 \pm 0.05 \\
 A_{CP}(B^+ \rightarrow \omega \rho^+) &= -0.20 \pm 0.09 \\
 A_{CP}(B^+ \rightarrow \eta \pi^+) &= -0.14 \pm 0.07 \quad (S = 1.4) \\
 A_{CP}(B^+ \rightarrow \eta \rho^+) &= 0.11 \pm 0.11 \\
 A_{CP}(B^+ \rightarrow \eta' \pi^+) &= 0.06 \pm 0.16 \\
 A_{CP}(B^+ \rightarrow \eta' \rho^+) &= 0.26 \pm 0.17 \\
 A_{CP}(B^+ \rightarrow b_1^0 \pi^+) &= 0.05 \pm 0.16 \\
 A_{CP}(B^+ \rightarrow p \bar{p} \pi^+) &= 0.00 \pm 0.04 \\
 A_{CP}(B^+ \rightarrow p \bar{p} K^+) &= 0.00 \pm 0.04 \quad (S = 2.2) \\
 A_{CP}(B^+ \rightarrow p \bar{p} K^*(892)^+) &= 0.21 \pm 0.16 \quad (S = 1.4) \\
 A_{CP}(B^+ \rightarrow p \bar{\Lambda} \gamma) &= 0.17 \pm 0.17 \\
 A_{CP}(B^+ \rightarrow p \bar{\Lambda} \pi^0) &= 0.01 \pm 0.17 \\
 A_{CP}(B^+ \rightarrow K^+ \ell^+ \ell^-) &= -0.02 \pm 0.08 \\
 A_{CP}(B^+ \rightarrow K^+ e^+ e^-) &= 0.14 \pm 0.14 \\
 A_{CP}(B^+ \rightarrow K^+ \mu^+ \mu^-) &= 0.011 \pm 0.017 \\
 A_{CP}(B^+ \rightarrow \pi^+ \mu^+ \mu^-) &= -0.11 \pm 0.12 \\
 A_{CP}(B^+ \rightarrow K^{*+} \ell^+ \ell^-) &= -0.09 \pm 0.14 \\
 A_{CP}(B^+ \rightarrow K^* e^+ e^-) &= -0.14 \pm 0.23 \\
 A_{CP}(B^+ \rightarrow K^* \mu^+ \mu^-) &= -0.12 \pm 0.24 \\
 \gamma &= (71.1^{+4.6}_{-5.3})^\circ \\
 r_B(B^+ \rightarrow D^0 K^+) &= 0.0993 \pm 0.0046 \\
 \delta_B(B^+ \rightarrow D^0 K^+) &= (129.6^{+5.0}_{-6.0})^\circ \\
 r_B(B^+ \rightarrow D^0 K^{*+}) &= 0.076 \pm 0.020 \\
 \delta_B(B^+ \rightarrow D^0 K^{*+}) &= (98^{+18}_{-37})^\circ \\
 r_B(B^+ \rightarrow D^{*0} K^+) &= 0.140 \pm 0.019 \\
 \delta_B(B^+ \rightarrow D^{*0} K^+) &= (319.2^{+7.7}_{-8.7})^\circ
 \end{aligned}$$

B^- modes are charge conjugates of the modes below. Modes which do not identify the charge state of the B are listed in the B^\pm/B^0 ADMIXTURE section.

The branching fractions listed below assume 50% $B^0\bar{B}^0$ and 50% B^+B^- production at the $\Upsilon(4S)$. We have attempted to bring older measurements up to date by rescaling their assumed $\Upsilon(4S)$ production ratio to 50:50 and their assumed D , D_s , D^* , and ψ branching ratios to current values whenever this would affect our averages and best limits significantly.

Indentation is used to indicate a subchannel of a previous reaction. All resonant subchannels have been corrected for resonance branching fractions to the final state so the sum of the subchannel branching fractions can exceed that of the final state.

For inclusive branching fractions, e.g., $B \rightarrow D^\pm X$, the values usually are multiplicities, not branching fractions. They can be greater than one.

B^+ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level(MeV/c)	ρ
Semileptonic and leptonic modes			
$\ell^+ \nu_\ell X$	[III] (10.99 ± 0.28) %		–
$e^+ \nu_e X_c$	(10.8 ± 0.4) %		–
$D \ell^+ \nu_\ell X$	(9.7 ± 0.7) %		–
$\bar{D}^0 \ell^+ \nu_\ell$	[III] (2.35 ± 0.09) %		2310
$\bar{D}^0 \tau^+ \nu_\tau$	(7.7 ± 2.5) × 10 ⁻³		1911
$\bar{D}^*(2007)^0 \ell^+ \nu_\ell$	[III] (5.66 ± 0.22) %		2258
$\bar{D}^*(2007)^0 \tau^+ \nu_\tau$	(1.88 ± 0.20) %		1839
$D^- \pi^+ \ell^+ \nu_\ell$	(4.4 ± 0.4) × 10 ⁻³		2306
$\bar{D}_0^*(2420)^0 \ell^+ \nu_\ell, \bar{D}_0^{*0} \rightarrow$ $D^- \pi^+$	(2.5 ± 0.5) × 10 ⁻³		–
$\bar{D}_2^*(2460)^0 \ell^+ \nu_\ell, \bar{D}_2^{*0} \rightarrow$ $D^- \pi^+$	(1.53 ± 0.16) × 10 ⁻³		2065
$D^{(*)} n \pi \ell^+ \nu_\ell (n \geq 1)$	(1.88 ± 0.25) %		–
$D^{*-} \pi^+ \ell^+ \nu_\ell$	(6.0 ± 0.4) × 10 ⁻³		2254
$\bar{D}_1(2420)^0 \ell^+ \nu_\ell, \bar{D}_1^0 \rightarrow$ $D^{*-} \pi^+$	(3.03 ± 0.20) × 10 ⁻³		2084
$\bar{D}_1'(2430)^0 \ell^+ \nu_\ell, \bar{D}_1'^0 \rightarrow$ $D^{*-} \pi^+$	(2.7 ± 0.6) × 10 ⁻³		–
$\bar{D}_2^*(2460)^0 \ell^+ \nu_\ell,$ $\bar{D}_2^{*0} \rightarrow D^{*-} \pi^+$	(1.01 ± 0.24) × 10 ⁻³	S=2.0	2065
$\bar{D}^0 \pi^+ \pi^- \ell^+ \nu_\ell$	(1.7 ± 0.4) × 10 ⁻³		2301
$\bar{D}^{*0} \pi^+ \pi^- \ell^+ \nu_\ell$	(8 ± 5) × 10 ⁻⁴		2248
$D_s^{(*)-} K^+ \ell^+ \nu_\ell$	(6.1 ± 1.0) × 10 ⁻⁴		–
$D_s^- K^+ \ell^+ \nu_\ell$	(3.0 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ $\begin{smallmatrix} 1.4 \\ 1.2 \end{smallmatrix}$) × 10 ⁻⁴		2242

$D_s^{*-} K^+ \ell^+ \nu_\ell$	(2.9 ± 1.9) × 10 ⁻⁴	2185
$\pi^0 \ell^+ \nu_\ell$	(7.80 ± 0.27) × 10 ⁻⁵	2638
$\eta \ell^+ \nu_\ell$	(3.9 ± 0.5) × 10 ⁻⁵	2611
$\eta' \ell^+ \nu_\ell$	(2.3 ± 0.8) × 10 ⁻⁵	2553
$\omega \ell^+ \nu_\ell$	[III] (1.19 ± 0.09) × 10 ⁻⁴	2582
$\rho^0 \ell^+ \nu_\ell$	[III] (1.58 ± 0.11) × 10 ⁻⁴	2583
$p \bar{p} \ell^+ \nu_\ell$	(5.8 + - 2.6 - 2.3) × 10 ⁻⁶	2467
$p \bar{p} \mu^+ \nu_\mu$	< 8.5 × 10 ⁻⁶ CL=90%	2446
$p \bar{p} e^+ \nu_e$	(8.2 + - 4.0 - 3.3) × 10 ⁻⁶	2467
$e^+ \nu_e$	< 9.8 × 10 ⁻⁷ CL=90%	2640
$\mu^+ \nu_\mu$	2.90 × 10 ⁻⁰⁷ to 1.07 × 10 ⁻⁰⁶ CL=90%	2639
$\tau^+ \nu_\tau$	(1.09 ± 0.24) × 10 ⁻⁴ S=1.2	2341
$\ell^+ \nu_\ell \gamma$	< 3.0 × 10 ⁻⁶ CL=90%	2640
$e^+ \nu_e \gamma$	< 4.3 × 10 ⁻⁶ CL=90%	2640
$\mu^+ \nu_\mu \gamma$	< 3.4 × 10 ⁻⁶ CL=90%	2639
$\mu^+ \mu^- \mu^+ \nu_\mu$	< 1.6 × 10 ⁻⁸ CL=95%	2634

Inclusive modes

$D^0 X$	(8.6 ± 0.7) %	—
$\bar{D}^0 X$	(79 ± 4) %	—
$D^+ X$	(2.5 ± 0.5) %	—
$D^- X$	(9.9 ± 1.2) %	—
$D_s^+ X$	(7.9 + - 1.4 - 1.3) %	—
$D_s^- X$	(1.10 + - 0.40 - 0.32) %	—
$\Lambda_c^+ X$	(2.1 + - 0.9 - 0.6) %	—
$\bar{\Lambda}_c^- X$	(2.8 + - 1.1 - 0.9) %	—
$\bar{c} X$	(97 ± 4) %	—
$c X$	(23.4 + - 2.2 - 1.8) %	—
$c / \bar{c} X$	(120 ± 6) %	—

D, D*, or D_s modes

$\bar{D}^0 \pi^+$	(4.68 ± 0.13) × 10 ⁻³	2308
$D_{CP(+1)} \pi^+$	[nnn] (2.05 ± 0.18) × 10 ⁻³	—
$D_{CP(-1)} \pi^+$	[nnn] (2.0 ± 0.4) × 10 ⁻³	—
$\bar{D}^0 \rho^+$	(1.34 ± 0.18) %	2237
$\bar{D}^0 K^+$	(3.63 ± 0.12) × 10 ⁻⁴	2281
$D_{CP(+1)} K^+$	[nnn] (1.80 ± 0.07) × 10 ⁻⁴	—
$D_{CP(-1)} K^+$	[nnn] (1.96 ± 0.18) × 10 ⁻⁴	—
$D^0 K^+$	(3.57 ± 0.35) × 10 ⁻⁶	2281
$[K^- \pi^+]_D K^+$	[ooo] < 2.8 × 10 ⁻⁷ CL=90%	—

$[K^+\pi^-]_D K^+$	$[ooo] < 1.5$	$\times 10^{-5}$	CL=90%	—
$[K^-\pi^+\pi^0]_D K^+$	seen			—
$[K^+\pi^-\pi^0]_D K^+$	seen			—
$[K^-\pi^+\pi^+\pi^-]_D K^+$	seen			—
$[K^+\pi^-\pi^+\pi^-]_D K^+$	seen			—
$[K^-\pi^+]_D \pi^+$	$[ooo] (6.3 \pm 1.1)$	$\times 10^{-7}$		—
$[K^+\pi^-]_D \pi^+$	(1.78 ± 0.32)	$\times 10^{-4}$		—
$[K^-\pi^+\pi^0]_D \pi^+$	seen			—
$[K^+\pi^-\pi^0]_D \pi^+$	seen			—
$[K^-\pi^+\pi^+\pi^-]_D \pi^+$	seen			—
$[K^+\pi^-\pi^+\pi^-]_D \pi^+$	seen			—
$[\pi^+\pi^-\pi^0]_D K^-$	(4.6 ± 0.9)	$\times 10^{-6}$		—
$[K_S^0 K^+\pi^-]_D K^+$	seen			—
$[K_S^0 K^-\pi^+]_D K^+$	seen			—
$[K^*(892)^+ K^-]_D K^+$	seen			—
$[K_S^0 K^-\pi^+]_D \pi^+$	seen			—
$[K^*(892)^+ K^-]_D \pi^+$	seen			—
$[K_S^0 K^+\pi^-]_D \pi^+$	seen			—
$[K^*(892)^- K^+]_D \pi^+$	seen			—
$\bar{D}^0 K^*(892)^+$	(5.3 ± 0.4)	$\times 10^{-4}$		2213
$D_{CP(-1)} K^*(892)^+$	$[nnn] (2.7 \pm 0.8)$	$\times 10^{-4}$		—
$D_{CP(+1)} K^*(892)^+$	$[nnn] (6.2 \pm 0.7)$	$\times 10^{-4}$		—
$D^0 K^*(892)^+$	(3.1 ± 1.6)	$\times 10^{-6}$		2213
$\bar{D}^0 K^+\pi^+\pi^-$	(5.2 ± 2.1)	$\times 10^{-4}$		2237
$\bar{D}^0 K+\bar{K}^0$	(5.5 ± 1.6)	$\times 10^{-4}$		2189
$\bar{D}^0 K+\bar{K}^*(892)^0$	(7.5 ± 1.7)	$\times 10^{-4}$		2072
$\bar{D}^0 \pi^+\pi^+\pi^-$	(5.6 ± 2.1)	$\times 10^{-3}$	S=3.6	2289
$\bar{D}^0 \pi^+\pi^+\pi^-$ nonresonant	(5 ± 4)	$\times 10^{-3}$		2289
$\bar{D}^0 \pi^+\rho^0$	(4.2 ± 3.0)	$\times 10^{-3}$		2208
$\bar{D}^0 a_1(1260)^+$	(4 ± 4)	$\times 10^{-3}$		2123
$\bar{D}^0 \omega \pi^+$	(4.1 ± 0.9)	$\times 10^{-3}$		2206
$D^*(2010)^- \pi^+\pi^+$	(1.35 ± 0.22)	$\times 10^{-3}$		2247
$D^*(2010)^- K^+\pi^+$	(8.2 ± 1.4)	$\times 10^{-5}$		2206
$\bar{D}_1(2420)^0 \pi^+, \bar{D}_1^0 \rightarrow$ $D^*(2010)^- \pi^+$	(5.2 ± 2.2)	$\times 10^{-4}$		2081
$D^- \pi^+\pi^+$	(1.07 ± 0.05)	$\times 10^{-3}$		2299
$D^- K^+\pi^+$	(7.7 ± 0.5)	$\times 10^{-5}$		2260
$D_0^*(2300)^0 K^+, D_0^{*0} \rightarrow$ $D^- \pi^+$	(6.1 ± 2.4)	$\times 10^{-6}$		—
$D_2^*(2460)^0 K^+, D_2^{*0} \rightarrow$ $D^- \pi^+$	(2.32 ± 0.23)	$\times 10^{-5}$		—
$D_1^*(2760)^0 K^+, D_1^{*0} \rightarrow$ $D^- \pi^+$	(3.6 ± 1.2)	$\times 10^{-6}$		—

$D^+ K^0$	< 2.9	$\times 10^{-6}$	CL=90%	2278
$D^+ K^+ \pi^-$	(5.6 ± 1.1)	$\times 10^{-6}$		2260
$D_2^*(2460)^0 K^+, D_2^{*0} \rightarrow$ $D^+ \pi^-$	< 6.3	$\times 10^{-7}$	CL=90%	—
$D^+ K^{*0}$	< 4.9	$\times 10^{-7}$	CL=90%	2211
$D^+ \bar{K}^{*0}$	< 1.4	$\times 10^{-6}$	CL=90%	2211
$\bar{D}^*(2007)^0 \pi^+$	(4.90 ± 0.17)	$\times 10^{-3}$		2256
$\bar{D}_{CP(+1)}^{*0} \pi^+$	[ppp] (2.7 ± 0.6)	$\times 10^{-3}$		—
$\bar{D}_{CP(-1)}^{*0} \pi^+$	[ppp] (2.4 ± 0.9)	$\times 10^{-3}$		—
$\bar{D}^*(2007)^0 \omega \pi^+$	(4.5 ± 1.2)	$\times 10^{-3}$		2149
$\bar{D}^*(2007)^0 \rho^+$	(9.8 ± 1.7)	$\times 10^{-3}$		2181
$\bar{D}^*(2007)^0 K^+$	$(3.97 \pm_{-0.28}^{+0.31})$	$\times 10^{-4}$		2227
$\bar{D}_{CP(+1)}^{*0} K^+$	[ppp] (2.60 ± 0.33)	$\times 10^{-4}$		—
$\bar{D}_{CP(-1)}^{*0} K^+$	[ppp] (2.19 ± 0.30)	$\times 10^{-4}$		—
$D^*(2007)^0 K^+$	(7.8 ± 2.2)	$\times 10^{-6}$		2227
$\bar{D}^*(2007)^0 K^*(892)^+$	(8.1 ± 1.4)	$\times 10^{-4}$		2156
$\bar{D}^*(2007)^0 K^+ \bar{K}^0$	< 1.06	$\times 10^{-3}$	CL=90%	2132
$\bar{D}^*(2007)^0 K^+ \bar{K}^*(892)^0$	(1.5 ± 0.4)	$\times 10^{-3}$		2009
$\bar{D}^*(2007)^0 \pi^+ \pi^+ \pi^-$	(1.03 ± 0.12)	%		2236
$\bar{D}^*(2007)^0 a_1(1260)^+$	(1.9 ± 0.5)	%		2063
$\bar{D}^*(2007)^0 \pi^- \pi^+ \pi^+ \pi^0$	(1.8 ± 0.4)	%		2219
$\bar{D}^{*0} 3\pi^+ 2\pi^-$	(5.7 ± 1.2)	$\times 10^{-3}$		2196
$D^*(2010)^+ \pi^0$	< 3.6	$\times 10^{-6}$		2255
$D^*(2010)^+ K^0$	< 9.0	$\times 10^{-6}$	CL=90%	2225
$D^*(2010)^- \pi^+ \pi^+ \pi^0$	(1.5 ± 0.7)	%		2235
$D^*(2010)^- \pi^+ \pi^+ \pi^+ \pi^-$	(2.6 ± 0.4)	$\times 10^{-3}$		2217
$\bar{D}^{*0} \pi^+$	[qqq] (5.7 ± 1.2)	$\times 10^{-3}$		—
$\bar{D}_1^*(2420)^0 \pi^+$	(1.5 ± 0.6)	$\times 10^{-3}$	S=1.3	2082
$\bar{D}_1(2420)^0 \pi^+ \times B(\bar{D}_1^0 \rightarrow$ $\bar{D}^0 \pi^+ \pi^-)$	$(2.5 \pm_{-1.4}^{+1.6})$	$\times 10^{-4}$	S=3.9	2082
$\bar{D}_1(2420)^0 \pi^+ \times B(\bar{D}_1^0 \rightarrow$ $\bar{D}^0 \pi^+ \pi^- \text{ (nonresonant)})$	(2.2 ± 1.0)	$\times 10^{-4}$		2082
$\bar{D}_2^*(2462)^0 \pi^+$	(3.56 ± 0.24)	$\times 10^{-4}$		—
$\times B(\bar{D}_2^*(2462)^0 \rightarrow D^- \pi^+)$				
$\bar{D}_2^*(2462)^0 \pi^+ \times B(\bar{D}_2^{*0} \rightarrow$ $\bar{D}^0 \pi^- \pi^+)$	(2.2 ± 1.0)	$\times 10^{-4}$		—
$\bar{D}_2^*(2462)^0 \pi^+ \times B(\bar{D}_2^{*0} \rightarrow$ $\bar{D}^0 \pi^- \pi^+ \text{ (nonresonant)})$	< 1.7	$\times 10^{-4}$	CL=90%	—
$\bar{D}_2^*(2462)^0 \pi^+ \times B(\bar{D}_2^{*0} \rightarrow$ $D^*(2010)^- \pi^+)$	(2.2 ± 1.1)	$\times 10^{-4}$		—

$\bar{D}_0^*(2400)^0 \pi^+$ $\times B(\bar{D}_0^*(2400)^0 \rightarrow D^- \pi^+)$	$(6.4 \pm 1.4) \times 10^{-4}$	2136
$\bar{D}_1(2421)^0 \pi^+$ $\times B(\bar{D}_1(2421)^0 \rightarrow D^{*-} \pi^+)$	$(6.8 \pm 1.5) \times 10^{-4}$	—
$\bar{D}_2^*(2462)^0 \pi^+$ $\times B(\bar{D}_2^*(2462)^0 \rightarrow D^{*-} \pi^+)$	$(1.8 \pm 0.5) \times 10^{-4}$	—
$\bar{D}'_1(2427)^0 \pi^+$ $\times B(\bar{D}'_1(2427)^0 \rightarrow D^{*-} \pi^+)$	$(5.0 \pm 1.2) \times 10^{-4}$	—
$\bar{D}_1(2420)^0 \pi^+ \times B(\bar{D}_1^0 \rightarrow$ $\bar{D}^{*0} \pi^+ \pi^-)$	$< 6 \times 10^{-6}$ CL=90%	2082
$\bar{D}_1^*(2420)^0 \rho^+$	$< 1.4 \times 10^{-3}$ CL=90%	1996
$\bar{D}_2^*(2460)^0 \pi^+$	$< 1.3 \times 10^{-3}$ CL=90%	2063
$\bar{D}_2^*(2460)^0 \pi^+ \times B(\bar{D}_2^{*0} \rightarrow$ $\bar{D}^{*0} \pi^+ \pi^-)$	$< 2.2 \times 10^{-5}$ CL=90%	2063
$\bar{D}_1^*(2680)^0 \pi^+, \bar{D}_1^*(2680)^0 \rightarrow$ $D^- \pi^+$	$(8.4 \pm 2.1) \times 10^{-5}$	—
$\bar{D}_3^*(2760)^0 \pi^+, \bar{D}_3^*(2760)^0 \pi^+ \rightarrow$ $D^- \pi^+$	$(1.00 \pm 0.22) \times 10^{-5}$	—
$\bar{D}_2^*(3000)^0 \pi^+, \bar{D}_2^*(3000)^0 \pi^+ \rightarrow$ $D^- \pi^+$	$(2.0 \pm 1.4) \times 10^{-6}$	—
$\bar{D}_2^*(2460)^0 \rho^+$	$< 4.7 \times 10^{-3}$ CL=90%	1977
$\bar{D}^0 D_s^+$	$(9.0 \pm 0.9) \times 10^{-3}$	1815
$D_{s0}^*(2317)^+ \bar{D}^0, D_{s0}^{*+} \rightarrow$ $D_s^+ \pi^0$	$(8.0 \pm 1.6 \pm 1.3) \times 10^{-4}$	1605
$D_{s0}(2317)^+ \bar{D}^0 \times$ $B(D_{s0}(2317)^+ \rightarrow D_s^{*+} \gamma)$	$< 7.6 \times 10^{-4}$ CL=90%	1605
$D_{s0}(2317)^+ \bar{D}^*(2007)^0 \times$ $B(D_{s0}(2317)^+ \rightarrow D_s^+ \pi^0)$	$(9 \pm 7) \times 10^{-4}$	1511
$D_{sJ}(2457)^+ \bar{D}^0$	$(3.1 \pm 1.0 \pm 0.9) \times 10^{-3}$	—
$D_{sJ}(2457)^+ \bar{D}^0 \times$ $B(D_{sJ}(2457)^+ \rightarrow D_s^+ \gamma)$	$(4.6 \pm 1.3 \pm 1.1) \times 10^{-4}$	—
$D_{sJ}(2457)^+ \bar{D}^0 \times$ $B(D_{sJ}(2457)^+ \rightarrow$ $D_s^+ \pi^+ \pi^-)$	$< 2.2 \times 10^{-4}$ CL=90%	—
$D_{sJ}(2457)^+ \bar{D}^0 \times$ $B(D_{sJ}(2457)^+ \rightarrow D_s^+ \pi^0)$	$< 2.7 \times 10^{-4}$ CL=90%	—
$D_{sJ}(2457)^+ \bar{D}^0 \times$ $B(D_{sJ}(2457)^+ \rightarrow D_s^{*+} \gamma)$	$< 9.8 \times 10^{-4}$ CL=90%	—
$D_{sJ}(2457)^+ \bar{D}^*(2007)^0$	$(1.20 \pm 0.30) \%$	—

$D_{sJ}(2457)^+ \bar{D}^*(2007)^0 \times$ $B(D_{sJ}(2457)^+ \rightarrow D_s^+ \gamma)$	$(1.4 \begin{smallmatrix} + 0.7 \\ - 0.6 \end{smallmatrix}) \times 10^{-3}$		–
$\bar{D}^0 D_{s1}(2536)^+ \times$ $B(D_{s1}(2536)^+ \rightarrow$ $D^*(2007)^0 K^+ +$ $D^*(2010)^+ K^0)$	$(4.0 \pm 1.0) \times 10^{-4}$		1447
$\bar{D}^0 D_{s1}(2536)^+ \times$ $B(D_{s1}(2536)^+ \rightarrow$ $D^*(2007)^0 K^+)$	$(2.2 \pm 0.7) \times 10^{-4}$		1447
$\bar{D}^*(2007)^0 D_{s1}(2536)^+ \times$ $B(D_{s1}(2536)^+ \rightarrow$ $D^*(2007)^0 K^+)$	$(5.5 \pm 1.6) \times 10^{-4}$		1339
$\bar{D}^0 D_{s1}(2536)^+ \times$ $B(D_{s1}(2536)^+ \rightarrow D^{*+} K^0)$	$(2.3 \pm 1.1) \times 10^{-4}$		1447
$\bar{D}^0 D_{sJ}(2700)^+ \times$ $B(D_{sJ}(2700)^+ \rightarrow D^0 K^+)$	$(5.6 \pm 1.8) \times 10^{-4}$	S=1.7	–
$\bar{D}^{*0} D_{s1}(2536)^+, D_{s1}^+ \rightarrow$ $D^{*+} K^0$	$(3.9 \pm 2.6) \times 10^{-4}$		1339
$\bar{D}^0 D_{sJ}(2573)^+, D_{sJ}^+ \rightarrow$ $D^0 K^+$	$(8 \pm 15) \times 10^{-6}$		–
$\bar{D}^{*0} D_{sJ}(2573), D_{sJ}^+ \rightarrow$ $D^0 K^+$	$< 2 \times 10^{-4}$	CL=90%	1306
$\bar{D}^*(2007)^0 D_{sJ}(2573), D_{sJ}^+ \rightarrow$ $D^0 K^+$	$< 5 \times 10^{-4}$	CL=90%	1306
$\bar{D}^0 D_s^{*+}$	$(7.6 \pm 1.6) \times 10^{-3}$		1734
$\bar{D}^*(2007)^0 D_s^+$	$(8.2 \pm 1.7) \times 10^{-3}$		1737
$\bar{D}^*(2007)^0 D_s^{*+}$	$(1.71 \pm 0.24) \%$		1651
$D_s^{(*)+} \bar{D}^{*0}$	$(2.7 \pm 1.2) \%$		–
$\bar{D}^*(2007)^0 D^*(2010)^+$	$(8.1 \pm 1.7) \times 10^{-4}$		1713
$\bar{D}^0 D^*(2010)^+ +$ $\bar{D}^*(2007)^0 D^+$	$< 1.30 \%$	CL=90%	1792
$\bar{D}^0 D^*(2010)^+$	$(3.9 \pm 0.5) \times 10^{-4}$		1792
$\bar{D}^0 D^+$	$(3.8 \pm 0.4) \times 10^{-4}$		1866
$\bar{D}^0 D^+ K^0$	$(1.55 \pm 0.21) \times 10^{-3}$		1571
$D^+ \bar{D}^*(2007)^0$	$(6.3 \pm 1.7) \times 10^{-4}$		1791
$\bar{D}^*(2007)^0 D^+ K^0$	$(2.1 \pm 0.5) \times 10^{-3}$		1475
$\bar{D}^0 D^*(2010)^+ K^0$	$(3.8 \pm 0.4) \times 10^{-3}$		1476
$\bar{D}^*(2007)^0 D^*(2010)^+ K^0$	$(9.2 \pm 1.2) \times 10^{-3}$		1362
$\bar{D}^0 D^0 K^+$	$(1.45 \pm 0.33) \times 10^{-3}$	S=2.6	1577
$\bar{D}^*(2007)^0 D^0 K^+$	$(2.26 \pm 0.23) \times 10^{-3}$		1481
$\bar{D}^0 D^*(2007)^0 K^+$	$(6.3 \pm 0.5) \times 10^{-3}$		1481
$\bar{D}^*(2007)^0 D^*(2007)^0 K^+$	$(1.12 \pm 0.13) \%$		1368
$D^- D^+ K^+$	$(2.2 \pm 0.7) \times 10^{-4}$		1571

$D^- D^*(2010)^+ K^+$	$(6.3 \pm 1.1) \times 10^{-4}$	1475
$D^*(2010)^- D^+ K^+$	$(6.0 \pm 1.3) \times 10^{-4}$	1475
$D^*(2010)^- D^*(2010)^+ K^+$	$(1.32 \pm 0.18) \times 10^{-3}$	1363
$(\bar{D} + \bar{D}^*)(D + D^*)K$	$(4.05 \pm 0.30) \%$	–
$D_s^+ \pi^0$	$(1.6 \pm 0.5) \times 10^{-5}$	2270
$D_s^{*+} \pi^0$	$< 2.6 \times 10^{-4}$ CL=90%	2215
$D_s^+ \eta$	$< 4 \times 10^{-4}$ CL=90%	2235
$D_s^{*+} \eta$	$< 6 \times 10^{-4}$ CL=90%	2178
$D_s^+ \rho^0$	$< 3.0 \times 10^{-4}$ CL=90%	2197
$D_s^{*+} \rho^0$	$< 4 \times 10^{-4}$ CL=90%	2138
$D_s^+ \omega$	$< 4 \times 10^{-4}$ CL=90%	2195
$D_s^{*+} \omega$	$< 6 \times 10^{-4}$ CL=90%	2136
$D_s^+ a_1(1260)^0$	$< 1.8 \times 10^{-3}$ CL=90%	2079
$D_s^{*+} a_1(1260)^0$	$< 1.3 \times 10^{-3}$ CL=90%	2015
$D_s^+ K^+ K^-$	$(7.2 \pm 1.1) \times 10^{-6}$	2149
$D_s^+ \phi$	$< 4.2 \times 10^{-7}$ CL=90%	2141
$D_s^{*+} \phi$	$< 1.2 \times 10^{-5}$ CL=90%	2079
$D_s^+ \bar{K}^0$	$< 8 \times 10^{-4}$ CL=90%	2242
$D_s^{*+} \bar{K}^0$	$< 9 \times 10^{-4}$ CL=90%	2185
$D_s^+ \bar{K}^*(892)^0$	$< 4.4 \times 10^{-6}$ CL=90%	2172
$D_s^+ K^{*0}$	$< 3.5 \times 10^{-6}$ CL=90%	2172
$D_s^{*+} \bar{K}^*(892)^0$	$< 3.5 \times 10^{-4}$ CL=90%	2112
$D_s^- \pi^+ K^+$	$(1.80 \pm 0.22) \times 10^{-4}$	2222
$D_s^{*-} \pi^+ K^+$	$(1.45 \pm 0.24) \times 10^{-4}$	2164
$D_s^- \pi^+ K^*(892)^+$	$< 5 \times 10^{-3}$ CL=90%	2138
$D_s^{*-} \pi^+ K^*(892)^+$	$< 7 \times 10^{-3}$ CL=90%	2076
$D_s^- K^+ K^+$	$(9.7 \pm 2.1) \times 10^{-6}$	2149
$D_s^{*-} K^+ K^+$	$< 1.5 \times 10^{-5}$ CL=90%	2088

Charmonium modes

$\eta_c K^+$	$(1.06 \pm 0.09) \times 10^{-3}$	S=1.2	1751
$\eta_c K^+, \eta_c \rightarrow K_S^0 K^\mp \pi^\pm$	$(2.7 \pm 0.6) \times 10^{-5}$		–
$\eta_c K^*(892)^+$	$(1.1 \pm_{-0.4}^{0.5}) \times 10^{-3}$		1646
$\eta_c K^+ \pi^+ \pi^-$	$< 3.9 \times 10^{-4}$ CL=90%		1684
$\eta_c K^+ \omega(782)$	$< 5.3 \times 10^{-4}$ CL=90%		1475
$\eta_c K^+ \eta$	$< 2.2 \times 10^{-4}$ CL=90%		1588
$\eta_c K^+ \pi^0$	$< 6.2 \times 10^{-5}$ CL=90%		1723
$\eta_c(2S) K^+$	$(4.4 \pm 1.0) \times 10^{-4}$		1320
$\eta_c(2S) K^+, \eta_c \rightarrow p \bar{p}$	$(3.5 \pm 0.8) \times 10^{-8}$		–
$\eta_c(2S) K^+, \eta_c \rightarrow K_S^0 K^\mp \pi^\pm$	$(3.4 \pm_{-1.6}^{2.3}) \times 10^{-6}$		–

$\eta_c(2S)K^+, \eta_c \rightarrow p\bar{p}\pi^+\pi^-$	$(1.12 \pm 0.18) \times 10^{-6}$	—	
$h_c(1P)K^+, h_c \rightarrow J/\psi\pi^+\pi^-$	$< 3.4 \times 10^{-6}$	CL=90%	1401
$X(3730)^0 K^+, X^0 \rightarrow \eta_c \eta$	$< 4.6 \times 10^{-5}$	CL=90%	—
$X(3730)^0 K^+, X^0 \rightarrow \eta_c \pi^0$	$< 5.7 \times 10^{-6}$	CL=90%	—
$\chi_{c1}(3872)K^+$	$< 2.6 \times 10^{-4}$	CL=90%	1141
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow p\bar{p}$	$< 5 \times 10^{-9}$	CL=95%	—
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow J/\psi\pi^+\pi^-$	$(8.6 \pm 0.8) \times 10^{-6}$		1141
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow J/\psi\gamma$	$(2.1 \pm 0.4) \times 10^{-6}$	S=1.1	1141
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow \psi(2S)\gamma$	$(4 \pm 4) \times 10^{-6}$	S=2.5	1141
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow J/\psi(1S)\eta$	$< 7.7 \times 10^{-6}$	CL=90%	1141
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow D^0\bar{D}^0$	$< 6.0 \times 10^{-5}$	CL=90%	1141
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow D^+D^-$	$< 4.0 \times 10^{-5}$	CL=90%	1141
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow D^0\bar{D}^0\pi^0$	$(1.0 \pm 0.4) \times 10^{-4}$		1141
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow \bar{D}^{*0}D^0$	$(8.5 \pm 2.6) \times 10^{-5}$	S=1.4	1141
$\chi_{c1}(3872)^0 K^+, \chi_{c1}^0 \rightarrow \eta_c\pi^+\pi^-$	$< 3.0 \times 10^{-5}$	CL=90%	—
$\chi_{c1}(3872)^0 K^+, \chi_{c1}^0 \rightarrow \eta_c\omega(782)$	$< 6.9 \times 10^{-5}$	CL=90%	—
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow \chi_{c1}(1P)\pi^+\pi^-$	$< 1.5 \times 10^{-6}$	CL=90%	—
$\chi_{c1}(3872)K^+, \chi_{c1}(3872) \rightarrow \chi_{c1}(1P)\pi^0$	$< 8.1 \times 10^{-6}$	CL=90%	—
$X(3915)K^+$	$< 2.8 \times 10^{-4}$	CL=90%	1103
$X(3915)^0 K^+, X^0 \rightarrow \eta_c \eta$	$< 4.7 \times 10^{-5}$	CL=90%	—
$X(3915)^0 K^+, X^0 \rightarrow \eta_c \pi^0$	$< 1.7 \times 10^{-5}$	CL=90%	—
$X(4014)^0 K^+, X^0 \rightarrow \eta_c \eta$	$< 3.9 \times 10^{-5}$	CL=90%	—
$X(4014)^0 K^+, X^0 \rightarrow \eta_c \pi^0$	$< 1.2 \times 10^{-5}$	CL=90%	—
$Z_c(3900)^0 K^+, Z_c^0 \rightarrow \eta_c\pi^+\pi^-$	$< 4.7 \times 10^{-5}$	CL=90%	—
$X(4020)^0 K^+, X^0 \rightarrow \eta_c\pi^+\pi^-$	$< 1.6 \times 10^{-5}$	CL=90%	—
$\chi_{c1}(3872)K^*(892)^+, \chi_{c1} \rightarrow J/\psi\gamma$	$< 4.8 \times 10^{-6}$	CL=90%	939
$\chi_{c1}(3872)K^*(892)^+, \chi_{c1} \rightarrow \psi(2S)\gamma$	$< 2.8 \times 10^{-5}$	CL=90%	939
$\chi_{c1}(3872)^+ K^0, \chi_{c1}^+ \rightarrow J/\psi(1S)\pi^+\pi^0$	[rrr] $< 6.1 \times 10^{-6}$	CL=90%	—

$\chi_{c1}(3872)K^0\pi^+$, $\chi_{c1} \rightarrow$ $J/\psi(1S)\pi^+\pi^-$	$(1.06 \pm 0.31) \times 10^{-5}$	—
$Z_c(4430)^+K^0$, $Z_c^+ \rightarrow J/\psi\pi^+$	$< 1.5 \times 10^{-5}$	CL=95% —
$Z_c(4430)^+K^0$, $Z_c^+ \rightarrow$ $\psi(2S)\pi^+$	$< 4.7 \times 10^{-5}$	CL=95% —
$\psi(4260)^0K^+$, $\psi^0 \rightarrow$ $J/\psi\pi^+\pi^-$	$< 1.56 \times 10^{-5}$	CL=95% —
$X(3915)K^+$, $X \rightarrow J/\psi\gamma$	$< 1.4 \times 10^{-5}$	CL=90% —
$X(3915)K^+$, $X \rightarrow$ $\chi_{c1}(1P)\pi^0$	$< 3.8 \times 10^{-5}$	CL=90% —
$X(3930)^0K^+$, $X^0 \rightarrow J/\psi\gamma$	$< 2.5 \times 10^{-6}$	CL=90% —
$J/\psi(1S)K^+$	$(1.006 \pm 0.027) \times 10^{-3}$	1684
$J/\psi(1S)K^0\pi^+$	$(1.14 \pm 0.11) \times 10^{-3}$	1651
$J/\psi(1S)K^+\pi^+\pi^-$	$(8.1 \pm 1.3) \times 10^{-4}$	S=2.5 1612
$J/\psi(1S)K^+K^-K^+$	$(3.37 \pm 0.29) \times 10^{-5}$	1252
$X(3915)K^+$, $X \rightarrow p\bar{p}$	$< 7.1 \times 10^{-8}$	CL=95% —
$J/\psi(1S)K^*(892)^+$	$(1.43 \pm 0.08) \times 10^{-3}$	1571
$J/\psi(1S)K(1270)^+$	$(1.8 \pm 0.5) \times 10^{-3}$	1402
$J/\psi(1S)K(1400)^+$	$< 5 \times 10^{-4}$	CL=90% 1308
$J/\psi(1S)\eta K^+$	$(1.24 \pm 0.14) \times 10^{-4}$	1510
$\chi_{c1-odd}(3872)K^+$, $\chi_{c1-odd} \rightarrow J/\psi\eta$	$< 3.8 \times 10^{-6}$	CL=90% —
$\psi(4160)K^+$, $\psi \rightarrow J/\psi\eta$	$< 7.4 \times 10^{-6}$	CL=90% —
$J/\psi(1S)\eta'K^+$	$< 8.8 \times 10^{-5}$	CL=90% 1273
$J/\psi(1S)\phi K^+$	$(5.0 \pm 0.4) \times 10^{-5}$	1227
$J/\psi(1S)K_1(1650)$, $K_1 \rightarrow$ ϕK^+	$(6 \begin{smallmatrix} +10 \\ -6 \end{smallmatrix}) \times 10^{-6}$	—
$J/\psi(1S)K^*(1680)^+$, $K^* \rightarrow$ ϕK^+	$(3.4 \begin{smallmatrix} +1.9 \\ -2.2 \end{smallmatrix}) \times 10^{-6}$	—
$J/\psi(1S)K_2^*(1980)$, $K_2^* \rightarrow$ ϕK^+	$(1.5 \begin{smallmatrix} +0.9 \\ -0.5 \end{smallmatrix}) \times 10^{-6}$	—
$J/\psi(1S)K(1830)^+$, $K(1830)^+ \rightarrow \phi K^+$	$(1.3 \begin{smallmatrix} +1.3 \\ -1.1 \end{smallmatrix}) \times 10^{-6}$	—
$\chi_{c1}(4140)K^+$, $\chi_{c1} \rightarrow$ $J/\psi(1S)\phi$	$(10 \pm 4) \times 10^{-6}$	—
$\chi_{c1}(4274)K^+$, $\chi_{c1} \rightarrow$ $J/\psi(1S)\phi$	$(3.6 \begin{smallmatrix} +2.2 \\ -1.8 \end{smallmatrix}) \times 10^{-6}$	—
$\chi_{c0}(4500)K^+$, $\chi_c^0 \rightarrow$ $J/\psi(1S)\phi$	$(3.3 \begin{smallmatrix} +2.1 \\ -1.7 \end{smallmatrix}) \times 10^{-6}$	—
$\chi_{c0}(4700)K^+$, $\chi_{c0} \rightarrow$ $J/\psi(1S)\phi$	$(6 \begin{smallmatrix} +5 \\ -4 \end{smallmatrix}) \times 10^{-6}$	—

$J/\psi(1S)\omega K^+$	$(3.20 \pm_{-0.32}^{+0.60}) \times 10^{-4}$		1388
$\chi_{c1}(3872)K^+, \chi_{c1} \rightarrow J/\psi\omega$	$(6.0 \pm 2.2) \times 10^{-6}$		1141
$X(3915)K^+, X \rightarrow J/\psi\omega$	$(3.0 \pm_{-0.7}^{+0.9}) \times 10^{-5}$		1103
$J/\psi(1S)\pi^+$	$(3.87 \pm 0.11) \times 10^{-5}$		1728
$J/\psi(1S)\pi^+\pi^+\pi^-\pi^-\pi^+$	$(1.16 \pm 0.13) \times 10^{-5}$		1635
$\psi(2S)\pi^+\pi^+\pi^+$	$(1.9 \pm 0.4) \times 10^{-5}$		1304
$J/\psi(1S)\rho^+$	$(4.1 \pm 0.5) \times 10^{-5}$	S=1.4	1611
$J/\psi(1S)\pi^+\pi^0$ nonresonant	$< 7.3 \times 10^{-6}$	CL=90%	1717
$J/\psi(1S)a_1(1260)^+$	$< 1.2 \times 10^{-3}$	CL=90%	1415
$J/\psi(1S)p\bar{p}\pi^+$	$< 5.0 \times 10^{-7}$	CL=90%	643
$J/\psi(1S)p\bar{\Lambda}$	$(1.46 \pm 0.12) \times 10^{-5}$		567
$J/\psi(1S)\bar{\Sigma}^0\rho$	$< 1.1 \times 10^{-5}$	CL=90%	–
$J/\psi(1S)D^+$	$< 1.2 \times 10^{-4}$	CL=90%	871
$J/\psi(1S)\bar{D}^0\pi^+$	$< 2.5 \times 10^{-5}$	CL=90%	665
$\psi(2S)\pi^+$	$(2.44 \pm 0.30) \times 10^{-5}$		1347
$\psi(2S)K^+$	$(6.19 \pm 0.22) \times 10^{-4}$		1284
$\psi(2S)K^*(892)^+$	$(6.7 \pm 1.4) \times 10^{-4}$	S=1.3	1116
$\psi(2S)K^+\pi^+\pi^+$	$(4.3 \pm 0.5) \times 10^{-4}$		1179
$\psi(2S)\phi(1020)K^+$	$(4.0 \pm 0.7) \times 10^{-6}$		417
$\psi(3770)K^+$	$(4.9 \pm 1.3) \times 10^{-4}$		1218
$\psi(3770)K^+, \psi \rightarrow D^0\bar{D}^0$	$(1.5 \pm 0.5) \times 10^{-4}$	S=1.4	1218
$\psi(3770)K^+, \psi \rightarrow D^+D^-$	$(9.4 \pm 3.5) \times 10^{-5}$		1218
$\psi(3770)K^+, \psi \rightarrow p\bar{p}$	$< 2 \times 10^{-7}$	CL=95%	–
$\psi(4040)K^+$	$< 1.3 \times 10^{-4}$	CL=90%	1003
$\psi(4160)K^+$	$(5.1 \pm 2.7) \times 10^{-4}$		868
$\psi(4160)K^+, \psi \rightarrow \bar{D}^0D^0$	$(8 \pm 5) \times 10^{-5}$		–
$\chi_{c0}\pi^+, \chi_{c0} \rightarrow \pi^+\pi^-$	$< 1 \times 10^{-7}$	CL=90%	1531
$\chi_{c0}K^+$	$(1.50 \pm_{-0.13}^{+0.15}) \times 10^{-4}$		1478
$\chi_{c0}K^*(892)^+$	$< 2.1 \times 10^{-4}$	CL=90%	1341
$\chi_{c1}(1P)\pi^+$	$(2.2 \pm 0.5) \times 10^{-5}$		1468
$\chi_{c1}(1P)K^+$	$(4.85 \pm 0.33) \times 10^{-4}$	S=1.5	1412
$\chi_{c1}(1P)K^*(892)^+$	$(3.0 \pm 0.6) \times 10^{-4}$	S=1.1	1265
$\chi_{c1}(1P)K^0\pi^+$	$(5.8 \pm 0.4) \times 10^{-4}$		1370
$\chi_{c1}(1P)K^+\pi^0$	$(3.29 \pm 0.35) \times 10^{-4}$		1373
$\chi_{c1}(1P)K^+\pi^+\pi^-$	$(3.74 \pm 0.30) \times 10^{-4}$		1319
$\chi_{c1}(2P)K^+, \chi_{c1}(2P) \rightarrow \pi^+\pi^-\chi_{c1}(1P)$	$< 1.1 \times 10^{-5}$	CL=90%	–
$\chi_{c2}K^+$	$(1.1 \pm 0.4) \times 10^{-5}$		1379
$\chi_{c2}K^+, \chi_{c2} \rightarrow p\bar{p}\pi^+\pi^-$	$< 1.9 \times 10^{-7}$		–
$\chi_{c2}K^*(892)^+$	$< 1.2 \times 10^{-4}$	CL=90%	1228
$\chi_{c2}K^0\pi^+$	$(1.16 \pm 0.25) \times 10^{-4}$		1336

$\chi_{c2} K^+ \pi^0$	< 6.2	$\times 10^{-5}$	CL=90%	1339
$\chi_{c2} K^+ \pi^+ \pi^-$	(1.34 ± 0.19)	$\times 10^{-4}$		1284
$\chi_{c2}(3930) \pi^+, \chi_{c2} \rightarrow \pi^+ \pi^-$	< 1	$\times 10^{-7}$	CL=90%	1437
$h_c(1P) K^+$	(3.7 ± 1.2)	$\times 10^{-5}$		1401
$h_c(1P) K^+, h_c \rightarrow p \bar{p}$	< 6.4	$\times 10^{-8}$	CL=95%	—

K or K* modes

$K^0 \pi^+$	(2.37 ± 0.08)	$\times 10^{-5}$		2614
$K^+ \pi^0$	(1.29 ± 0.05)	$\times 10^{-5}$		2615
$\eta' K^+$	(7.04 ± 0.25)	$\times 10^{-5}$		2528
$\eta' K^*(892)^+$	$(4.8 \begin{smallmatrix} + 1.8 \\ - 1.6 \end{smallmatrix})$	$\times 10^{-6}$		2472
$\eta' K_0^*(1430)^+$	(5.2 ± 2.1)	$\times 10^{-6}$		—
$\eta' K_2^*(1430)^+$	(2.8 ± 0.5)	$\times 10^{-5}$		2346
ηK^+	(2.4 ± 0.4)	$\times 10^{-6}$	S=1.7	2588
$\eta K^*(892)^+$	(1.93 ± 0.16)	$\times 10^{-5}$		2534
$\eta K_0^*(1430)^+$	(1.8 ± 0.4)	$\times 10^{-5}$		—
$\eta K_2^*(1430)^+$	(9.1 ± 3.0)	$\times 10^{-6}$		2414
$\eta(1295) K^+ \times B(\eta(1295) \rightarrow \eta \pi \pi)$	$(2.9 \begin{smallmatrix} + 0.8 \\ - 0.7 \end{smallmatrix})$	$\times 10^{-6}$		2455
$\eta(1405) K^+ \times B(\eta(1405) \rightarrow \eta \pi \pi)$	< 1.3	$\times 10^{-6}$	CL=90%	2425
$\eta(1405) K^+ \times B(\eta(1405) \rightarrow K^* K)$	< 1.2	$\times 10^{-6}$	CL=90%	2425
$\eta(1475) K^+ \times B(\eta(1475) \rightarrow K^* K)$	$(1.38 \begin{smallmatrix} + 0.21 \\ - 0.18 \end{smallmatrix})$	$\times 10^{-5}$		2407
$f_1(1285) K^+$	< 2.0	$\times 10^{-6}$	CL=90%	2458
$f_1(1420) K^+ \times B(f_1(1420) \rightarrow \eta \pi \pi)$	< 2.9	$\times 10^{-6}$	CL=90%	2420
$f_1(1420) K^+ \times B(f_1(1420) \rightarrow K^* K)$	< 4.1	$\times 10^{-6}$	CL=90%	2420
$\phi(1680) K^+ \times B(\phi(1680) \rightarrow K^* K)$	< 3.4	$\times 10^{-6}$	CL=90%	2344
$f_0(1500) K^+$	(3.7 ± 2.2)	$\times 10^{-6}$		2398
ωK^+	(6.5 ± 0.4)	$\times 10^{-6}$		2558
$\omega K^*(892)^+$	< 7.4	$\times 10^{-6}$	CL=90%	2503
$\omega (K\pi)_0^{*+}$	(2.8 ± 0.4)	$\times 10^{-5}$		—
$\omega K_0^*(1430)^+$	(2.4 ± 0.5)	$\times 10^{-5}$		—
$\omega K_2^*(1430)^+$	(2.1 ± 0.4)	$\times 10^{-5}$		2379
$a_0(980)^+ K^0 \times B(a_0(980)^+ \rightarrow \eta \pi^+)$	< 3.9	$\times 10^{-6}$	CL=90%	—
$a_0(980)^0 K^+ \times B(a_0(980)^0 \rightarrow \eta \pi^0)$	< 2.5	$\times 10^{-6}$	CL=90%	—
$K^*(892)^0 \pi^+$	(1.01 ± 0.08)	$\times 10^{-5}$		2562

$K^*(892)^+ \pi^0$	$(6.8 \pm 0.9) \times 10^{-6}$		2563
$K^+ \pi^- \pi^+$	$(5.10 \pm 0.29) \times 10^{-5}$		2609
$K^+ \pi^- \pi^+$ nonresonant	$(1.63 \begin{smallmatrix} + 0.21 \\ - 0.15 \end{smallmatrix}) \times 10^{-5}$		2609
$\omega(782) K^+$	$(6 \pm 9) \times 10^{-6}$		2558
$K^+ f_0(980) \times B(f_0(980) \rightarrow \pi^+ \pi^-)$	$(9.4 \begin{smallmatrix} + 1.0 \\ - 1.2 \end{smallmatrix}) \times 10^{-6}$		2522
$f_2(1270)^0 K^+$	$(1.07 \pm 0.27) \times 10^{-6}$		—
$f_0(1370)^0 K^+ \times B(f_0(1370)^0 \rightarrow \pi^+ \pi^-)$	$< 1.07 \times 10^{-5}$	CL=90%	—
$\rho^0(1450) K^+ \times B(\rho^0(1450) \rightarrow \pi^+ \pi^-)$	$< 1.17 \times 10^{-5}$	CL=90%	—
$f_2'(1525) K^+ \times B(f_2'(1525) \rightarrow \pi^+ \pi^-)$	$< 3.4 \times 10^{-6}$	CL=90%	2394
$K^+ \rho^0$	$(3.7 \pm 0.5) \times 10^{-6}$		2559
$K_0^*(1430)^0 \pi^+$	$(3.9 \begin{smallmatrix} + 0.6 \\ - 0.5 \end{smallmatrix}) \times 10^{-5}$	S=1.4	2445
$K_0^*(1430)^+ \pi^0$	$(1.19 \begin{smallmatrix} + 0.20 \\ - 0.23 \end{smallmatrix}) \times 10^{-5}$		—
$K_2^*(1430)^0 \pi^+$	$(5.6 \begin{smallmatrix} + 2.2 \\ - 1.5 \end{smallmatrix}) \times 10^{-6}$		2445
$K^*(1410)^0 \pi^+$	$< 4.5 \times 10^{-5}$	CL=90%	2448
$K^*(1680)^0 \pi^+$	$< 1.2 \times 10^{-5}$	CL=90%	2358
$K^+ \pi^0 \pi^0$	$(1.62 \pm 0.19) \times 10^{-5}$		2610
$f_0(980) K^+ \times B(f_0 \rightarrow \pi^0 \pi^0)$	$(2.8 \pm 0.8) \times 10^{-6}$		2522
$K^- \pi^+ \pi^+$	$< 4.6 \times 10^{-8}$	CL=90%	2609
$K^- \pi^+ \pi^+$ nonresonant	$< 5.6 \times 10^{-5}$	CL=90%	2609
$K_1(1270)^0 \pi^+$	$< 4.0 \times 10^{-5}$	CL=90%	2489
$K_1(1400)^0 \pi^+$	$< 3.9 \times 10^{-5}$	CL=90%	2451
$K^0 \pi^+ \pi^0$	$< 6.6 \times 10^{-5}$	CL=90%	2609
$K^0 \rho^+$	$(7.3 \begin{smallmatrix} + 1.0 \\ - 1.2 \end{smallmatrix}) \times 10^{-6}$		2558
$K^*(892)^+ \pi^+ \pi^-$	$(7.5 \pm 1.0) \times 10^{-5}$		2557
$K^*(892)^+ \rho^0$	$(4.6 \pm 1.1) \times 10^{-6}$		2504
$K^*(892)^+ f_0(980)$	$(4.2 \pm 0.7) \times 10^{-6}$		2466
$a_1^+ K^0$	$(3.5 \pm 0.7) \times 10^{-5}$		—
$b_1^+ K^0 \times B(b_1^+ \rightarrow \omega \pi^+)$	$(9.6 \pm 1.9) \times 10^{-6}$		—
$K^*(892)^0 \rho^+$	$(9.2 \pm 1.5) \times 10^{-6}$		2504
$K_1(1400)^+ \rho^0$	$< 7.8 \times 10^{-4}$	CL=90%	2388
$K_2^*(1430)^+ \rho^0$	$< 1.5 \times 10^{-3}$	CL=90%	2381
$b_1^0 K^+ \times B(b_1^0 \rightarrow \omega \pi^0)$	$(9.1 \pm 2.0) \times 10^{-6}$		—
$b_1^+ K^{*0} \times B(b_1^+ \rightarrow \omega \pi^+)$	$< 5.9 \times 10^{-6}$	CL=90%	—
$b_1^0 K^{*+} \times B(b_1^0 \rightarrow \omega \pi^0)$	$< 6.7 \times 10^{-6}$	CL=90%	—
$K^+ \bar{K}^0$	$(1.31 \pm 0.17) \times 10^{-6}$	S=1.2	2593
$\bar{K}^0 K^+ \pi^0$	$< 2.4 \times 10^{-5}$	CL=90%	2578

$K^+ K_S^0 K_S^0$	$(1.05 \pm 0.04) \times 10^{-5}$		2521
$f_0(980) K^+, f_0 \rightarrow K_S^0 K_S^0$	$(1.47 \pm 0.33) \times 10^{-5}$		—
$f_0(1710) K^+, f_0 \rightarrow K_S^0 K_S^0$	$(4.8 \begin{smallmatrix} + 4.0 \\ - 2.6 \end{smallmatrix}) \times 10^{-7}$		—
$K^+ K_S^0 K_S^0$ nonresonant	$(2.0 \pm 0.4) \times 10^{-5}$		2521
$K_S^0 K_S^0 \pi^+$	$< 5.1 \times 10^{-7}$	CL=90%	2577
$K^+ K^- \pi^+$	$(5.2 \pm 0.4) \times 10^{-6}$		2578
$K^+ K^- \pi^+$ nonresonant	$(1.68 \pm 0.26) \times 10^{-6}$		2578
$K^+ \bar{K}^*(892)^0$	$(5.9 \pm 0.8) \times 10^{-7}$		2540
$K^+ \bar{K}_0^*(1430)^0$	$(3.8 \pm 1.3) \times 10^{-7}$		2421
$\pi^+ (K^+ K^-)_{S\text{-wave}}$	$(8.5 \pm 0.9) \times 10^{-7}$		2578
$K^+ K^+ \pi^-$	$< 1.1 \times 10^{-8}$	CL=90%	2578
$K^+ K^+ \pi^-$ nonresonant	$< 8.79 \times 10^{-5}$	CL=90%	2578
$f_2'(1525) K^+$	$(1.8 \pm 0.5) \times 10^{-6}$	S=1.1	2394
$K^{*+} \pi^+ K^-$	$< 1.18 \times 10^{-5}$	CL=90%	2524
$K^*(892)^+ K^*(892)^0$	$(9.1 \pm 2.9) \times 10^{-7}$		2485
$K^{*+} K^+ \pi^-$	$< 6.1 \times 10^{-6}$	CL=90%	2524
$K^+ K^- K^+$	$(3.40 \pm 0.14) \times 10^{-5}$	S=1.4	2523
$K^+ \phi$	$(8.8 \begin{smallmatrix} + 0.7 \\ - 0.6 \end{smallmatrix}) \times 10^{-6}$	S=1.1	2516
$f_0(980) K^+ \times B(f_0(980) \rightarrow K^+ K^-)$	$(9.4 \pm 3.2) \times 10^{-6}$		2522
$a_2(1320) K^+ \times B(a_2(1320) \rightarrow K^+ K^-)$	$< 1.1 \times 10^{-6}$	CL=90%	2449
$X_0(1550) K^+ \times B(X_0(1550) \rightarrow K^+ K^-)$	$(4.3 \pm 0.7) \times 10^{-6}$		—
$\phi(1680) K^+ \times B(\phi(1680) \rightarrow K^+ K^-)$	$< 8 \times 10^{-7}$	CL=90%	2344
$f_0(1710) K^+ \times B(f_0(1710) \rightarrow K^+ K^-)$	$(1.1 \pm 0.6) \times 10^{-6}$		2336
$K^+ K^- K^+$ nonresonant	$(2.38 \begin{smallmatrix} + 0.28 \\ - 0.50 \end{smallmatrix}) \times 10^{-5}$		2523
$K^*(892)^+ K^+ K^-$	$(3.6 \pm 0.5) \times 10^{-5}$		2466
$K^*(892)^+ \phi$	$(10.0 \pm 2.0) \times 10^{-6}$	S=1.7	2460
$\phi(K\pi)_0^{*+}$	$(8.3 \pm 1.6) \times 10^{-6}$		—
$\phi K_1(1270)^+$	$(6.1 \pm 1.9) \times 10^{-6}$		2380
$\phi K_1(1400)^+$	$< 3.2 \times 10^{-6}$	CL=90%	2339
$\phi K^*(1410)^+$	$< 4.3 \times 10^{-6}$	CL=90%	—
$\phi K_0^*(1430)^+$	$(7.0 \pm 1.6) \times 10^{-6}$		—
$\phi K_2^*(1430)^+$	$(8.4 \pm 2.1) \times 10^{-6}$		2332
$\phi K_2^*(1770)^+$	$< 1.50 \times 10^{-5}$	CL=90%	—
$\phi K_2^*(1820)^+$	$< 1.63 \times 10^{-5}$	CL=90%	—
$a_1^+ K^{*0}$	$< 3.6 \times 10^{-6}$	CL=90%	—
$K^+ \phi \phi$	$(5.0 \pm 1.2) \times 10^{-6}$	S=2.3	2306

$\eta' \eta' K^+$	< 2.5	$\times 10^{-5}$	CL=90%	2338
$\omega \phi K^+$	< 1.9	$\times 10^{-6}$	CL=90%	2374
$X(1812) K^+ \times B(X \rightarrow \omega \phi)$	< 3.2	$\times 10^{-7}$	CL=90%	–
$K^*(892)^+ \gamma$	(3.92 ± 0.22)	$\times 10^{-5}$	S=1.7	2564
$K_1(1270)^+ \gamma$	$(4.4 \begin{smallmatrix} + 0.7 \\ - 0.6 \end{smallmatrix})$	$\times 10^{-5}$		2491
$\eta K^+ \gamma$	(7.9 ± 0.9)	$\times 10^{-6}$		2588
$\eta' K^+ \gamma$	$(2.9 \begin{smallmatrix} + 1.0 \\ - 0.9 \end{smallmatrix})$	$\times 10^{-6}$		2528
$\phi K^+ \gamma$	(2.7 ± 0.4)	$\times 10^{-6}$	S=1.2	2516
$K^+ \pi^- \pi^+ \gamma$	(2.58 ± 0.15)	$\times 10^{-5}$	S=1.3	2609
$K^*(892)^0 \pi^+ \gamma$	(2.33 ± 0.12)	$\times 10^{-5}$		2562
$K^+ \rho^0 \gamma$	(8.2 ± 0.9)	$\times 10^{-6}$		2559
$(K^+ \pi^-)_{NR} \pi^+ \gamma$	$(9.9 \begin{smallmatrix} + 1.7 \\ - 2.0 \end{smallmatrix})$	$\times 10^{-6}$		2609
$K^0 \pi^+ \pi^0 \gamma$	(4.6 ± 0.5)	$\times 10^{-5}$		2609
$K_1(1400)^+ \gamma$	$(10 \begin{smallmatrix} + 5 \\ - 4 \end{smallmatrix})$	$\times 10^{-6}$		2453
$K^*(1410)^+ \gamma$	$(2.7 \begin{smallmatrix} + 0.8 \\ - 0.6 \end{smallmatrix})$	$\times 10^{-5}$		–
$K_0^*(1430)^0 \pi^+ \gamma$	$(1.32 \begin{smallmatrix} + 0.26 \\ - 0.32 \end{smallmatrix})$	$\times 10^{-6}$		2445
$K_2^*(1430)^+ \gamma$	(1.4 ± 0.4)	$\times 10^{-5}$		2447
$K^*(1680)^+ \gamma$	$(6.7 \begin{smallmatrix} + 1.7 \\ - 1.4 \end{smallmatrix})$	$\times 10^{-5}$		2360
$K_3^*(1780)^+ \gamma$	< 3.9	$\times 10^{-5}$	CL=90%	2341
$K_4^*(2045)^+ \gamma$	< 9.9	$\times 10^{-3}$	CL=90%	2242

Light unflavored meson modes

$\rho^+ \gamma$	(9.8 ± 2.5)	$\times 10^{-7}$		2583
$\pi^+ \pi^0$	(5.5 ± 0.4)	$\times 10^{-6}$	S=1.2	2636
$\pi^+ \pi^+ \pi^-$	(1.52 ± 0.14)	$\times 10^{-5}$		2630
$\rho^0 \pi^+$	(8.3 ± 1.2)	$\times 10^{-6}$		2581
$\pi^+ f_0(980), f_0 \rightarrow \pi^+ \pi^-$	< 1.5	$\times 10^{-6}$	CL=90%	2545
$\pi^+ f_2(1270)$	$(2.2 \begin{smallmatrix} + 0.7 \\ - 0.4 \end{smallmatrix})$	$\times 10^{-6}$		2484
$\rho(1450)^0 \pi^+, \rho^0 \rightarrow \pi^+ \pi^-$	$(1.4 \begin{smallmatrix} + 0.6 \\ - 0.9 \end{smallmatrix})$	$\times 10^{-6}$		2434
$\rho(1450)^0 \pi^+, \rho^0 \rightarrow K^+ K^-$	(1.60 ± 0.14)	$\times 10^{-6}$		–
$f_0(1370) \pi^+, f_0 \rightarrow \pi^+ \pi^-$	< 4.0	$\times 10^{-6}$	CL=90%	2460
$f_0(500) \pi^+, f_0 \rightarrow \pi^+ \pi^-$	< 4.1	$\times 10^{-6}$	CL=90%	–
$\pi^+ \pi^- \pi^+$ nonresonant	$(5.3 \begin{smallmatrix} + 1.5 \\ - 1.1 \end{smallmatrix})$	$\times 10^{-6}$		2630
$\pi^+ \pi^0 \pi^0$	< 8.9	$\times 10^{-4}$	CL=90%	2631
$\rho^+ \pi^0$	(1.09 ± 0.14)	$\times 10^{-5}$		2581
$\pi^+ \pi^- \pi^+ \pi^0$	< 4.0	$\times 10^{-3}$	CL=90%	2622
$\rho^+ \rho^0$	(2.40 ± 0.19)	$\times 10^{-5}$		2523
$\rho^+ f_0(980), f_0 \rightarrow \pi^+ \pi^-$	< 2.0	$\times 10^{-6}$	CL=90%	2486

$a_1(1260)^+\pi^0$	$(2.6 \pm 0.7) \times 10^{-5}$		2494
$a_1(1260)^0\pi^+$	$(2.0 \pm 0.6) \times 10^{-5}$		2494
$\omega\pi^+$	$(6.9 \pm 0.5) \times 10^{-6}$		2580
$\omega\rho^+$	$(1.59 \pm 0.21) \times 10^{-5}$		2522
$\eta\pi^+$	$(4.02 \pm 0.27) \times 10^{-6}$		2609
$\eta\rho^+$	$(7.0 \pm 2.9) \times 10^{-6}$	S=2.8	2553
$\eta'\pi^+$	$(2.7 \pm 0.9) \times 10^{-6}$	S=1.9	2551
$\eta'\rho^+$	$(9.7 \pm 2.2) \times 10^{-6}$		2492
$\phi\pi^+$	$(3.2 \pm 1.5) \times 10^{-8}$		2539
$\phi\rho^+$	< 3.0	$\times 10^{-6}$ CL=90%	2480
$a_0(980)^0\pi^+, a_0^0 \rightarrow \eta\pi^0$	< 5.8	$\times 10^{-6}$ CL=90%	—
$a_0(980)^+\pi^0, a_0^+ \rightarrow \eta\pi^+$	< 1.4	$\times 10^{-6}$ CL=90%	—
$\pi^+\pi^+\pi^+\pi^-\pi^-$	< 8.6	$\times 10^{-4}$ CL=90%	2608
$\rho^0 a_1(1260)^+$	< 6.2	$\times 10^{-4}$ CL=90%	2433
$\rho^0 a_2(1320)^+$	< 7.2	$\times 10^{-4}$ CL=90%	2411
$b_1^0\pi^+, b_1^0 \rightarrow \omega\pi^0$	$(6.7 \pm 2.0) \times 10^{-6}$		—
$b_1^+\pi^0, b_1^+ \rightarrow \omega\pi^+$	< 3.3	$\times 10^{-6}$ CL=90%	—
$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^0$	< 6.3	$\times 10^{-3}$ CL=90%	2592
$b_1^+\rho^0, b_1^+ \rightarrow \omega\pi^+$	< 5.2	$\times 10^{-6}$ CL=90%	—
$a_1(1260)^+ a_1(1260)^0$	< 1.3	% CL=90%	2336
$b_1^0\rho^+, b_1^0 \rightarrow \omega\pi^0$	< 3.3	$\times 10^{-6}$ CL=90%	—

Charged particle (h^\pm) modes

$$h^\pm = K^\pm \text{ or } \pi^\pm$$

$h^+\pi^0$	$(1.6 \begin{smallmatrix} + 0.7 \\ - 0.6 \end{smallmatrix}) \times 10^{-5}$		2636
ωh^+	$(1.38 \begin{smallmatrix} + 0.27 \\ - 0.24 \end{smallmatrix}) \times 10^{-5}$		2580
$h^+ X^0$ (Familon)	< 4.9	$\times 10^{-5}$ CL=90%	—
$K^+ X^0, X^0 \rightarrow \mu^+\mu^-$	< 1	$\times 10^{-7}$ CL=95%	—

Baryon modes

$p\bar{p}\pi^+$	$(1.62 \pm 0.20) \times 10^{-6}$		2439
$p\bar{p}\pi^+$ nonresonant	< 5.3	$\times 10^{-5}$ CL=90%	2439
$p\bar{p}K^+$	$(5.9 \pm 0.5) \times 10^{-6}$	S=1.5	2348
$\Theta(1710)^{++}\bar{p}, \Theta^{++} \rightarrow pK^+$	[sss] < 9.1	$\times 10^{-8}$ CL=90%	—
$f_J(2220)K^+, f_J \rightarrow p\bar{p}$	[sss] < 4.1	$\times 10^{-7}$ CL=90%	2135
$p\bar{\Lambda}(1520)$	$(3.1 \pm 0.6) \times 10^{-7}$		2322
$p\bar{p}K^+$ nonresonant	< 8.9	$\times 10^{-5}$ CL=90%	2348
$p\bar{p}K^*(892)^+$	$(3.6 \begin{smallmatrix} + 0.8 \\ - 0.7 \end{smallmatrix}) \times 10^{-6}$		2215
$f_J(2220)K^{*+}, f_J \rightarrow p\bar{p}$	< 7.7	$\times 10^{-7}$ CL=90%	2059
$p\bar{\Lambda}$	$(2.4 \begin{smallmatrix} + 1.0 \\ - 0.9 \end{smallmatrix}) \times 10^{-7}$		2430

$\rho\bar{\Lambda}\gamma$	$(2.4 \begin{smallmatrix} + 0.5 \\ - 0.4 \end{smallmatrix}) \times 10^{-6}$		2430
$\rho\bar{\Lambda}\pi^0$	$(3.0 \begin{smallmatrix} + 0.7 \\ - 0.6 \end{smallmatrix}) \times 10^{-6}$		2402
$\rho\bar{\Sigma}(1385)^0$	< 4.7	$\times 10^{-7}$	CL=90% 2362
$\Delta^+\bar{\Lambda}$	< 8.2	$\times 10^{-7}$	CL=90% -
$\rho\bar{\Sigma}\gamma$	< 4.6	$\times 10^{-6}$	CL=90% 2413
$\rho\bar{\Lambda}\pi^+\pi^-$	$(1.13 \pm 0.13) \times 10^{-5}$		2367
$\rho\bar{\Lambda}\pi^+\pi^-$ nonresonant	$(5.9 \pm 1.1) \times 10^{-6}$		2367
$\rho\bar{\Lambda}\rho^0, \rho^0 \rightarrow \pi^+\pi^-$	$(4.8 \pm 0.9) \times 10^{-6}$		2214
$\rho\bar{\Lambda}f_2(1270), f_2 \rightarrow \pi^+\pi^-$	$(2.0 \pm 0.8) \times 10^{-6}$		2026
$\rho\bar{\Lambda}K^+K^-$	$(4.1 \pm 0.7) \times 10^{-6}$		2132
$\rho\bar{\Lambda}\phi$	$(8.0 \pm 2.2) \times 10^{-7}$		2119
$\bar{p}\Lambda K^+K^-$	$(3.7 \pm 0.6) \times 10^{-6}$		2132
$\Lambda\bar{\Lambda}\pi^+$	< 9.4	$\times 10^{-7}$	CL=90% 2358
$\Lambda\bar{\Lambda}K^+$	$(3.4 \pm 0.6) \times 10^{-6}$		2251
$\Lambda\bar{\Lambda}K^{*+}$	$(2.2 \begin{smallmatrix} + 1.2 \\ - 0.9 \end{smallmatrix}) \times 10^{-6}$		2098
$\Lambda(1520)\bar{\Lambda}K^+$	$(2.2 \pm 0.7) \times 10^{-6}$		2126
$\Lambda\bar{\Lambda}(1520)K^+$	< 2.08	$\times 10^{-6}$	2126
$\bar{\Delta}^0\rho$	< 1.38	$\times 10^{-6}$	CL=90% 2403
$\Delta^{++}\bar{p}$	< 1.4	$\times 10^{-7}$	CL=90% 2403
$D^+p\bar{p}$	< 1.5	$\times 10^{-5}$	CL=90% 1860
$D^*(2010)^+p\bar{p}$	< 1.5	$\times 10^{-5}$	CL=90% 1786
$\bar{D}^0p\bar{p}\pi^+$	$(3.72 \pm 0.27) \times 10^{-4}$		1789
$\bar{D}^{*0}p\bar{p}\pi^+$	$(3.73 \pm 0.32) \times 10^{-4}$		1709
$D^-p\bar{p}\pi^+\pi^-$	$(1.66 \pm 0.30) \times 10^{-4}$		1705
$D^{*-}p\bar{p}\pi^+\pi^-$	$(1.86 \pm 0.25) \times 10^{-4}$		1621
$\rho\bar{\Lambda}^0\bar{D}^0$	$(1.43 \pm 0.32) \times 10^{-5}$		-
$\rho\bar{\Lambda}^0\bar{D}^*(2007)^0$	< 5	$\times 10^{-5}$	CL=90% -
$\bar{\Lambda}_c^-p\pi^+$	$(2.3 \pm 0.4) \times 10^{-4}$		S=2.2 1980
$\bar{\Lambda}_c^- \Delta(1232)^{++}$	< 1.9	$\times 10^{-5}$	CL=90% 1928
$\bar{\Lambda}_c^- \Delta_X(1600)^{++}$	$(4.7 \pm 1.0) \times 10^{-5}$		-
$\bar{\Lambda}_c^- \Delta_X(2420)^{++}$	$(3.7 \pm 0.8) \times 10^{-5}$		-
$(\bar{\Lambda}_c^-p)_s\pi^+$	[<i>ttt</i>] $(3.1 \pm 0.7) \times 10^{-5}$		-
$\bar{\Sigma}_c(2520)^0\rho$	< 3	$\times 10^{-6}$	CL=90% 1904
$\bar{\Sigma}_c(2800)^0\rho$	$(2.6 \pm 0.9) \times 10^{-5}$		-
$\bar{\Lambda}_c^-p\pi^+\pi^0$	$(1.8 \pm 0.6) \times 10^{-3}$		1935
$\bar{\Lambda}_c^-p\pi^+\pi^+\pi^-$	$(2.2 \pm 0.7) \times 10^{-3}$		1880
$\bar{\Lambda}_c^-p\pi^+\pi^+\pi^-\pi^0$	< 1.34	%	CL=90% 1823
$\Lambda_c^+\Lambda_c^-K^+$	$(4.9 \pm 0.7) \times 10^{-4}$		739
$\Xi_c(2930)\Lambda_c^+, \Xi_c \rightarrow K^+\Lambda_c^-$	$(1.7 \pm 0.5) \times 10^{-4}$		-
$\bar{\Sigma}_c(2455)^0\rho$	$(2.9 \pm 0.7) \times 10^{-5}$		1938
$\bar{\Sigma}_c(2455)^0\rho\pi^0$	$(3.5 \pm 1.1) \times 10^{-4}$		1896

$\overline{\Sigma}_c(2455)^0 p \pi^- \pi^+$		$(3.5 \pm 1.1) \times 10^{-4}$		1845
$\overline{\Sigma}_c(2455)^{--} p \pi^+ \pi^+$		$(2.37 \pm 0.20) \times 10^{-4}$		1845
$\overline{\Lambda}_c(2593)^- / \overline{\Lambda}_c(2625)^- p \pi^+$		$< 1.9 \times 10^{-4}$	CL=90%	–
$\overline{\Xi}_c^0 \Lambda_c^+$		$(9.5 \pm 2.3) \times 10^{-4}$		1144
$\overline{\Xi}_c^0 \Lambda_c^+, \overline{\Xi}_c^0 \rightarrow \Xi^+ \pi^-$		$(1.76 \pm 0.29) \times 10^{-5}$		1144
$\overline{\Xi}_c^0 \Lambda_c^+, \overline{\Xi}_c^0 \rightarrow \Lambda K^+ \pi^-$		$(1.14 \pm 0.26) \times 10^{-5}$		1144
$\overline{\Xi}_c^0 \Lambda_c^+, \overline{\Xi}_c^0 \rightarrow p K^- K^- \pi^+$		$(5.5 \pm 1.9) \times 10^{-6}$		–
$\Lambda_c^+ \overline{\Xi}_c^0$		$< 6.5 \times 10^{-4}$	CL=90%	1023
$\Lambda_c^+ \overline{\Xi}_c(2645)^0$		$< 7.9 \times 10^{-4}$	CL=90%	–
$\Lambda_c^+ \overline{\Xi}_c(2790)^0$		$(1.1 \pm 0.4) \times 10^{-3}$		–

Lepton Family number (LF) or Lepton number (L) or Baryon number (B) violating modes, or/and $\Delta B = 1$ weak neutral current (B1) modes

$\pi^+ \ell^+ \ell^-$	B1	$< 4.9 \times 10^{-8}$	CL=90%	2638
$\pi^+ e^+ e^-$	B1	$< 8.0 \times 10^{-8}$	CL=90%	2638
$\pi^+ \mu^+ \mu^-$	B1	$(1.75 \pm 0.22) \times 10^{-8}$		2634
$\pi^+ \nu \bar{\nu}$	B1	$< 1.4 \times 10^{-5}$	CL=90%	2638
$K^+ \ell^+ \ell^-$	B1 [III]	$(4.51 \pm 0.23) \times 10^{-7}$	S=1.1	2617
$K^+ e^+ e^-$	B1	$(5.5 \pm 0.7) \times 10^{-7}$		2617
$K^+ \mu^+ \mu^-$	B1	$(4.41 \pm 0.22) \times 10^{-7}$	S=1.2	2612
$K^+ \mu^+ \mu^-$ nonresonant	B1	$(4.37 \pm 0.27) \times 10^{-7}$		2612
$K^+ \tau^+ \tau^-$	B1	$< 2.25 \times 10^{-3}$	CL=90%	1687
$K^+ \bar{\nu} \nu$	B1	$< 1.6 \times 10^{-5}$	CL=90%	2617
$\rho^+ \nu \bar{\nu}$	B1	$< 3.0 \times 10^{-5}$	CL=90%	2583
$K^*(892)^+ \ell^+ \ell^-$	B1 [III]	$(1.01 \pm 0.11) \times 10^{-6}$	S=1.1	2564
$K^*(892)^+ e^+ e^-$	B1	$(1.55 \pm_{-0.31}^{+0.40}) \times 10^{-6}$		2564
$K^*(892)^+ \mu^+ \mu^-$	B1	$(9.6 \pm 1.0) \times 10^{-7}$		2560
$K^*(892)^+ \nu \bar{\nu}$	B1	$< 4.0 \times 10^{-5}$	CL=90%	2564
$K^+ \pi^+ \pi^- \mu^+ \mu^-$	B1	$(4.3 \pm 0.4) \times 10^{-7}$		2593
$\phi K^+ \mu^+ \mu^-$	B1	$(7.9 \pm_{-1.7}^{+2.1}) \times 10^{-8}$		2490
$\overline{\Lambda} p \nu \bar{\nu}$		$< 3.0 \times 10^{-5}$	CL=90%	2430
$\pi^+ e^+ \mu^-$	LF	$< 6.4 \times 10^{-3}$	CL=90%	2637
$\pi^+ e^- \mu^+$	LF	$< 6.4 \times 10^{-3}$	CL=90%	2637
$\pi^+ e^\pm \mu^\mp$	LF	$< 1.7 \times 10^{-7}$	CL=90%	2637
$\pi^+ e^+ \tau^-$	LF	$< 7.4 \times 10^{-5}$	CL=90%	2338
$\pi^+ e^- \tau^+$	LF	$< 2.0 \times 10^{-5}$	CL=90%	2338
$\pi^+ e^\pm \tau^\mp$	LF	$< 7.5 \times 10^{-5}$	CL=90%	2338
$\pi^+ \mu^+ \tau^-$	LF	$< 6.2 \times 10^{-5}$	CL=90%	2333
$\pi^+ \mu^- \tau^+$	LF	$< 4.5 \times 10^{-5}$	CL=90%	2333
$\pi^+ \mu^\pm \tau^\mp$	LF	$< 7.2 \times 10^{-5}$	CL=90%	2333
$K^+ e^+ \mu^-$	LF	$< 7.0 \times 10^{-9}$	CL=90%	2615
$K^+ e^- \mu^+$	LF	$< 6.4 \times 10^{-9}$	CL=90%	2615

$K^+ e^\pm \mu^\mp$	LF	< 9.1	$\times 10^{-8}$	CL=90%	2615
$K^+ e^+ \tau^-$	LF	< 4.3	$\times 10^{-5}$	CL=90%	2312
$K^+ e^- \tau^+$	LF	< 1.5	$\times 10^{-5}$	CL=90%	2312
$K^+ e^\pm \tau^\mp$	LF	< 3.0	$\times 10^{-5}$	CL=90%	2312
$K^+ \mu^+ \tau^-$	LF	< 4.5	$\times 10^{-5}$	CL=90%	2298
$K^+ \mu^- \tau^+$	LF	< 2.8	$\times 10^{-5}$	CL=90%	2298
$K^+ \mu^\pm \tau^\mp$	LF	< 4.8	$\times 10^{-5}$	CL=90%	2298
$K^*(892)^+ e^+ \mu^-$	LF	< 1.3	$\times 10^{-6}$	CL=90%	2563
$K^*(892)^+ e^- \mu^+$	LF	< 9.9	$\times 10^{-7}$	CL=90%	2563
$K^*(892)^+ e^\pm \mu^\mp$	LF	< 1.4	$\times 10^{-6}$	CL=90%	2563
$\pi^- e^+ e^+$	L	< 2.3	$\times 10^{-8}$	CL=90%	2638
$\pi^- \mu^+ \mu^+$	L	< 4.0	$\times 10^{-9}$	CL=95%	2634
$\pi^- e^+ \mu^+$	L	< 1.5	$\times 10^{-7}$	CL=90%	2637
$\rho^- e^+ e^+$	L	< 1.7	$\times 10^{-7}$	CL=90%	2583
$\rho^- \mu^+ \mu^+$	L	< 4.2	$\times 10^{-7}$	CL=90%	2578
$\rho^- e^+ \mu^+$	L	< 4.7	$\times 10^{-7}$	CL=90%	2582
$K^- e^+ e^+$	L	< 3.0	$\times 10^{-8}$	CL=90%	2617
$K^- \mu^+ \mu^+$	L	< 4.1	$\times 10^{-8}$	CL=90%	2612
$K^- e^+ \mu^+$	L	< 1.6	$\times 10^{-7}$	CL=90%	2615
$K^*(892)^- e^+ e^+$	L	< 4.0	$\times 10^{-7}$	CL=90%	2564
$K^*(892)^- \mu^+ \mu^+$	L	< 5.9	$\times 10^{-7}$	CL=90%	2560
$K^*(892)^- e^+ \mu^+$	L	< 3.0	$\times 10^{-7}$	CL=90%	2563
$D^- e^+ e^+$	L	< 2.6	$\times 10^{-6}$	CL=90%	2309
$D^- e^+ \mu^+$	L	< 1.8	$\times 10^{-6}$	CL=90%	2307
$D^- \mu^+ \mu^+$	L	< 6.9	$\times 10^{-7}$	CL=95%	2303
$D^{*-} \mu^+ \mu^+$	L	< 2.4	$\times 10^{-6}$	CL=95%	2251
$D_s^- \mu^+ \mu^+$	L	< 5.8	$\times 10^{-7}$	CL=95%	2267
$\overline{D}^0 \pi^- \mu^+ \mu^+$	L	< 1.5	$\times 10^{-6}$	CL=95%	2295
$\Lambda^0 \mu^+$	L,B	< 6	$\times 10^{-8}$	CL=90%	–
$\Lambda^0 e^+$	L,B	< 3.2	$\times 10^{-8}$	CL=90%	–
$\overline{\Lambda}^0 \mu^+$	L,B	< 6	$\times 10^{-8}$	CL=90%	–
$\overline{\Lambda}^0 e^+$	L,B	< 8	$\times 10^{-8}$	CL=90%	–



$$I(J^P) = \frac{1}{2}(0^-)$$

I, J, P need confirmation. Quantum numbers shown are quark-model predictions.

$$\text{Mass } m_{B^0} = 5279.65 \pm 0.12 \text{ MeV}$$

$$m_{B^0} - m_{B^\pm} = 0.31 \pm 0.05 \text{ MeV}$$

$$\text{Mean life } \tau_{B^0} = (1.519 \pm 0.004) \times 10^{-12} \text{ s}$$

$$c\tau = 455.4 \text{ } \mu\text{m}$$

$$\tau_{B^+}/\tau_{B^0} = 1.076 \pm 0.004 \quad (\text{direct measurements})$$

B^0 - \bar{B}^0 mixing parameters

$$\chi_d = 0.1858 \pm 0.0011$$

$$\begin{aligned} \Delta m_{B^0} = m_{B_H^0} - m_{B_L^0} &= (0.5065 \pm 0.0019) \times 10^{12} \hbar \text{ s}^{-1} \\ &= (3.334 \pm 0.013) \times 10^{-10} \text{ MeV} \end{aligned}$$

$$x_d = \Delta m_{B^0} / \Gamma_{B^0} = 0.769 \pm 0.004$$

$$\text{Re}(\lambda_{CP} / |\lambda_{CP}|) \text{ Re}(z) = 0.047 \pm 0.022$$

$$\Delta \Gamma \text{ Re}(z) = -0.007 \pm 0.004$$

$$\text{Re}(z) = (-4 \pm 4) \times 10^{-2} \quad (S = 1.4)$$

$$\text{Im}(z) = (-0.8 \pm 0.4) \times 10^{-2}$$

CP violation parameters

$$\text{Re}(\epsilon_{B^0}) / (1 + |\epsilon_{B^0}|^2) = (-0.5 \pm 0.4) \times 10^{-3}$$

$$A_{T/CP}(B^0 \leftrightarrow \bar{B}^0) = 0.005 \pm 0.018$$

$$A_{CP}(B^0 \rightarrow D^*(2010)^+ D^-) = 0.037 \pm 0.034$$

$$A_{CP}(B^0 \rightarrow [K^+ K^-]_D K^*(892)^0) = -0.05 \pm 0.10$$

$$A_{CP}(B^0 \rightarrow [K^+ \pi^-]_D K^*(892)^0) = 0.047 \pm 0.029$$

$$A_{CP}(B^0 \rightarrow [K^+ \pi^- \pi^+ \pi^-]_D K^*(892)^0) = 0.037 \pm 0.034$$

$$A_{CP}(B^0 \rightarrow [K^- \pi^+]_D K^*(892)^0) = 0.19 \pm 0.19$$

$$A_{CP}(B^0 \rightarrow [K^- \pi^+ \pi^+ \pi^-]_D K^*(892)^0) = -0.01 \pm 0.24$$

$$R_d^+ = \Gamma(B^0 \rightarrow [\pi^+ K^-]_D K^{*0}) / \Gamma(B^0 \rightarrow [\pi^- K^+]_D K^{*0}) = 0.064 \pm 0.021$$

$$R_d^- = \Gamma(\bar{B}^0 \rightarrow [\pi^- K^+]_D K^{*0}) / \Gamma(\bar{B}^0 \rightarrow [\pi^+ K^-]_D K^{*0}) = 0.095 \pm 0.021$$

$$A_{CP}(B^0 \rightarrow [\pi^+ \pi^-]_D K^*(892)^0) = -0.18 \pm 0.14$$

$$A_{CP}(B^0 \rightarrow [\pi^+ \pi^- \pi^+ \pi^-]_D K^*(892)^0) = -0.03 \pm 0.15$$

$$R_d^+ = \Gamma(B^0 \rightarrow [\pi^+ K^- \pi^+ \pi^-]_D K^{*0}) / \Gamma(B^0 \rightarrow [\pi^- K^+ \pi^+ \pi^-]_D K^{*0}) = 0.074 \pm 0.026$$

$$R_d^- = \Gamma(\bar{B}^0 \rightarrow [\pi^- K^+ \pi^+ \pi^-]_D K^{*0}) / \Gamma(\bar{B}^0 \rightarrow [\pi^+ K^- \pi^+ \pi^-]_D K^{*0}) = 0.072 \pm 0.025$$

$$\mathbf{A_{CP}(B^0 \rightarrow K^+ \pi^-) = -0.083 \pm 0.004}$$

$$A_{CP}(B^0 \rightarrow \eta' K^*(892)^0) = -0.07 \pm 0.18$$

$$A_{CP}(B^0 \rightarrow \eta' K_0^*(1430)^0) = -0.19 \pm 0.17$$

$$A_{CP}(B^0 \rightarrow \eta' K_2^*(1430)^0) = 0.14 \pm 0.18$$

$$\mathbf{A_{CP}(B^0 \rightarrow \eta K^*(892)^0) = 0.19 \pm 0.05}$$

$$A_{CP}(B^0 \rightarrow \eta K_0^*(1430)^0) = 0.06 \pm 0.13$$

$$A_{CP}(B^0 \rightarrow \eta K_2^*(1430)^0) = -0.07 \pm 0.19$$

$$A_{CP}(B^0 \rightarrow b_1 K^+) = -0.07 \pm 0.12$$

$$A_{CP}(B^0 \rightarrow \omega K^{*0}) = 0.45 \pm 0.25$$

$$A_{CP}(B^0 \rightarrow \omega(K\pi)_0^{*0}) = -0.07 \pm 0.09$$

$$A_{CP}(B^0 \rightarrow \omega K_2^*(1430)^0) = -0.37 \pm 0.17$$

$$\begin{aligned}
A_{CP}(B^0 \rightarrow K^+ \pi^- \pi^0) &= (0 \pm 6) \times 10^{-2} \\
A_{CP}(B^0 \rightarrow \rho^- K^+) &= 0.20 \pm 0.11 \\
A_{CP}(B^0 \rightarrow \rho(1450)^- K^+) &= -0.10 \pm 0.33 \\
A_{CP}(B^0 \rightarrow \rho(1700)^- K^+) &= -0.4 \pm 0.6 \\
A_{CP}(B^0 \rightarrow K^+ \pi^- \pi^0 \text{ nonresonant}) &= 0.10 \pm 0.18 \\
A_{CP}(B^0 \rightarrow K^0 \pi^+ \pi^-) &= -0.01 \pm 0.05 \\
\mathbf{A_{CP}(B^0 \rightarrow K^*(892)^+ \pi^-)} &= -0.27 \pm 0.04 \\
A_{CP}(B^0 \rightarrow (K\pi)_0^{*+} \pi^-) &= 0.02 \pm 0.04 \\
A_{CP}(B^0 \rightarrow K_2^*(1430)^+ \pi^-) &= -0.29 \pm 0.24 \\
A_{CP}(B^0 \rightarrow K^*(1680)^+ \pi^-) &= -0.07 \pm 0.14 \\
A_{CP}(B^0 \rightarrow f_0(980) K_S^0) &= 0.28 \pm 0.31 \\
A_{CP}(B^0 \rightarrow (K\pi)_0^{*0} \pi^0) &= -0.15 \pm 0.11 \\
A_{CP}(B^0 \rightarrow K^{*0} \pi^0) &= -0.15 \pm 0.13 \\
A_{CP}(B^0 \rightarrow K^*(892)^0 \pi^+ \pi^-) &= 0.07 \pm 0.05 \\
A_{CP}(B^0 \rightarrow K^*(892)^0 \rho^0) &= -0.06 \pm 0.09 \\
A_{CP}(B^0 \rightarrow K^{*0} f_0(980)) &= 0.07 \pm 0.10 \\
A_{CP}(B^0 \rightarrow K^{*+} \rho^-) &= 0.21 \pm 0.15 \\
A_{CP}(B^0 \rightarrow K^*(892)^0 K^+ K^-) &= 0.01 \pm 0.05 \\
A_{CP}(B^0 \rightarrow a_1^- K^+) &= -0.16 \pm 0.12 \\
A_{CP}(B^0 \rightarrow K^0 K^0) &= -0.6 \pm 0.7 \\
A_{CP}(B^0 \rightarrow K^*(892)^0 \phi) &= 0.00 \pm 0.04 \\
A_{CP}(B^0 \rightarrow K^*(892)^0 K^- \pi^+) &= 0.2 \pm 0.4 \\
A_{CP}(B^0 \rightarrow \phi (K\pi)_0^{*0}) &= 0.12 \pm 0.08 \\
A_{CP}(B^0 \rightarrow \phi K_2^*(1430)^0) &= -0.11 \pm 0.10 \\
A_{CP}(B^0 \rightarrow K^*(892)^0 \gamma) &= -0.006 \pm 0.011 \\
A_{CP}(B^0 \rightarrow K_2^*(1430)^0 \gamma) &= -0.08 \pm 0.15 \\
A_{CP}(B^0 \rightarrow X_S \gamma) &= -0.009 \pm 0.018 \\
A_{CP}(B^0 \rightarrow \rho^+ \pi^-) &= 0.13 \pm 0.06 \quad (S = 1.1) \\
A_{CP}(B^0 \rightarrow \rho^- \pi^+) &= -0.08 \pm 0.08 \\
A_{CP}(B^0 \rightarrow a_1(1260)^\pm \pi^\mp) &= -0.07 \pm 0.06 \\
A_{CP}(B^0 \rightarrow b_1^- \pi^+) &= -0.05 \pm 0.10 \\
A_{CP}(B^0 \rightarrow p \bar{p} K^*(892)^0) &= 0.05 \pm 0.12 \\
A_{CP}(B^0 \rightarrow p \bar{\Lambda} \pi^-) &= 0.04 \pm 0.07 \\
A_{CP}(B^0 \rightarrow K^{*0} \ell^+ \ell^-) &= -0.05 \pm 0.10 \\
A_{CP}(B^0 \rightarrow K^{*0} e^+ e^-) &= -0.21 \pm 0.19 \\
A_{CP}(B^0 \rightarrow K^{*0} \mu^+ \mu^-) &= -0.034 \pm 0.024 \\
C_{D^{*-} D^+} (B^0 \rightarrow D^*(2010)^- D^+) &= -0.01 \pm 0.11 \\
\mathbf{S_{D^{*-} D^+} (B^0 \rightarrow D^*(2010)^- D^+)} &= -0.72 \pm 0.15 \\
C_{D^{*+} D^-} (B^0 \rightarrow D^*(2010)^+ D^-) &= 0.00 \pm 0.13 \quad (S = 1.3) \\
\mathbf{S_{D^{*+} D^-} (B^0 \rightarrow D^*(2010)^+ D^-)} &= -0.73 \pm 0.14 \\
C_{D^{*+} D^{*-}} (B^0 \rightarrow D^{*+} D^{*-}) &= 0.01 \pm 0.09 \quad (S = 1.6)
\end{aligned}$$

$$\begin{aligned}
 S_{D^{*+}D^{*-}}(B^0 \rightarrow D^{*+}D^{*-}) &= -0.59 \pm 0.14 \quad (S = 1.8) \\
 C_+(B^0 \rightarrow D^{*+}D^{*-}) &= 0.00 \pm 0.10 \quad (S = 1.6) \\
 S_+(B^0 \rightarrow D^{*+}D^{*-}) &= -0.73 \pm 0.09 \\
 C_-(B^0 \rightarrow D^{*+}D^{*-}) &= 0.19 \pm 0.31 \\
 S_-(B^0 \rightarrow D^{*+}D^{*-}) &= 0.1 \pm 1.6 \quad (S = 3.5) \\
 C(B^0 \rightarrow D^*(2010)^+D^*(2010)^-K_S^0) &= 0.01 \pm 0.29 \\
 S(B^0 \rightarrow D^*(2010)^+D^*(2010)^-K_S^0) &= 0.1 \pm 0.4 \\
 C_{D^+D^-}(B^0 \rightarrow D^+D^-) &= -0.22 \pm 0.24 \quad (S = 2.5) \\
 S_{D^+D^-}(B^0 \rightarrow D^+D^-) &= -0.76_{-0.13}^{+0.15} \quad (S = 1.2) \\
 C_{J/\psi(1S)\pi^0}(B^0 \rightarrow J/\psi(1S)\pi^0) &= 0.03 \pm 0.17 \quad (S = 1.5) \\
 S_{J/\psi(1S)\pi^0}(B^0 \rightarrow J/\psi(1S)\pi^0) &= -0.88 \pm 0.32 \quad (S = 2.2) \\
 C(B^0 \rightarrow J/\psi(1S)\rho^0) &= -0.06 \pm 0.06 \\
 S(B^0 \rightarrow J/\psi(1S)\rho^0) &= -0.66_{-0.12}^{+0.16} \\
 C_{D_{CP}^{(*)}h^0}(B^0 \rightarrow D_{CP}^{(*)}h^0) &= -0.02 \pm 0.08 \\
 S_{D_{CP}^{(*)}h^0}(B^0 \rightarrow D_{CP}^{(*)}h^0) &= -0.66 \pm 0.12 \\
 C_{K^0\pi^0}(B^0 \rightarrow K^0\pi^0) &= 0.00 \pm 0.13 \quad (S = 1.4) \\
 S_{K^0\pi^0}(B^0 \rightarrow K^0\pi^0) &= 0.58 \pm 0.17 \\
 C_{\eta'(958)K_S^0}(B^0 \rightarrow \eta'(958)K_S^0) &= -0.04 \pm 0.20 \quad (S = 2.5) \\
 S_{\eta'(958)K_S^0}(B^0 \rightarrow \eta'(958)K_S^0) &= 0.43 \pm 0.17 \quad (S = 1.5) \\
 C_{\eta'K^0}(B^0 \rightarrow \eta'K^0) &= -0.06 \pm 0.04 \\
 S_{\eta'K^0}(B^0 \rightarrow \eta'K^0) &= 0.63 \pm 0.06 \\
 C_{\omega K_S^0}(B^0 \rightarrow \omega K_S^0) &= 0.0 \pm 0.4 \quad (S = 3.0) \\
 S_{\omega K_S^0}(B^0 \rightarrow \omega K_S^0) &= 0.70 \pm 0.21 \\
 C(B^0 \rightarrow K_S^0\pi^0\pi^0) &= -0.21 \pm 0.20 \\
 S(B^0 \rightarrow K_S^0\pi^0\pi^0) &= 0.89_{-0.30}^{+0.27} \\
 C_{\rho^0 K_S^0}(B^0 \rightarrow \rho^0 K_S^0) &= -0.04 \pm 0.20 \\
 S_{\rho^0 K_S^0}(B^0 \rightarrow \rho^0 K_S^0) &= 0.50_{-0.21}^{+0.17} \\
 C_{f_0 K_S^0}(B^0 \rightarrow f_0(980)K_S^0) &= 0.29 \pm 0.20 \\
 S_{f_0 K_S^0}(B^0 \rightarrow f_0(980)K_S^0) &= -0.50 \pm 0.16 \\
 S_{f_2 K_S^0}(B^0 \rightarrow f_2(1270)K_S^0) &= -0.5 \pm 0.5 \\
 C_{f_2 K_S^0}(B^0 \rightarrow f_2(1270)K_S^0) &= 0.3 \pm 0.4 \\
 S_{f_x K_S^0}(B^0 \rightarrow f_x(1300)K_S^0) &= -0.2 \pm 0.5 \\
 C_{f_x K_S^0}(B^0 \rightarrow f_x(1300)K_S^0) &= 0.13 \pm 0.35 \\
 S_{K^0\pi^+\pi^-}(B^0 \rightarrow K^0\pi^+\pi^- \text{ nonresonant}) &= -0.01 \pm 0.33
 \end{aligned}$$

$$\begin{aligned}
 C_{K^0\pi^+\pi^-} (B^0 \rightarrow K^0\pi^+\pi^- \text{ nonresonant}) &= 0.01 \pm 0.26 \\
 S_{K_S^0 K_S^0} (B^0 \rightarrow K_S^0 K_S^0) &= 0.0 \pm 0.4 \quad (S = 1.4) \\
 S_{K_S^0 K_S^0} (B^0 \rightarrow K_S^0 K_S^0) &= -0.8 \pm 0.5 \\
 C_{K^+K^-K_S^0} (B^0 \rightarrow K^+K^-K_S^0 \text{ nonresonant}) &= 0.06 \pm 0.08 \\
 \mathbf{S_{K^+K^-K_S^0} (B^0 \rightarrow K^+K^-K_S^0 \text{ nonresonant})} &= -0.66 \pm 0.11 \\
 C_{K^+K^-K_S^0} (B^0 \rightarrow K^+K^-K_S^0 \text{ inclusive}) &= 0.01 \pm 0.09 \\
 \mathbf{S_{K^+K^-K_S^0} (B^0 \rightarrow K^+K^-K_S^0 \text{ inclusive})} &= -0.65 \pm 0.12 \\
 C_{\phi K_S^0} (B^0 \rightarrow \phi K_S^0) &= 0.01 \pm 0.14 \\
 \mathbf{S_{\phi K_S^0} (B^0 \rightarrow \phi K_S^0)} &= 0.59 \pm 0.14 \\
 C_{K_S K_S K_S} (B^0 \rightarrow K_S K_S K_S) &= -0.23 \pm 0.14 \\
 S_{K_S K_S K_S} (B^0 \rightarrow K_S K_S K_S) &= -0.5 \pm 0.6 \quad (S = 3.0) \\
 C_{K_S^0 \pi^0 \gamma} (B^0 \rightarrow K_S^0 \pi^0 \gamma) &= 0.36 \pm 0.33 \\
 S_{K_S^0 \pi^0 \gamma} (B^0 \rightarrow K_S^0 \pi^0 \gamma) &= -0.8 \pm 0.6 \\
 C_{K_S^0 \pi^+ \pi^- \gamma} (B^0 \rightarrow K_S^0 \pi^+ \pi^- \gamma) &= -0.39 \pm 0.20 \\
 S_{K_S^0 \pi^+ \pi^- \gamma} (B^0 \rightarrow K_S^0 \pi^+ \pi^- \gamma) &= 0.14 \pm 0.25 \\
 C_{K^{*0} \gamma} (B^0 \rightarrow K^{*0} \gamma) &= -0.04 \pm 0.16 \quad (S = 1.2) \\
 S_{K^{*0} \gamma} (B^0 \rightarrow K^{*0} \gamma) &= -0.15 \pm 0.22 \\
 C_{\eta K^0 \gamma} (B^0 \rightarrow \eta K^0 \gamma) &= 0.1 \pm 0.4 \quad (S = 1.4) \\
 S_{\eta K^0 \gamma} (B^0 \rightarrow \eta K^0 \gamma) &= -0.5 \pm 0.5 \quad (S = 1.2) \\
 C_{K^0 \phi \gamma} (B^0 \rightarrow K^0 \phi \gamma) &= -0.3 \pm 0.6 \\
 S_{K^0 \phi \gamma} (B^0 \rightarrow K^0 \phi \gamma) &= 0.7^{+0.7}_{-1.1} \\
 C(B^0 \rightarrow K_S^0 \rho^0 \gamma) &= -0.05 \pm 0.19 \\
 S(B^0 \rightarrow K_S^0 \rho^0 \gamma) &= -0.04 \pm 0.23 \\
 C(B^0 \rightarrow \rho^0 \gamma) &= 0.4 \pm 0.5 \\
 S(B^0 \rightarrow \rho^0 \gamma) &= -0.8 \pm 0.7 \\
 \mathbf{C_{\pi\pi} (B^0 \rightarrow \pi^+\pi^-)} &= -0.32 \pm 0.04 \\
 \mathbf{S_{\pi\pi} (B^0 \rightarrow \pi^+\pi^-)} &= -0.65 \pm 0.04 \\
 C_{\pi^0 \pi^0} (B^0 \rightarrow \pi^0 \pi^0) &= -0.33 \pm 0.22 \\
 C_{\rho\pi} (B^0 \rightarrow \rho^+ \pi^-) &= -0.03 \pm 0.07 \quad (S = 1.2) \\
 S_{\rho\pi} (B^0 \rightarrow \rho^+ \pi^-) &= 0.05 \pm 0.07 \\
 \mathbf{\Delta C_{\rho\pi} (B^0 \rightarrow \rho^+ \pi^-)} &= 0.27 \pm 0.06 \\
 \Delta S_{\rho\pi} (B^0 \rightarrow \rho^+ \pi^-) &= 0.01 \pm 0.08 \\
 C_{\rho^0 \pi^0} (B^0 \rightarrow \rho^0 \pi^0) &= 0.27 \pm 0.24 \\
 S_{\rho^0 \pi^0} (B^0 \rightarrow \rho^0 \pi^0) &= -0.23 \pm 0.34 \\
 C_{a_1 \pi} (B^0 \rightarrow a_1(1260)^+ \pi^-) &= -0.05 \pm 0.11
 \end{aligned}$$

$$\begin{aligned}
 S_{a_1\pi}(B^0 \rightarrow a_1(1260)^+\pi^-) &= -0.2 \pm 0.4 \quad (S = 3.2) \\
 \Delta C_{a_1\pi}(B^0 \rightarrow a_1(1260)^+\pi^-) &= 0.43 \pm 0.14 \quad (S = 1.3) \\
 \Delta S_{a_1\pi}(B^0 \rightarrow a_1(1260)^+\pi^-) &= -0.11 \pm 0.12 \\
 C(B^0 \rightarrow b_1^- K^+) &= -0.22 \pm 0.24 \\
 \Delta C(B^0 \rightarrow b_1^- \pi^+) &= -1.04 \pm 0.24 \\
 C_{\rho^0\rho^0}(B^0 \rightarrow \rho^0\rho^0) &= 0.2 \pm 0.9 \\
 S_{\rho^0\rho^0}(B^0 \rightarrow \rho^0\rho^0) &= 0.3 \pm 0.7 \\
 C_{\rho\rho}(B^0 \rightarrow \rho^+\rho^-) &= 0.00 \pm 0.09 \\
 S_{\rho\rho}(B^0 \rightarrow \rho^+\rho^-) &= -0.14 \pm 0.13 \\
 |\lambda|(B^0 \rightarrow J/\psi K^*(892)^0) &< 0.25, \text{ CL} = 95\% \\
 \cos 2\beta(B^0 \rightarrow J/\psi K^*(892)^0) &= 1.7_{-0.9}^{+0.7} \quad (S = 1.6) \\
 \cos 2\beta(B^0 \rightarrow [K_S^0\pi^+\pi^-]_{D^{(*)}} h^0) &= 0.91 \pm 0.25 \\
 (S_+ + S_-)/2(B^0 \rightarrow D^{*-}\pi^+) &= -0.039 \pm 0.011 \\
 (S_- - S_+)/2(B^0 \rightarrow D^{*-}\pi^+) &= -0.009 \pm 0.015 \\
 (S_+ + S_-)/2(B^0 \rightarrow D^-\pi^+) &= -0.046 \pm 0.023 \\
 (S_- - S_+)/2(B^0 \rightarrow D^-\pi^+) &= -0.022 \pm 0.021 \\
 S_+(B^0 \rightarrow D^-\pi^+) &= 0.058 \pm 0.023 \\
 S_-(B^0 \rightarrow D^+\pi^-) &= 0.038 \pm 0.021 \\
 (S_+ + S_-)/2(B^0 \rightarrow D^-\rho^+) &= -0.024 \pm 0.032 \\
 (S_- - S_+)/2(B^0 \rightarrow D^-\rho^+) &= -0.10 \pm 0.06 \\
 C_{\eta_c K_S^0}(B^0 \rightarrow \eta_c K_S^0) &= 0.08 \pm 0.13 \\
 S_{\eta_c K_S^0}(B^0 \rightarrow \eta_c K_S^0) &= 0.93 \pm 0.17 \\
 C_{c\bar{c}K^{(*)0}}(B^0 \rightarrow c\bar{c}K^{(*)0}) &= (0.5 \pm 1.7) \times 10^{-2} \\
 \sin(2\beta) &= 0.695 \pm 0.019 \\
 C_{J/\psi(nS)K^0}(B^0 \rightarrow J/\psi(nS)K^0) &= (0.5 \pm 2.0) \times 10^{-2} \\
 S_{J/\psi(nS)K^0}(B^0 \rightarrow J/\psi(nS)K^0) &= 0.701 \pm 0.017 \\
 C_{J/\psi K^{*0}}(B^0 \rightarrow J/\psi K^{*0}) &= 0.03 \pm 0.10 \\
 S_{J/\psi K^{*0}}(B^0 \rightarrow J/\psi K^{*0}) &= 0.60 \pm 0.25 \\
 C_{\chi_{c0} K_S^0}(B^0 \rightarrow \chi_{c0} K_S^0) &= -0.3_{-0.4}^{+0.5} \\
 S_{\chi_{c0} K_S^0}(B^0 \rightarrow \chi_{c0} K_S^0) &= -0.7 \pm 0.5 \\
 C_{\chi_{c1} K_S^0}(B^0 \rightarrow \chi_{c1} K_S^0) &= 0.06 \pm 0.07 \\
 S_{\chi_{c1} K_S^0}(B^0 \rightarrow \chi_{c1} K_S^0) &= 0.63 \pm 0.10 \\
 \sin(2\beta_{\text{eff}})(B^0 \rightarrow \phi K^0) &= 0.22 \pm 0.30 \\
 \sin(2\beta_{\text{eff}})(B^0 \rightarrow \phi K_0^*(1430)^0) &= 0.97_{-0.52}^{+0.03} \\
 \sin(2\beta_{\text{eff}})(B^0 \rightarrow K^+ K^- K_S^0) &= 0.77_{-0.12}^{+0.13} \\
 \sin(2\beta_{\text{eff}})(B^0 \rightarrow [K_S^0\pi^+\pi^-]_{D^{(*)}} h^0) &= 0.80 \pm 0.16 \\
 \beta_{\text{eff}}(B^0 \rightarrow [K_S^0\pi^+\pi^-]_{D^{(*)}} h^0) &= (22 \pm 5)^\circ
 \end{aligned}$$

$$\begin{aligned}
 2\beta_{\text{eff}}(B^0 \rightarrow J/\psi \rho^0) &= (42_{-11}^{+10})^\circ \\
 |\lambda| (B^0 \rightarrow [K_S^0 \pi^+ \pi^-]_{D^{(*)}} h^0) &= 1.01 \pm 0.08 \\
 |\sin(2\beta + \gamma)| &> 0.40, \text{ CL} = 90\% \\
 2\beta + \gamma &= (83 \pm 60)^\circ \\
 \alpha &= (84.9_{-4.5}^{+5.1})^\circ \\
 x_+(B^0 \rightarrow DK^{*0}) &= 0.04 \pm 0.17 \\
 x_-(B^0 \rightarrow DK^{*0}) &= -0.16 \pm 0.14 \\
 y_+(B^0 \rightarrow DK^{*0}) &= -0.68 \pm 0.22 \\
 y_-(B^0 \rightarrow DK^{*0}) &= 0.20 \pm 0.25 \quad (S = 1.2) \\
 r_{B^0}(B^0 \rightarrow DK^{*0}) &= 0.220_{-0.047}^{+0.041} \\
 \delta_{B^0}(B^0 \rightarrow DK^{*0}) &= (194_{-22}^{+30})^\circ
 \end{aligned}$$

\bar{B}^0 modes are charge conjugates of the modes below. Reactions indicate the weak decay vertex and do not include mixing. Modes which do not identify the charge state of the B are listed in the B^\pm/B^0 ADMIXTURE section.

The branching fractions listed below assume 50% $B^0\bar{B}^0$ and 50% B^+B^- production at the $\Upsilon(4S)$. We have attempted to bring older measurements up to date by rescaling their assumed $\Upsilon(4S)$ production ratio to 50:50 and their assumed D , D_S , D^* , and ψ branching ratios to current values whenever this would affect our averages and best limits significantly.

Indentation is used to indicate a subchannel of a previous reaction. All resonant subchannels have been corrected for resonance branching fractions to the final state so the sum of the subchannel branching fractions can exceed that of the final state.

For inclusive branching fractions, *e.g.*, $B \rightarrow D^\pm X$, the values usually are multiplicities, not branching fractions. They can be greater than one.

B^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\ell^+ \nu_\ell X$	[III] (10.33 ± 0.28) %		–
$e^+ \nu_e X_c$	(10.1 ± 0.4) %		–
$D \ell^+ \nu_\ell X$	(9.4 ± 0.9) %		–
$D^- \ell^+ \nu_\ell$	[III] (2.31 ± 0.10) %		2309
$D^- \tau^+ \nu_\tau$	(1.08 ± 0.23) %		1909
$D^*(2010)^- \ell^+ \nu_\ell$	[III] (5.05 ± 0.14) %		2257
$D^*(2010)^- \tau^+ \nu_\tau$	(1.57 ± 0.09) %	S=1.1	1838
$\bar{D}^0 \pi^- \ell^+ \nu_\ell$	(4.1 ± 0.5) × 10 ⁻³		2308
$D_0^*(2300)^- \ell^+ \nu_\ell, D_0^{*-} \rightarrow \bar{D}^0 \pi^-$	(3.0 ± 1.2) × 10 ⁻³	S=1.8	–
$D_2^*(2460)^- \ell^+ \nu_\ell, D_2^{*-} \rightarrow \bar{D}^0 \pi^-$	(1.21 ± 0.33) × 10 ⁻³	S=1.8	2065

$\overline{D}^{(*)} n \pi \ell^+ \nu_\ell (n \geq 1)$	(2.3 ± 0.5) %		—
$\overline{D}^{*0} \pi^- \ell^+ \nu_\ell$	(5.8 ± 0.8) × 10 ⁻³	S=1.4	2256
$D_1(2420)^- \ell^+ \nu_\ell, D_1^- \rightarrow \overline{D}^{*0} \pi^-$	(2.80 ± 0.28) × 10 ⁻³		—
$D_1'(2430)^- \ell^+ \nu_\ell, D_1'^- \rightarrow \overline{D}^{*0} \pi^-$	(3.1 ± 0.9) × 10 ⁻³		—
$D_2^*(2460)^- \ell^+ \nu_\ell, D_2^{*-} \rightarrow \overline{D}^{*0} \pi^-$	(6.8 ± 1.2) × 10 ⁻⁴		2065
$D^- \pi^+ \pi^- \ell^+ \nu_\ell$	(1.3 ± 0.5) × 10 ⁻³		2299
$D^{*-} \pi^+ \pi^- \ell^+ \nu_\ell$	(1.4 ± 0.5) × 10 ⁻³		2247
$\rho^- \ell^+ \nu_\ell$	[III] (2.94 ± 0.21) × 10 ⁻⁴		2583
$\pi^- \ell^+ \nu_\ell$	[III] (1.50 ± 0.06) × 10 ⁻⁴		2638
$\pi^- \tau^+ \nu_\tau$	< 2.5 × 10 ⁻⁴	CL=90%	2339

Inclusive modes

$K^\pm X$	(78 ± 8) %		—
$D^0 X$	(8.1 ± 1.5) %		—
$\overline{D}^0 X$	(47.4 ± 2.8) %		—
$D^+ X$	< 3.9 %	CL=90%	—
$D^- X$	(36.9 ± 3.3) %		—
$D_s^+ X$	(10.3 $\begin{smallmatrix} + 2.1 \\ - 1.8 \end{smallmatrix}$) %		—
$D_s^- X$	< 2.6 %	CL=90%	—
$\Lambda_c^+ X$	< 3.1 %	CL=90%	—
$\overline{\Lambda}_c^- X$	(5.0 $\begin{smallmatrix} + 2.1 \\ - 1.5 \end{smallmatrix}$) %		—
$\overline{c} X$	(95 ± 5) %		—
$c X$	(24.6 ± 3.1) %		—
$\overline{c}/c X$	(119 ± 6) %		—

D, D*, or D_s modes

$D^- \pi^+$	(2.52 ± 0.13) × 10 ⁻³	S=1.1	2306
$D^- \rho^+$	(7.6 ± 1.2) × 10 ⁻³		2235
$D^- K^0 \pi^+$	(4.9 ± 0.9) × 10 ⁻⁴		2259
$D^- K^*(892)^+$	(4.5 ± 0.7) × 10 ⁻⁴		2211
$D^- \omega \pi^+$	(2.8 ± 0.6) × 10 ⁻³		2204
$D^- K^+$	(1.86 ± 0.20) × 10 ⁻⁴		2279
$D^- K^+ \pi^+ \pi^-$	(3.5 ± 0.8) × 10 ⁻⁴		2236
$D^- K^+ \overline{K}^0$	< 3.1 × 10 ⁻⁴	CL=90%	2188
$D^- K^+ \overline{K}^*(892)^0$	(8.8 ± 1.9) × 10 ⁻⁴		2070
$\overline{D}^0 \pi^+ \pi^-$	(8.8 ± 0.5) × 10 ⁻⁴		2301
$D^*(2010)^- \pi^+$	(2.74 ± 0.13) × 10 ⁻³		2255
$\overline{D}^0 K^+ K^-$	(5.9 ± 0.5) × 10 ⁻⁵		2191
$D^- \pi^+ \pi^+ \pi^-$	(6.0 ± 0.7) × 10 ⁻³	S=1.1	2287
($D^- \pi^+ \pi^+ \pi^-$) nonresonant	(3.9 ± 1.9) × 10 ⁻³		2287
$D^- \pi^+ \rho^0$	(1.1 ± 1.0) × 10 ⁻³		2206

$D^- a_1(1260)^+$	$(6.0 \pm 3.3) \times 10^{-3}$	2121
$D^*(2010)^- \pi^+ \pi^0$	$(1.5 \pm 0.5) \%$	2248
$D^*(2010)^- \rho^+$	$(6.8 \pm 0.9) \times 10^{-3}$	2180
$D^*(2010)^- K^+$	$(2.12 \pm 0.15) \times 10^{-4}$	2226
$D^*(2010)^- K^0 \pi^+$	$(3.0 \pm 0.8) \times 10^{-4}$	2205
$D^*(2010)^- K^{*}(892)^+$	$(3.3 \pm 0.6) \times 10^{-4}$	2155
$D^*(2010)^- K^+ \bar{K}^0$	$< 4.7 \times 10^{-4}$ CL=90%	2131
$D^*(2010)^- K^+ \bar{K}^{*}(892)^0$	$(1.29 \pm 0.33) \times 10^{-3}$	2007
$D^*(2010)^- \pi^+ \pi^+ \pi^-$	$(7.21 \pm 0.29) \times 10^{-3}$	2235
$(D^*(2010)^- \pi^+ \pi^+ \pi^-)$ non-resonant	$(0.0 \pm 2.5) \times 10^{-3}$	2235
$D^*(2010)^- \pi^+ \rho^0$	$(5.7 \pm 3.2) \times 10^{-3}$	2150
$D^*(2010)^- a_1(1260)^+$	$(1.30 \pm 0.27) \%$	2061
$\bar{D}_1(2420)^0 \pi^- \pi^+, \bar{D}_1^0 \rightarrow$	$(1.47 \pm 0.35) \times 10^{-4}$	—
$D^{*-} \pi^+$		
$D^*(2010)^- K^+ \pi^- \pi^+$	$(4.7 \pm 0.4) \times 10^{-4}$	2181
$D^*(2010)^- \pi^+ \pi^+ \pi^- \pi^0$	$(1.76 \pm 0.27) \%$	2218
$D^{*-} 3\pi^+ 2\pi^-$	$(4.7 \pm 0.9) \times 10^{-3}$	2195
$D^*(2010)^- \omega \pi^+$	$(2.46 \pm 0.18) \times 10^{-3}$ S=1.2	2148
$\bar{D}_1(2430)^0 \omega, \bar{D}_1^0 \rightarrow$	$(2.7 \begin{smallmatrix} + 0.8 \\ - 0.4 \end{smallmatrix}) \times 10^{-4}$	1992
$D^{*-} \pi^+$		
$D^{*-} \rho(1450)^+, \rho^+ \rightarrow \omega \pi^+$	$(1.07 \begin{smallmatrix} + 0.40 \\ - 0.34 \end{smallmatrix}) \times 10^{-3}$	—
$\bar{D}_1(2420)^0 \omega, \bar{D}_1^0 \rightarrow$	$(7.0 \pm 2.2) \times 10^{-5}$	1995
$D^{*-} \pi^+$		
$\bar{D}_2^*(2460)^0 \omega, \bar{D}_2^0 \rightarrow$	$(4.0 \pm 1.4) \times 10^{-5}$	1975
$D^{*-} \pi^+$		
$D^{*-} b_1(1235)^+, b_1^+ \rightarrow$	$< 7 \times 10^{-5}$ CL=90%	—
$\bar{D}^{*-} \omega \pi^+$		
$\bar{D}^{*-} \pi^+$ [qqq]	$(1.9 \pm 0.9) \times 10^{-3}$	—
$D_1(2420)^- \pi^+, D_1^- \rightarrow$	$(9.9 \begin{smallmatrix} + 2.0 \\ - 2.5 \end{smallmatrix}) \times 10^{-5}$	—
$D^- \pi^+ \pi^-$		
$D_1(2420)^- \pi^+, D_1^- \rightarrow$	$< 3.3 \times 10^{-5}$ CL=90%	—
$D^{*-} \pi^+ \pi^-$		
$\bar{D}_2^*(2460)^- \pi^+, (D_2^*)^- \rightarrow$	$(2.38 \pm 0.16) \times 10^{-4}$	2062
$D^0 \pi^-$		
$\bar{D}_0^*(2400)^- \pi^+, (D_0^*)^- \rightarrow$	$(7.6 \pm 0.8) \times 10^{-5}$	2090
$D^0 \pi^-$		
$D_2^*(2460)^- \pi^+, (D_2^*)^- \rightarrow$	$< 2.4 \times 10^{-5}$ CL=90%	—
$D^{*-} \pi^+ \pi^-$		
$\bar{D}_2^*(2460)^- \rho^+$	$< 4.9 \times 10^{-3}$ CL=90%	1974
$D^0 \bar{D}^0$	$(1.4 \pm 0.7) \times 10^{-5}$	1868
$D^{*0} \bar{D}^0$	$< 2.9 \times 10^{-4}$ CL=90%	1794
$D^- D^+$	$(2.11 \pm 0.18) \times 10^{-4}$	1864
$D^\pm D^{*\mp}$ (CP-averaged)	$(6.1 \pm 0.6) \times 10^{-4}$	—

$D^- D_s^+$	$(7.2 \pm 0.8) \times 10^{-3}$	1812
$D^{*(2010)-} D_s^+$	$(8.0 \pm 1.1) \times 10^{-3}$	1735
$D^- D_s^{*+}$	$(7.4 \pm 1.6) \times 10^{-3}$	1732
$D^{*(2010)-} D_s^{*+}$	$(1.77 \pm 0.14) \%$	1649
$D_{s0}(2317)^- K^+, D_{s0}^- \rightarrow$ $D_s^- \pi^0$	$(4.2 \pm 1.4) \times 10^{-5}$	2097
$D_{s0}(2317)^- \pi^+, D_{s0}^- \rightarrow$ $D_s^- \pi^0$	$< 2.5 \times 10^{-5}$ CL=90%	2128
$D_{sJ}(2457)^- K^+, D_{sJ}^- \rightarrow$ $D_s^- \pi^0$	$< 9.4 \times 10^{-6}$ CL=90%	—
$D_{sJ}(2457)^- \pi^+, D_{sJ}^- \rightarrow$ $D_s^- \pi^0$	$< 4.0 \times 10^{-6}$ CL=90%	—
$D_s^- D_s^+$	$< 3.6 \times 10^{-5}$ CL=90%	1759
$D_s^{*-} D_s^+$	$< 1.3 \times 10^{-4}$ CL=90%	1674
$D_s^{*0} D_s^+$	$< 2.4 \times 10^{-4}$ CL=90%	1583
$D_{s0}^{*(2317)+} D^-, D_{s0}^{*+} \rightarrow$ $D_s^+ \pi^0$	$(1.06 \pm 0.16) \times 10^{-3}$ S=1.1	1602
$D_{s0}(2317)^+ D^-, D_{s0}^+ \rightarrow$ $D_s^{*+} \gamma$	$< 9.5 \times 10^{-4}$ CL=90%	—
$D_{s0}(2317)^+ D^{*(2010)-},$ $D_{s0}^+ \rightarrow D_s^+ \pi^0$	$(1.5 \pm 0.6) \times 10^{-3}$	1509
$D_{sJ}(2457)^+ D^-$	$(3.5 \pm 1.1) \times 10^{-3}$	—
$D_{sJ}(2457)^+ D^-, D_{sJ}^+ \rightarrow$ $D_s^+ \gamma$	$(6.5 \begin{smallmatrix} + 1.7 \\ - 1.4 \end{smallmatrix}) \times 10^{-4}$	—
$D_{sJ}(2457)^+ D^-, D_{sJ}^+ \rightarrow$ $D_s^{*+} \gamma$	$< 6.0 \times 10^{-4}$ CL=90%	—
$D_{sJ}(2457)^+ D^-, D_{sJ}^+ \rightarrow$ $D_s^+ \pi^+ \pi^-$	$< 2.0 \times 10^{-4}$ CL=90%	—
$D_{sJ}(2457)^+ D^-, D_{sJ}^+ \rightarrow$ $D_s^+ \pi^0$	$< 3.6 \times 10^{-4}$ CL=90%	—
$D^{*(2010)-} D_{sJ}(2457)^+$	$(9.3 \pm 2.2) \times 10^{-3}$	—
$D_{sJ}(2457)^+ D^{*(2010)}, D_{sJ}^+ \rightarrow$ $D_s^+ \gamma$	$(2.3 \begin{smallmatrix} + 0.9 \\ - 0.7 \end{smallmatrix}) \times 10^{-3}$	—
$D^- D_{s1}(2536)^+, D_{s1}^+ \rightarrow$ $D^{*0} K^+ + D^{*+} K^0$	$(2.8 \pm 0.7) \times 10^{-4}$	1444
$D^- D_{s1}(2536)^+, D_{s1}^+ \rightarrow$ $D^{*0} K^+$	$(1.7 \pm 0.6) \times 10^{-4}$	1444
$D^- D_{s1}(2536)^+, D_{s1}^+ \rightarrow$ $D^{*+} K^0$	$(2.6 \pm 1.1) \times 10^{-4}$	1444

$D^*(2010)^- D_{s1}(2536)^+$,	$(5.0 \pm 1.4) \times 10^{-4}$	1336
$D_{s1}^+ \rightarrow D^{*0} K^+ + D^{*+} K^0$		
$D^*(2010)^- D_{s1}(2536)^+$,	$(3.3 \pm 1.1) \times 10^{-4}$	1336
$D_{s1}^+ \rightarrow D^{*0} K^+$		
$D^{*-} D_{s1}(2536)^+$, $D_{s1}^+ \rightarrow$	$(5.0 \pm 1.7) \times 10^{-4}$	1336
$D^{*+} K^0$		
$D^- D_{sJ}(2573)^+$, $D_{sJ}^+ \rightarrow$	$(3.4 \pm 1.8) \times 10^{-5}$	1414
$D^0 K^+$		
$D^*(2010)^- D_{sJ}(2573)^+$,	$< 2 \times 10^{-4}$ CL=90%	1304
$D_{sJ}^+ \rightarrow D^0 K^+$		
$D^- D_{sJ}(2700)^+$, $D_{sJ}^+ \rightarrow$	$(7.1 \pm 1.2) \times 10^{-4}$	—
$D^0 K^+$		
$D^+ \pi^-$	$(7.4 \pm 1.3) \times 10^{-7}$	2306
$D_s^+ \pi^-$	$(2.16 \pm 0.26) \times 10^{-5}$	2270
$D_s^{*+} \pi^-$	$(2.1 \pm 0.4) \times 10^{-5}$ S=1.4	2215
$D_s^+ \rho^-$	$< 2.4 \times 10^{-5}$ CL=90%	2197
$D_s^{*+} \rho^-$	$(4.1 \pm 1.3) \times 10^{-5}$	2138
$D_s^+ a_0^-$	$< 1.9 \times 10^{-5}$ CL=90%	—
$D_s^{*+} a_0^-$	$< 3.6 \times 10^{-5}$ CL=90%	—
$D_s^+ a_1(1260)^-$	$< 2.1 \times 10^{-3}$ CL=90%	2080
$D_s^{*+} a_1(1260)^-$	$< 1.7 \times 10^{-3}$ CL=90%	2015
$D_s^+ a_2^-$	$< 1.9 \times 10^{-4}$ CL=90%	—
$D_s^{*+} a_2^-$	$< 2.0 \times 10^{-4}$ CL=90%	—
$D_s^- K^+$	$(2.7 \pm 0.5) \times 10^{-5}$ S=2.7	2242
$D_s^{*-} K^+$	$(2.19 \pm 0.30) \times 10^{-5}$	2185
$D_s^- K^*(892)^+$	$(3.5 \pm 1.0) \times 10^{-5}$	2172
$D_s^{*-} K^*(892)^+$	$(3.2 \pm 1.5) \times 10^{-5}$	2112
	$(3.2 \pm 1.3) \times 10^{-5}$	
$D_s^- \pi^+ K^0$	$(9.7 \pm 1.4) \times 10^{-5}$	2222
$D_s^{*-} \pi^+ K^0$	$< 1.10 \times 10^{-4}$ CL=90%	2164
$D_s^- K^+ \pi^+ \pi^-$	$(1.7 \pm 0.5) \times 10^{-4}$	2198
$D_s^- \pi^+ K^*(892)^0$	$< 3.0 \times 10^{-3}$ CL=90%	2138
$D_s^{*-} \pi^+ K^*(892)^0$	$< 1.6 \times 10^{-3}$ CL=90%	2076
$\overline{D}^0 K^0$	$(5.2 \pm 0.7) \times 10^{-5}$	2280
$\overline{D}^0 K^+ \pi^-$	$(8.8 \pm 1.7) \times 10^{-5}$	2261
$\overline{D}^0 K^*(892)^0$	$(4.5 \pm 0.6) \times 10^{-5}$	2213
$\overline{D}^0 K^*(1410)^0$	$< 6.7 \times 10^{-5}$ CL=90%	2062
$\overline{D}^0 K_0^*(1430)^0$	$(7 \pm 7) \times 10^{-6}$	2058
$\overline{D}^0 K_2^*(1430)^0$	$(2.1 \pm 0.9) \times 10^{-5}$	2057
$D_0^*(2300)^- K^+$, $D_0^{*-} \rightarrow$	$(1.9 \pm 0.9) \times 10^{-5}$	—
$\overline{D}^0 \pi^-$		

$D_2^*(2460)^- K^+, D_2^{*-} \rightarrow \bar{D}^0 \pi^-$	$(2.03 \pm 0.35) \times 10^{-5}$	2029
$D_3^*(2760)^- K^+, D_3^{*-} \rightarrow \bar{D}^0 \pi^-$	$< 1.0 \times 10^{-6}$ CL=90%	—
$\bar{D}^0 K^+ \pi^-$ nonresonant	$< 3.7 \times 10^{-5}$ CL=90%	2261
$[K^+ K^-]_D K^*(892)^0$	$(4.2 \pm 0.7) \times 10^{-5}$	—
$[\pi^+ \pi^-]_D K^*(892)^0$	$(6.0 \pm 1.1) \times 10^{-5}$	—
$[\pi^+ \pi^- \pi^+ \pi^-]_D K^{*0}$	$(4.6 \pm 0.9) \times 10^{-5}$	—
$\bar{D}^0 \pi^0$	$(2.63 \pm 0.14) \times 10^{-4}$	2308
$\bar{D}^0 \rho^0$	$(3.21 \pm 0.21) \times 10^{-4}$	2237
$\bar{D}^0 f_2$	$(1.56 \pm 0.21) \times 10^{-4}$	—
$\bar{D}^0 \eta$	$(2.36 \pm 0.32) \times 10^{-4}$ S=2.5	2274
$\bar{D}^0 \eta'$	$(1.38 \pm 0.16) \times 10^{-4}$ S=1.3	2198
$\bar{D}^0 \omega$	$(2.54 \pm 0.16) \times 10^{-4}$	2235
$D^0 \phi$	$< 2.3 \times 10^{-6}$ CL=95%	2183
$D^0 K^+ \pi^-$	$(5.3 \pm 3.2) \times 10^{-6}$	2261
$D^0 K^*(892)^0$	$(2.2 \begin{smallmatrix} + 0.9 \\ - 1.0 \end{smallmatrix}) \times 10^{-6}$	2213
$\bar{D}^{*0} \gamma$	$< 2.5 \times 10^{-5}$ CL=90%	2258
$\bar{D}^*(2007)^0 \pi^0$	$(2.2 \pm 0.6) \times 10^{-4}$ S=2.6	2256
$\bar{D}^*(2007)^0 \rho^0$	$< 5.1 \times 10^{-4}$ CL=90%	2182
$\bar{D}^*(2007)^0 \eta$	$(2.3 \pm 0.6) \times 10^{-4}$ S=2.8	2220
$\bar{D}^*(2007)^0 \eta'$	$(1.40 \pm 0.22) \times 10^{-4}$	2141
$\bar{D}^*(2007)^0 \pi^+ \pi^-$	$(6.2 \pm 2.2) \times 10^{-4}$	2249
$\bar{D}^*(2007)^0 K^0$	$(3.6 \pm 1.2) \times 10^{-5}$	2227
$\bar{D}^*(2007)^0 K^*(892)^0$	$< 6.9 \times 10^{-5}$ CL=90%	2157
$D^*(2007)^0 K^*(892)^0$	$< 4.0 \times 10^{-5}$ CL=90%	2157
$D^*(2007)^0 \pi^+ \pi^+ \pi^- \pi^-$	$(2.7 \pm 0.5) \times 10^{-3}$	2219
$D^*(2010)^+ D^*(2010)^-$	$(8.0 \pm 0.6) \times 10^{-4}$	1711
$\bar{D}^*(2007)^0 \omega$	$(3.6 \pm 1.1) \times 10^{-4}$ S=3.1	2180
$D^*(2010)^+ D^-$	$(6.1 \pm 1.5) \times 10^{-4}$ S=1.6	1790
$D^*(2007)^0 \bar{D}^*(2007)^0$	$< 9 \times 10^{-5}$ CL=90%	1715
$D^- D^0 K^+$	$(1.07 \pm 0.11) \times 10^{-3}$	1574
$D^- D^*(2007)^0 K^+$	$(3.5 \pm 0.4) \times 10^{-3}$	1478
$D^*(2010)^- D^0 K^+$	$(2.47 \pm 0.21) \times 10^{-3}$	1479
$D^*(2010)^- D^*(2007)^0 K^+$	$(1.06 \pm 0.09) \%$	1366
$D^- D^+ K^0$	$(7.5 \pm 1.7) \times 10^{-4}$	1568
$D^*(2010)^- D^+ K^0 + D^- D^*(2010)^+ K^0$	$(6.4 \pm 0.5) \times 10^{-3}$	1473
$D^*(2010)^- D^*(2010)^+ K^0$	$(8.1 \pm 0.7) \times 10^{-3}$	1360
$D^{*-} D_{s1}(2536)^+, D_{s1}^+ \rightarrow D^{*+} K^0$	$(8.0 \pm 2.4) \times 10^{-4}$	1336
$\bar{D}^0 D^0 K^0$	$(2.7 \pm 1.1) \times 10^{-4}$	1574

$\bar{D}^0 D^*(2007)^0 K^0 +$ $\bar{D}^*(2007)^0 D^0 K^0$	$(1.1 \pm 0.5) \times 10^{-3}$	1478
$\bar{D}^*(2007)^0 D^*(2007)^0 K^0$	$(2.4 \pm 0.9) \times 10^{-3}$	1365
$(\bar{D} + \bar{D}^*)(D + D^*)K$	$(3.68 \pm 0.26) \%$	—

Charmonium modes

$\eta_c K^0$	$(8.0 \pm 1.1) \times 10^{-4}$	1751
$\eta_c(1S) K^+ \pi^-$	$(6.0 \pm 0.7) \times 10^{-4}$	1722
$\eta_c(1S) K^+ \pi^-$ (NR)	$(6.2 \pm 1.3) \times 10^{-5}$	—
$X(4100)^- K^+, X^- \rightarrow$ $\eta_c \pi^-$	$(2.0 \pm 1.0) \times 10^{-5}$	—
$\eta_c(1S) K^*(1410)^0$	$(1.9 \pm 1.5) \times 10^{-4}$	1395
$\eta_c(1S) K_0^*(1430)^0$	$(1.6 \pm 0.4) \times 10^{-4}$	1387
$\eta_c(1S) K_2^*(1430)^0$	$(4.9 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 2.2 \\ 2.7 \end{smallmatrix}) \times 10^{-5}$	1386
$\eta_c(1S) K^*(1680)^0$	$(3 \pm 4) \times 10^{-5}$	1166
$\eta_c(1S) K_0^*(1950)^0$	$(4.4 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 2.9 \\ 4.0 \end{smallmatrix}) \times 10^{-5}$	—
$\eta_c K^*(892)^0$	$(5.2 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.7 \\ 0.8 \end{smallmatrix}) \times 10^{-4}$	S=1.5 1646
$\eta_c(2S) K_S^0, \eta_c \rightarrow p \bar{p} \pi^+ \pi^-$	$(4.2 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.4 \\ 1.2 \end{smallmatrix}) \times 10^{-7}$	—
$\eta_c(2S) K^{*0}$	$< 3.9 \times 10^{-4}$	CL=90% 1159
$h_c(1P) K_S^0$	$< 1.4 \times 10^{-5}$	1401
$h_c(1P) K^{*0}$	$< 4 \times 10^{-4}$	CL=90% 1253
$J/\psi(1S) K^0$	$(8.68 \pm 0.30) \times 10^{-4}$	1683
$J/\psi(1S) K^+ \pi^-$	$(1.15 \pm 0.05) \times 10^{-3}$	1652
$J/\psi(1S) K^*(892)^0$	$(1.27 \pm 0.05) \times 10^{-3}$	1571
$J/\psi(1S) \eta K_S^0$	$(5.4 \pm 0.9) \times 10^{-5}$	1508
$J/\psi(1S) \eta' K_S^0$	$< 2.5 \times 10^{-5}$	CL=90% 1271
$J/\psi(1S) \phi K^0$	$(4.9 \pm 1.0) \times 10^{-5}$	S=1.3 1224
$J/\psi(1S) \omega K^0$	$(2.3 \pm 0.4) \times 10^{-4}$	1386
$\chi_{c1}(3872) K^0, \chi_{c1} \rightarrow$ $J/\psi \omega$	$(6.0 \pm 3.2) \times 10^{-6}$	1140
$X(3915), X \rightarrow J/\psi \omega$	$(2.1 \pm 0.9) \times 10^{-5}$	1102
$J/\psi(1S) K(1270)^0$	$(1.3 \pm 0.5) \times 10^{-3}$	1402
$J/\psi(1S) \pi^0$	$(1.66 \pm 0.10) \times 10^{-5}$	1728
$J/\psi(1S) \eta$	$(1.08 \pm 0.23) \times 10^{-5}$	S=1.5 1673
$J/\psi(1S) \pi^+ \pi^-$	$(3.94 \pm 0.17) \times 10^{-5}$	1716
$J/\psi(1S) \pi^+ \pi^-$ nonresonant	$< 1.2 \times 10^{-5}$	CL=90% 1716
$J/\psi(1S) f_0(500), f_0 \rightarrow \pi \pi$	$(8.8 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.2 \\ 1.6 \end{smallmatrix}) \times 10^{-6}$	—
$J/\psi(1S) f_2$	$(3.3 \pm 0.5) \times 10^{-6}$	S=1.5 —
$J/\psi(1S) \rho^0$	$(2.55 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.18 \\ 0.16 \end{smallmatrix}) \times 10^{-5}$	1612
$J/\psi(1S) f_0(980), f_0 \rightarrow$ $\pi^+ \pi^-$	$< 1.1 \times 10^{-6}$	CL=90% —

$J/\psi(1S)\rho(1450)^0, \rho^0 \rightarrow$	$(2.9 \pm_{-0.7}^{+1.6}) \times 10^{-6}$	–
$J/\psi \rho(1700)^0, \rho^0 \rightarrow \pi^+ \pi^-$	$(2.0 \pm 1.3) \times 10^{-6}$	–
$J/\psi(1S)\omega$	$(1.8 \pm_{-0.5}^{+0.7}) \times 10^{-5}$	1609
$J/\psi(1S)K^+ K^-$	$(2.50 \pm 0.35) \times 10^{-6}$	1534
$J/\psi(1S)a_0(980), a_0 \rightarrow$ $K^+ K^-$	$(4.7 \pm 3.4) \times 10^{-7}$	–
$J/\psi(1S)\phi$	$< 1.9 \times 10^{-7}$ CL=90%	1520
$J/\psi(1S)\eta'(958)$	$(7.6 \pm 2.4) \times 10^{-6}$	1546
$J/\psi(1S)K^0 \pi^+ \pi^-$	$(4.3 \pm 0.4) \times 10^{-4}$	1611
$J/\psi(1S)K^0 K^- \pi^+ + \text{c.c.}$	$< 2.1 \times 10^{-5}$ CL=90%	1467
$J/\psi(1S)K^0 K^+ K^-$	$(2.5 \pm 0.7) \times 10^{-5}$ S=1.8	1249
$J/\psi(1S)K^0 \rho^0$	$(5.4 \pm 3.0) \times 10^{-4}$	1390
$J/\psi(1S)K^*(892)^+ \pi^-$	$(8 \pm 4) \times 10^{-4}$	1515
$J/\psi(1S)\pi^+ \pi^- \pi^+ \pi^-$	$(1.42 \pm 0.12) \times 10^{-5}$	1670
$J/\psi(1S)f_1(1285)$	$(8.4 \pm 2.1) \times 10^{-6}$	1385
$J/\psi(1S)K^*(892)^0 \pi^+ \pi^-$	$(6.6 \pm 2.2) \times 10^{-4}$	1447
$\chi_{c1}(3872)^- K^+$	$< 5 \times 10^{-4}$ CL=90%	–
$\chi_{c1}(3872)^- K^+,$ $\chi_{c1}(3872)^- \rightarrow$ $J/\psi(1S)\pi^- \pi^0$	$[rrr] < 4.2 \times 10^{-6}$ CL=90%	–
$\chi_{c1}(3872)K^0, \chi_{c1} \rightarrow$ $J/\psi \pi^+ \pi^-$	$(4.3 \pm 1.3) \times 10^{-6}$	1140
$\chi_{c1}(3872)K^0, \chi_{c1} \rightarrow J/\psi \gamma$	$< 2.4 \times 10^{-6}$ CL=90%	1140
$\chi_{c1}(3872)K^*(892)^0, \chi_{c1} \rightarrow$ $J/\psi \gamma$	$< 2.8 \times 10^{-6}$ CL=90%	940
$\chi_{c1}(3872)K^0, \chi_{c1} \rightarrow \psi(2S)\gamma$	$< 6.62 \times 10^{-6}$ CL=90%	1140
$\chi_{c1}(3872)K^*(892)^0, \chi_{c1} \rightarrow$ $\psi(2S)\gamma$	$< 4.4 \times 10^{-6}$ CL=90%	940
$\chi_{c1}(3872)K^0, \chi_{c1} \rightarrow$ $D^0 \bar{D}^0 \pi^0$	$(1.7 \pm 0.8) \times 10^{-4}$	1140
$\chi_{c1}(3872)K^0, \chi_{c1} \rightarrow \bar{D}^{*0} D^0$	$(1.2 \pm 0.4) \times 10^{-4}$	1140
$\chi_{c1}(3872)K^+ \pi^-, \chi_{c1} \rightarrow$ $J/\psi \pi^+ \pi^-$	$(7.9 \pm 1.4) \times 10^{-6}$	–
$\chi_{c1}(3872)K^*(892)^0, \chi_{c1} \rightarrow$ $J/\psi \pi^+ \pi^-$	$(4.0 \pm 1.5) \times 10^{-6}$	–
$\chi_{c1}(3872)\gamma, \chi_{c1} \rightarrow$ $J/\psi \pi^+ \pi^-$	$< 5.1 \times 10^{-7}$ CL=90%	–
$Z_c(4430)^\pm K^\mp, Z_c^\pm \rightarrow$ $\psi(2S)\pi^\pm$	$(6.0 \pm_{-2.4}^{+3.0}) \times 10^{-5}$	583
$Z_c(4430)^\pm K^\mp, Z_c^\pm \rightarrow$ $J/\psi \pi^\pm$	$(5.4 \pm_{-1.2}^{+4.0}) \times 10^{-6}$	583

$Z_c(3900)^\pm K^\mp, Z_c^\pm \rightarrow J/\psi \pi^\pm$	$< 9 \times 10^{-7}$	—
$Z_c(4200)^\pm K^\mp, X^\pm \rightarrow J/\psi \pi^\pm$	$(2.2 \begin{smallmatrix} + \\ - \end{smallmatrix} \frac{1.3}{0.8}) \times 10^{-5}$	—
$J/\psi(1S) p\bar{p}$	$(4.5 \pm 0.6) \times 10^{-7}$	862
$J/\psi(1S) \gamma$	$< 1.5 \times 10^{-6}$	CL=90% 1732
$J/\psi(1S) \bar{D}^0$	$< 1.3 \times 10^{-5}$	CL=90% 877
$\psi(2S) \pi^0$	$(1.17 \pm 0.19) \times 10^{-5}$	1348
$\psi(2S) K^0$	$(5.8 \pm 0.5) \times 10^{-4}$	1283
$\psi(3770) K^0, \psi \rightarrow \bar{D}^0 D^0$	$< 1.23 \times 10^{-4}$	CL=90% 1217
$\psi(3770) K^0, \psi \rightarrow D^- D^+$	$< 1.88 \times 10^{-4}$	CL=90% 1217
$\psi(2S) \pi^+ \pi^-$	$(2.21 \pm 0.35) \times 10^{-5}$	1331
$\psi(2S) K^+ \pi^-$	$(5.8 \pm 0.4) \times 10^{-4}$	1239
$\psi(2S) K^*(892)^0$	$(5.9 \pm 0.4) \times 10^{-4}$	1116
$\chi_{c0} K^0$	$(1.11 \begin{smallmatrix} + \\ - \end{smallmatrix} \frac{0.24}{0.21}) \times 10^{-6}$	1477
$\chi_{c0} K^*(892)^0$	$(1.7 \pm 0.4) \times 10^{-4}$	1342
$\chi_{c1} \pi^0$	$(1.12 \pm 0.28) \times 10^{-5}$	1468
$\chi_{c1} K^0$	$(3.95 \pm 0.27) \times 10^{-4}$	1411
$\chi_{c1} \pi^- K^+$	$(4.97 \pm 0.30) \times 10^{-4}$	1371
$\chi_{c1} K^*(892)^0$	$(2.38 \pm 0.19) \times 10^{-4}$	S=1.2 1265
$X(4051)^- K^+, X^- \rightarrow \chi_{c1} \pi^-$	$(3.0 \begin{smallmatrix} + \\ - \end{smallmatrix} \frac{4.0}{1.8}) \times 10^{-5}$	—
$X(4248)^- K^+, X^- \rightarrow \chi_{c1} \pi^-$	$(4.0 \begin{smallmatrix} + \\ - \end{smallmatrix} \frac{20.0}{1.0}) \times 10^{-5}$	—
$\chi_{c1} \pi^+ \pi^- K^0$	$(3.2 \pm 0.5) \times 10^{-4}$	1318
$\chi_{c1} \pi^- \pi^0 K^+$	$(3.5 \pm 0.6) \times 10^{-4}$	1321
$\chi_{c2} K^0$	$< 1.5 \times 10^{-5}$	CL=90% 1379
$\chi_{c2} K^*(892)^0$	$(4.9 \pm 1.2) \times 10^{-5}$	S=1.1 1228
$\chi_{c2} \pi^- K^+$	$(7.2 \pm 1.0) \times 10^{-5}$	1338
$\chi_{c2} \pi^+ \pi^- K^0$	$< 1.70 \times 10^{-4}$	CL=90% 1282
$\chi_{c2} \pi^- \pi^0 K^+$	$< 7.4 \times 10^{-5}$	CL=90% 1286
$\psi(4660) K^0, \psi \rightarrow \Lambda_c^+ \Lambda_c^-$	$< 2.3 \times 10^{-4}$	CL=90% —
$\psi(4260)^0 K^0, \psi^0 \rightarrow J/\psi \pi^+ \pi^-$	$< 1.7 \times 10^{-5}$	CL=90% —

K or K* modes

$K^+ \pi^-$	$(1.96 \pm 0.05) \times 10^{-5}$	2615
$K^0 \pi^0$	$(9.9 \pm 0.5) \times 10^{-6}$	2615
$\eta' K^0$	$(6.6 \pm 0.4) \times 10^{-5}$	S=1.4 2528
$\eta' K^*(892)^0$	$(2.8 \pm 0.6) \times 10^{-6}$	2472
$\eta' K_0^*(1430)^0$	$(6.3 \pm 1.6) \times 10^{-6}$	2346
$\eta' K_2^*(1430)^0$	$(1.37 \pm 0.32) \times 10^{-5}$	2346

ηK^0	$(1.23_{-0.24}^{+0.27}) \times 10^{-6}$		2587
$\eta K^*(892)^0$	$(1.59 \pm 0.10) \times 10^{-5}$		2534
$\eta K_0^*(1430)^0$	$(1.10 \pm 0.22) \times 10^{-5}$		2415
$\eta K_2^*(1430)^0$	$(9.6 \pm 2.1) \times 10^{-6}$		2414
ωK^0	$(4.8 \pm 0.4) \times 10^{-6}$		2557
$a_0(980)^0 K^0, a_0^0 \rightarrow \eta \pi^0$	< 7.8	$\times 10^{-6}$ CL=90%	—
$b_1^0 K^0, b_1^0 \rightarrow \omega \pi^0$	< 7.8	$\times 10^{-6}$ CL=90%	—
$a_0(980)^\pm K^\mp, a_0^\pm \rightarrow \eta \pi^\pm$	< 1.9	$\times 10^{-6}$ CL=90%	—
$b_1^- K^+, b_1^- \rightarrow \omega \pi^-$	$(7.4 \pm 1.4) \times 10^{-6}$		—
$b_1^0 K^{*0}, b_1^0 \rightarrow \omega \pi^0$	< 8.0	$\times 10^{-6}$ CL=90%	—
$b_1^- K^{*+}, b_1^- \rightarrow \omega \pi^-$	< 5.0	$\times 10^{-6}$ CL=90%	—
$a_0(1450)^\pm K^\mp, a_0^\pm \rightarrow \eta \pi^\pm$	< 3.1	$\times 10^{-6}$ CL=90%	—
$K_S^0 X^0$ (Familon)	< 5.3	$\times 10^{-5}$ CL=90%	—
$\omega K^*(892)^0$	$(2.0 \pm 0.5) \times 10^{-6}$		2503
$\omega (K\pi)_0^{*0}$	$(1.84 \pm 0.25) \times 10^{-5}$		—
$\omega K_0^*(1430)^0$	$(1.60 \pm 0.34) \times 10^{-5}$		2380
$\omega K_2^*(1430)^0$	$(1.01 \pm 0.23) \times 10^{-5}$		2380
$\omega K^+ \pi^-$ nonresonant	$(5.1 \pm 1.0) \times 10^{-6}$		2542
$K^+ \pi^- \pi^0$	$(3.78 \pm 0.32) \times 10^{-5}$		2609
$K^+ \rho^-$	$(7.0 \pm 0.9) \times 10^{-6}$		2559
$K^+ \rho(1450)^-$	$(2.4 \pm 1.2) \times 10^{-6}$		—
$K^+ \rho(1700)^-$	$(6 \pm 7) \times 10^{-7}$		—
$(K^+ \pi^- \pi^0)$ nonresonant	$(2.8 \pm 0.6) \times 10^{-6}$		2609
$(K\pi)_0^{*+} \pi^-, (K\pi)_0^{*+} \rightarrow$	$(3.4 \pm 0.5) \times 10^{-5}$		—
$K^+ \pi^0$			
$(K\pi)_0^{*0} \pi^0, (K\pi)_0^{*0} \rightarrow$	$(8.6 \pm 1.7) \times 10^{-6}$		—
$K^+ \pi^-$			
$K_2^*(1430)^0 \pi^0$	< 4.0	$\times 10^{-6}$ CL=90%	2445
$K^*(1680)^0 \pi^0$	< 7.5	$\times 10^{-6}$ CL=90%	2358
$K_x^{*0} \pi^0$	[<i>uuu</i>] $(6.1 \pm 1.6) \times 10^{-6}$		—
$K^0 \pi^+ \pi^-$	$(4.97 \pm 0.18) \times 10^{-5}$		2609
$K^0 \pi^+ \pi^-$ nonresonant	$(1.39_{-0.18}^{+0.26}) \times 10^{-5}$	S=1.6	2609
$K^0 \rho^0$	$(3.4 \pm 1.1) \times 10^{-6}$	S=2.3	2558
$K^*(892)^+ \pi^-$	$(7.5 \pm 0.4) \times 10^{-6}$		2563
$K_0^*(1430)^+ \pi^-$	$(3.3 \pm 0.7) \times 10^{-5}$	S=2.0	—
$K_x^{*+} \pi^-$	[<i>uuu</i>] $(5.1 \pm 1.6) \times 10^{-6}$		—
$K^*(1410)^+ \pi^-, K^{*+} \rightarrow$	< 3.8	$\times 10^{-6}$ CL=90%	—
$K^0 \pi^+$			
$(K\pi)_0^{*+} \pi^-, (K\pi)_0^{*+} \rightarrow$	$(1.62 \pm 0.13) \times 10^{-5}$		—
$K^0 \pi^+$			
$f_0(980) K^0, f_0 \rightarrow \pi^+ \pi^-$	$(8.1 \pm 0.8) \times 10^{-6}$	S=1.3	2522

$K^0 f_0(500)$	$(1.6 \pm_{-1.6}^{+2.5}) \times 10^{-7}$	—
$K^0 f_0(1500)$	$(1.3 \pm 0.8) \times 10^{-6}$	2397
$f_2(1270) K^0$	$(2.7 \pm_{-1.2}^{+1.3}) \times 10^{-6}$	2459
$f_x(1300) K^0, f_x \rightarrow \pi^+ \pi^-$	$(1.8 \pm 0.7) \times 10^{-6}$	—
$K^*(892)^0 \pi^0$	$(3.3 \pm 0.6) \times 10^{-6}$	2563
$K_2^*(1430)^+ \pi^-$	$(3.65 \pm 0.34) \times 10^{-6}$	2445
$K^*(1680)^+ \pi^-$	$(1.41 \pm 0.10) \times 10^{-5}$	2358
$K^+ \pi^- \pi^+ \pi^-$	[vvv] $< 2.3 \times 10^{-4}$	CL=90% 2600
$\rho^0 K^+ \pi^-$	$(2.8 \pm 0.7) \times 10^{-6}$	2543
$f_0(980) K^+ \pi^-, f_0 \rightarrow \pi \pi$	$(1.4 \pm_{-0.6}^{+0.5}) \times 10^{-6}$	2506
$K^+ \pi^- \pi^+ \pi^-$ nonresonant	$< 2.1 \times 10^{-6}$	CL=90% 2600
$K^*(892)^0 \pi^+ \pi^-$	$(5.5 \pm 0.5) \times 10^{-5}$	2557
$K^*(892)^0 \rho^0$	$(3.9 \pm 1.3) \times 10^{-6}$	S=1.9 2504
$K^*(892)^0 f_0(980), f_0 \rightarrow \pi \pi$	$(3.9 \pm_{-1.8}^{+2.1}) \times 10^{-6}$	S=3.9 2466
$K_1(1270)^+ \pi^-$	$< 3.0 \times 10^{-5}$	CL=90% 2489
$K_1(1400)^+ \pi^-$	$< 2.7 \times 10^{-5}$	CL=90% 2451
$a_1(1260)^- K^+$	[vvv] $(1.6 \pm 0.4) \times 10^{-5}$	2471
$K^*(892)^+ \rho^-$	$(1.03 \pm 0.26) \times 10^{-5}$	2504
$K_0^*(1430)^+ \rho^-$	$(2.8 \pm 1.2) \times 10^{-5}$	—
$K_1(1400)^0 \rho^0$	$< 3.0 \times 10^{-3}$	CL=90% 2388
$K_0^*(1430)^0 \rho^0$	$(2.7 \pm 0.6) \times 10^{-5}$	2381
$K_0^*(1430)^0 f_0(980), f_0 \rightarrow \pi \pi$	$(2.7 \pm 0.9) \times 10^{-6}$	—
$K_2^*(1430)^0 f_0(980), f_0 \rightarrow \pi \pi$	$(8.6 \pm 2.0) \times 10^{-6}$	—
$K^+ K^-$	$(7.8 \pm 1.5) \times 10^{-8}$	2593
$K^0 \bar{K}^0$	$(1.21 \pm 0.16) \times 10^{-6}$	2593
$K^0 K^- \pi^+$	$(6.7 \pm 0.5) \times 10^{-6}$	2578
$K^*(892)^\pm K^\mp$	$< 4 \times 10^{-7}$	CL=90% 2540
$\bar{K}^{*0} K^0 + K^{*0} \bar{K}^0$	$< 9.6 \times 10^{-7}$	CL=90% —
$K^+ K^- \pi^0$	$(2.2 \pm 0.6) \times 10^{-6}$	2579
$K_S^0 K_S^0 \pi^0$	$< 9 \times 10^{-7}$	CL=90% 2578
$K_S^0 K_S^0 \eta$	$< 1.0 \times 10^{-6}$	CL=90% 2515
$K_S^0 K_S^0 \eta'$	$< 2.0 \times 10^{-6}$	CL=90% 2453
$K^0 K^+ K^-$	$(2.68 \pm 0.11) \times 10^{-5}$	2522
$K^0 \phi$	$(7.3 \pm 0.7) \times 10^{-6}$	2516
$f_0(980) K^0, f_0 \rightarrow K^+ K^-$	$(7.0 \pm_{-3.0}^{+3.5}) \times 10^{-6}$	—
$f_0(1500) K^0$	$(1.3 \pm_{-0.5}^{+0.7}) \times 10^{-5}$	2397
$f_2'(1525)^0 K^0$	$(3 \pm_4^+ 5) \times 10^{-7}$	—
$f_0(1710) K^0, f_0 \rightarrow K^+ K^-$	$(4.4 \pm 0.9) \times 10^{-6}$	—
$K^0 K^+ K^-$ nonresonant	$(3.3 \pm 1.0) \times 10^{-5}$	2522

$K_S^0 K_S^0 K_S^0$	$(6.0 \pm 0.5) \times 10^{-6}$	S=1.1	2521
$f_0(980)K^0, f_0 \rightarrow K_S^0 K_S^0$	$(2.7 \pm 1.8) \times 10^{-6}$		—
$f_0(1710)K^0, f_0 \rightarrow K_S^0 K_S^0$	$(5.0 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 5.0 \\ 2.6 \end{smallmatrix}) \times 10^{-7}$		—
$f_2(2010)K^0, f_2 \rightarrow K_S^0 K_S^0$	$(5 \pm 6) \times 10^{-7}$		—
$K_S^0 K_S^0 K_S^0$ nonresonant	$(1.33 \pm 0.31) \times 10^{-5}$		2521
$K_S^0 K_S^0 K_L^0$	$< 1.6 \times 10^{-5}$	CL=90%	2521
$K^*(892)^0 K^+ K^-$	$(2.75 \pm 0.26) \times 10^{-5}$		2467
$K^*(892)^0 \phi$	$(1.00 \pm 0.05) \times 10^{-5}$		2460
$K^+ K^- \pi^+ \pi^-$ nonresonant	$< 7.17 \times 10^{-5}$	CL=90%	2559
$K^*(892)^0 K^- \pi^+$	$(4.5 \pm 1.3) \times 10^{-6}$		2524
$K^*(892)^0 \bar{K}^*(892)^0$	$(8.3 \pm 2.4) \times 10^{-7}$	S=1.5	2485
$K^+ K^+ \pi^- \pi^-$ nonresonant	$< 6.0 \times 10^{-6}$	CL=90%	2559
$K^*(892)^0 K^+ \pi^-$	$< 2.2 \times 10^{-6}$	CL=90%	2524
$K^*(892)^0 K^*(892)^0$	$< 2 \times 10^{-7}$	CL=90%	2485
$K^*(892)^+ K^*(892)^-$	$< 2.0 \times 10^{-6}$	CL=90%	2485
$K_1(1400)^0 \phi$	$< 5.0 \times 10^{-3}$	CL=90%	2339
$\phi(K\pi)_0^0$	$(4.3 \pm 0.4) \times 10^{-6}$		—
$\phi(K\pi)_0^0 (1.60 < m_{K\pi} < 2.15)$ [xxx]	$< 1.7 \times 10^{-6}$	CL=90%	—
$K_0^*(1430)^0 K^- \pi^+$	$< 3.18 \times 10^{-5}$	CL=90%	2403
$K_0^*(1430)^0 \bar{K}^*(892)^0$	$< 3.3 \times 10^{-6}$	CL=90%	2360
$K_0^*(1430)^0 \bar{K}_0^*(1430)^0$	$< 8.4 \times 10^{-6}$	CL=90%	2222
$K_0^*(1430)^0 \phi$	$(3.9 \pm 0.8) \times 10^{-6}$		2333
$K_0^*(1430)^0 K^*(892)^0$	$< 1.7 \times 10^{-6}$	CL=90%	2360
$K_0^*(1430)^0 K_0^*(1430)^0$	$< 4.7 \times 10^{-6}$	CL=90%	2222
$K^*(1680)^0 \phi$	$< 3.5 \times 10^{-6}$	CL=90%	2238
$K^*(1780)^0 \phi$	$< 2.7 \times 10^{-6}$	CL=90%	—
$K^*(2045)^0 \phi$	$< 1.53 \times 10^{-5}$	CL=90%	—
$K_2^*(1430)^0 \rho^0$	$< 1.1 \times 10^{-3}$	CL=90%	2381
$K_2^*(1430)^0 \phi$	$(6.8 \pm 0.9) \times 10^{-6}$	S=1.2	2332
$K_0^0 \phi \phi$	$(4.5 \pm 0.9) \times 10^{-6}$		2305
$\eta' \eta' K^0$	$< 3.1 \times 10^{-5}$	CL=90%	2337
$\eta K^0 \gamma$	$(7.6 \pm 1.8) \times 10^{-6}$		2587
$\eta' K^0 \gamma$	$< 6.4 \times 10^{-6}$	CL=90%	2528
$K^0 \phi \gamma$	$(2.7 \pm 0.7) \times 10^{-6}$		2516
$K^+ \pi^- \gamma$	$(4.6 \pm 1.4) \times 10^{-6}$		2615
$K^*(892)^0 \gamma$	$(4.18 \pm 0.25) \times 10^{-5}$	S=2.1	2565
$K^*(1410) \gamma$	$< 1.3 \times 10^{-4}$	CL=90%	2451
$K^+ \pi^- \gamma$ nonresonant	$< 2.6 \times 10^{-6}$	CL=90%	2615
$K^*(892)^0 X(214), X \rightarrow$ $\mu^+ \mu^-$	[yyy] $< 2.26 \times 10^{-8}$	CL=90%	—
$K^0 \pi^+ \pi^- \gamma$	$(1.99 \pm 0.18) \times 10^{-5}$		2609
$K^+ \pi^- \pi^0 \gamma$	$(4.1 \pm 0.4) \times 10^{-5}$		2609

$K_1(1270)^0 \gamma$	< 5.8	$\times 10^{-5}$	CL=90%	2491
$K_1(1400)^0 \gamma$	< 1.2	$\times 10^{-5}$	CL=90%	2454
$K_2^*(1430)^0 \gamma$	(1.24 ± 0.24)	$\times 10^{-5}$		2447
$K^*(1680)^0 \gamma$	< 2.0	$\times 10^{-3}$	CL=90%	2360
$K_3^*(1780)^0 \gamma$	< 8.3	$\times 10^{-5}$	CL=90%	2341
$K_4^*(2045)^0 \gamma$	< 4.3	$\times 10^{-3}$	CL=90%	2243

Light unflavored meson modes

$\rho^0 \gamma$	(8.6 ± 1.5)	$\times 10^{-7}$		2583
$\rho^0 X(214), X \rightarrow \mu^+ \mu^-$	[$\gamma\gamma\gamma$] < 1.73	$\times 10^{-8}$	CL=90%	—
$\omega \gamma$	(4.4 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ 1.8 / 1.6)	$\times 10^{-7}$		2582
$\phi \gamma$	< 1.0	$\times 10^{-7}$	CL=90%	2541
$\pi^+ \pi^-$	(5.12 ± 0.19)	$\times 10^{-6}$		2636
$\pi^0 \pi^0$	(1.59 ± 0.26)	$\times 10^{-6}$	S=1.4	2636
$\eta \pi^0$	(4.1 ± 1.7)	$\times 10^{-7}$		2610
$\eta \eta$	< 1.0	$\times 10^{-6}$	CL=90%	2582
$\eta' \pi^0$	(1.2 ± 0.6)	$\times 10^{-6}$	S=1.7	2551
$\eta' \eta'$	< 1.7	$\times 10^{-6}$	CL=90%	2460
$\eta' \eta$	< 1.2	$\times 10^{-6}$	CL=90%	2523
$\eta' \rho^0$	< 1.3	$\times 10^{-6}$	CL=90%	2492
$\eta' f_0(980), f_0 \rightarrow \pi^+ \pi^-$	< 9	$\times 10^{-7}$	CL=90%	2454
$\eta \rho^0$	< 1.5	$\times 10^{-6}$	CL=90%	2553
$\eta f_0(980), f_0 \rightarrow \pi^+ \pi^-$	< 4	$\times 10^{-7}$	CL=90%	2516
$\omega \eta$	(9.4 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ 4.0 / 3.1)	$\times 10^{-7}$		2552
$\omega \eta'$	(1.0 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ 0.5 / 0.4)	$\times 10^{-6}$		2491
$\omega \rho^0$	< 1.6	$\times 10^{-6}$	CL=90%	2522
$\omega f_0(980), f_0 \rightarrow \pi^+ \pi^-$	< 1.5	$\times 10^{-6}$	CL=90%	2485
$\omega \omega$	(1.2 ± 0.4)	$\times 10^{-6}$		2521
$\phi \pi^0$	< 1.5	$\times 10^{-7}$	CL=90%	2540
$\phi \eta$	< 5	$\times 10^{-7}$	CL=90%	2511
$\phi \eta'$	< 5	$\times 10^{-7}$	CL=90%	2448
$\phi \pi^+ \pi^-$	(1.8 ± 0.5)	$\times 10^{-7}$		2533
$\phi \rho^0$	< 3.3	$\times 10^{-7}$	CL=90%	2480
$\phi f_0(980), f_0 \rightarrow \pi^+ \pi^-$	< 3.8	$\times 10^{-7}$	CL=90%	2441
$\phi \omega$	< 7	$\times 10^{-7}$	CL=90%	2479
$\phi \phi$	< 2.7	$\times 10^{-8}$	CL=90%	2435
$a_0(980)^\pm \pi^\mp, a_0^\pm \rightarrow \eta \pi^\pm$	< 3.1	$\times 10^{-6}$	CL=90%	—
$a_0(1450)^\pm \pi^\mp, a_0^\pm \rightarrow \eta \pi^\pm$	< 2.3	$\times 10^{-6}$	CL=90%	—
$\pi^+ \pi^- \pi^0$	< 7.2	$\times 10^{-4}$	CL=90%	2631
$\rho^0 \pi^0$	(2.0 ± 0.5)	$\times 10^{-6}$		2581
$\rho^\mp \pi^\pm$	[bb] (2.30 ± 0.23)	$\times 10^{-5}$		2581
$\pi^+ \pi^- \pi^+ \pi^-$	< 1.12	$\times 10^{-5}$	CL=90%	2621

$\rho^0 \pi^+ \pi^-$	< 8.8	$\times 10^{-6}$	CL=90%	2575
$\rho^0 \rho^0$	(9.6 \pm 1.5)	$\times 10^{-7}$		2523
$f_0(980) \pi^+ \pi^-$, $f_0 \rightarrow \pi^+ \pi^-$	< 3.0	$\times 10^{-6}$	CL=90%	–
$\rho^0 f_0(980)$, $f_0 \rightarrow \pi^+ \pi^-$	(7.8 \pm 2.5)	$\times 10^{-7}$		2486
$f_0(980) f_0(980)$, $f_0 \rightarrow \pi^+ \pi^-$	< 1.9	$\times 10^{-7}$	CL=90%	2447
$f_0(980) f_0(980)$, $f_0 \rightarrow \pi^+ \pi^-$, $f_0 \rightarrow K^+ K^-$	< 2.3	$\times 10^{-7}$	CL=90%	2447
$a_1(1260)^\mp \pi^\pm$	[bb] (2.6 \pm 0.5)	$\times 10^{-5}$	S=1.9	2494
$a_2(1320)^\mp \pi^\pm$	[bb] < 6.3	$\times 10^{-6}$	CL=90%	2473
$\pi^+ \pi^- \pi^0 \pi^0$	< 3.1	$\times 10^{-3}$	CL=90%	2622
$\rho^+ \rho^-$	(2.77 \pm 0.19)	$\times 10^{-5}$		2523
$a_1(1260)^0 \pi^0$	< 1.1	$\times 10^{-3}$	CL=90%	2495
$\omega \pi^0$	< 5	$\times 10^{-7}$	CL=90%	2580
$\pi^+ \pi^+ \pi^- \pi^- \pi^0$	< 9.0	$\times 10^{-3}$	CL=90%	2609
$a_1(1260)^+ \rho^-$	< 6.1	$\times 10^{-5}$	CL=90%	2433
$a_1(1260)^0 \rho^0$	< 2.4	$\times 10^{-3}$	CL=90%	2433
$b_1^\mp \pi^\pm$, $b_1^\mp \rightarrow \omega \pi^\mp$	(1.09 \pm 0.15)	$\times 10^{-5}$		–
$b_1^0 \pi^0$, $b_1^0 \rightarrow \omega \pi^0$	< 1.9	$\times 10^{-6}$	CL=90%	–
$b_1^- \rho^+$, $b_1^- \rightarrow \omega \pi^-$	< 1.4	$\times 10^{-6}$	CL=90%	–
$b_1^0 \rho^0$, $b_1^0 \rightarrow \omega \pi^0$	< 3.4	$\times 10^{-6}$	CL=90%	–
$\pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^-$	< 3.0	$\times 10^{-3}$	CL=90%	2592
$a_1(1260)^+ a_1(1260)^-$, $a_1^+ \rightarrow 2\pi^+ \pi^-$, $a_1^- \rightarrow 2\pi^- \pi^+$	(1.18 \pm 0.31)	$\times 10^{-5}$		2336
$\pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^- \pi^0$	< 1.1	%	CL=90%	2572

Baryon modes

$p \bar{p}$	(1.25 \pm 0.32)	$\times 10^{-8}$		2467
$p \bar{p} \pi^+ \pi^-$	(2.87 \pm 0.19)	$\times 10^{-6}$		2406
$p \bar{p} K^+ \pi^-$	(6.3 \pm 0.5)	$\times 10^{-6}$		2306
$p \bar{p} K^0$	(2.66 \pm 0.32)	$\times 10^{-6}$		2347
$\Theta(1540)^+ \bar{p}$, $\Theta^+ \rightarrow p K_S^0$	[zzz] < 5	$\times 10^{-8}$	CL=90%	2318
$f_J(2220) K^0$, $f_J \rightarrow p \bar{p}$	< 4.5	$\times 10^{-7}$	CL=90%	2135
$p \bar{p} K^*(892)^0$	(1.24 $_{-0.25}^{+0.28}$)	$\times 10^{-6}$		2216
$f_J(2220) K_0^*$, $f_J \rightarrow p \bar{p}$	< 1.5	$\times 10^{-7}$	CL=90%	–
$p \bar{p} K^+ K^-$	(1.21 \pm 0.32)	$\times 10^{-7}$		2179
$p \bar{p} \pi^0$	(5.0 \pm 1.9)	$\times 10^{-7}$		2440
$p \bar{p} \bar{p} \bar{p}$	< 2.0	$\times 10^{-7}$	CL=90%	1735
$p \bar{\Lambda} \pi^-$	(3.14 \pm 0.29)	$\times 10^{-6}$		2401
$p \bar{\Lambda} \pi^- \gamma$	< 6.5	$\times 10^{-7}$	CL=90%	2401
$p \bar{\Sigma}(1385)^-$	< 2.6	$\times 10^{-7}$	CL=90%	2363
$\Delta(1232)^+ \bar{p} + \Delta(1232)^- p$	< 1.6	$\times 10^{-6}$		–

$\Delta^0 \bar{\Lambda}$	< 9.3	$\times 10^{-7}$	CL=90%	2364
$\rho \bar{\Lambda} K^-$	< 8.2	$\times 10^{-7}$	CL=90%	2308
$\rho \bar{\Lambda} D^-$	(2.5 ± 0.4)	$\times 10^{-5}$		1765
$\rho \bar{\Lambda} D^{*-}$	(3.4 ± 0.8)	$\times 10^{-5}$		1685
$\rho \bar{\Sigma}^0 \pi^-$	< 3.8	$\times 10^{-6}$	CL=90%	2383
$\bar{\Lambda} \Lambda$	< 3.2	$\times 10^{-7}$	CL=90%	2392
$\bar{\Lambda} \Lambda K^0$	(4.8 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ 1.0 / 0.9)	$\times 10^{-6}$		2250
$\bar{\Lambda} \Lambda K^{*0}$	(2.5 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ 0.9 / 0.8)	$\times 10^{-6}$		2098
$\bar{\Lambda} \Lambda D^0$	(1.00 $\begin{smallmatrix} + \\ - \end{smallmatrix}$ 0.30 / 0.26)	$\times 10^{-5}$		1662
$D^0 \Sigma^0 \bar{\Lambda} + \text{c.c.}$	< 3.1	$\times 10^{-5}$	CL=90%	1611
$\Delta^0 \bar{\Delta}^0$	< 1.5	$\times 10^{-3}$	CL=90%	2335
$\Delta^{++} \bar{\Delta}^{--}$	< 1.1	$\times 10^{-4}$	CL=90%	2335
$\bar{D}^0 \rho \bar{p}$	(1.04 ± 0.07)	$\times 10^{-4}$		1863
$D_s^- \bar{\Lambda} \rho$	(2.8 ± 0.9)	$\times 10^{-5}$		1710
$\bar{D}^{*}(2007)^0 \rho \bar{p}$	(9.9 ± 1.1)	$\times 10^{-5}$		1788
$D^{*}(2010)^- \rho \bar{n}$	(1.4 ± 0.4)	$\times 10^{-3}$		1785
$D^- \rho \bar{p} \pi^+$	(3.32 ± 0.31)	$\times 10^{-4}$		1786
$D^{*}(2010)^- \rho \bar{p} \pi^+$	(4.7 ± 0.5)	$\times 10^{-4}$	S=1.2	1708
$\bar{D}^0 \rho \bar{p} \pi^+ \pi^-$	(3.0 ± 0.5)	$\times 10^{-4}$		1708
$\bar{D}^{*0} \rho \bar{p} \pi^+ \pi^-$	(1.9 ± 0.5)	$\times 10^{-4}$		1623
$\Theta_c \bar{p} \pi^+, \Theta_c \rightarrow D^- p$	< 9	$\times 10^{-6}$	CL=90%	–
$\Theta_c \bar{p} \pi^+, \Theta_c \rightarrow D^{*-} p$	< 1.4	$\times 10^{-5}$	CL=90%	–
$\bar{\Sigma}_c^- \Delta^{++}$	< 8	$\times 10^{-4}$	CL=90%	1839
$\bar{\Lambda}_c^- \rho \pi^+ \pi^-$	(1.02 ± 0.14)	$\times 10^{-3}$	S=1.3	1934
$\bar{\Lambda}_c^- \rho$	(1.54 ± 0.18)	$\times 10^{-5}$		2021
$\bar{\Lambda}_c^- \rho \pi^0$	(1.55 ± 0.19)	$\times 10^{-4}$		1982
$\bar{\Sigma}_c(2455)^- \rho$	< 2.4	$\times 10^{-5}$		–
$\bar{\Lambda}_c^- \rho \pi^+ \pi^- \pi^0$	< 5.07	$\times 10^{-3}$	CL=90%	1883
$\bar{\Lambda}_c^- \rho \pi^+ \pi^- \pi^+ \pi^-$	< 2.74	$\times 10^{-3}$	CL=90%	1821
$\bar{\Lambda}_c^- \rho \pi^+ \pi^- \text{ (nonresonant)}$	(5.5 ± 1.0)	$\times 10^{-4}$	S=1.3	1934
$\bar{\Sigma}_c(2520)^{--} \rho \pi^+$	(1.02 ± 0.18)	$\times 10^{-4}$		1860
$\bar{\Sigma}_c(2520)^0 \rho \pi^-$	< 3.1	$\times 10^{-5}$	CL=90%	1860
$\bar{\Sigma}_c(2455)^0 \rho \pi^-$	(1.08 ± 0.16)	$\times 10^{-4}$		1895
$\bar{\Sigma}_c(2455)^0 N^0, N^0 \rightarrow$ $\rho \pi^-$	(6.4 ± 1.7)	$\times 10^{-5}$		–
$\bar{\Sigma}_c(2455)^{--} \rho \pi^+$	(1.83 ± 0.24)	$\times 10^{-4}$		1895
$\Lambda_c^- \rho K^+ \pi^-$	(3.4 ± 0.7)	$\times 10^{-5}$		1786
$\bar{\Sigma}_c(2455)^{--} \rho K^+, \bar{\Sigma}_c^{--} \rightarrow$ $\bar{\Lambda}_c^- \pi^-$	(8.8 ± 2.5)	$\times 10^{-6}$		1754
$\Lambda_c^- \rho K^*(892)^0$	< 2.42	$\times 10^{-5}$	CL=90%	1647
$\Lambda_c^- \rho K^+ K^-$	(2.0 ± 0.4)	$\times 10^{-5}$		1588

$\Lambda_c^- p \phi$	<	1.0	$\times 10^{-5}$	CL=90%	1567
$\Lambda_c^- p \bar{p} p$	<	2.8	$\times 10^{-6}$		677
$\bar{\Lambda}_c^- \Lambda K^+$	(	4.8 ± 1.1	$) \times 10^{-5}$		1767
$\bar{\Lambda}_c^- \Lambda_c^+$	<	1.6	$\times 10^{-5}$	CL=95%	1319
$\bar{\Lambda}_c(2593)^- / \bar{\Lambda}_c(2625)^- p$	<	1.1	$\times 10^{-4}$	CL=90%	–
$\Xi_c^- \Lambda_c^+$	(	1.2 ± 0.8	$) \times 10^{-3}$		1147
$\Xi_c^- \Lambda_c^+, \Xi_c^- \rightarrow \Xi_c^+ \pi^- \pi^-$	(	2.4 ± 1.1	$) \times 10^{-5}$	S=1.8	1147
$\Xi_c^- \Lambda_c^+, \Xi_c^- \rightarrow \bar{p} K^+ \pi^-$	(	5.3 ± 1.7	$) \times 10^{-6}$		–
$\Lambda_c^+ \Lambda_c^- K^0$	(	4.0 ± 0.9	$) \times 10^{-4}$		732
$\Xi_c(2930)^- \Lambda_c^+, \Xi_c^- \rightarrow \Lambda_c^- K^0$	(	2.4 ± 0.6	$) \times 10^{-4}$		–

**Lepton Family number (LF) or Lepton number (L) or Baryon number (B)
violating modes, or/and $\Delta B = 1$ weak neutral current (B1) modes**

$\gamma \gamma$	B1	<	3.2	$\times 10^{-7}$	CL=90%	2640
$e^+ e^-$	B1	<	8.3	$\times 10^{-8}$	CL=90%	2640
$e^+ e^- \gamma$	B1	<	1.2	$\times 10^{-7}$	CL=90%	2640
$\mu^+ \mu^-$	B1	(	$1.1 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.4 \\ 1.3 \end{smallmatrix}$	$) \times 10^{-10}$	S=1.6	2638
$\mu^+ \mu^- \gamma$	B1	<	1.6	$\times 10^{-7}$	CL=90%	2638
$\mu^+ \mu^- \mu^+ \mu^-$	B1	<	6.9	$\times 10^{-10}$	CL=95%	2629
$SP, S \rightarrow \mu^+ \mu^-,$ $P \rightarrow \mu^+ \mu^-$	B1 [aaaa]	<	6.0	$\times 10^{-10}$	CL=95%	–
$\tau^+ \tau^-$	B1	<	2.1	$\times 10^{-3}$	CL=95%	1952
$\pi^0 \ell^+ \ell^-$	B1	<	5.3	$\times 10^{-8}$	CL=90%	2638
$\pi^0 e^+ e^-$	B1	<	8.4	$\times 10^{-8}$	CL=90%	2638
$\pi^0 \mu^+ \mu^-$	B1	<	6.9	$\times 10^{-8}$	CL=90%	2634
$\eta \ell^+ \ell^-$	B1	<	6.4	$\times 10^{-8}$	CL=90%	2611
$\eta e^+ e^-$	B1	<	1.08	$\times 10^{-7}$	CL=90%	2611
$\eta \mu^+ \mu^-$	B1	<	1.12	$\times 10^{-7}$	CL=90%	2607
$\pi^0 \nu \bar{\nu}$	B1	<	9	$\times 10^{-6}$	CL=90%	2638
$K^0 \ell^+ \ell^-$	B1 [III]	(	$3.1 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.8 \\ 0.7 \end{smallmatrix}$	$) \times 10^{-7}$		2616
$K^0 e^+ e^-$	B1	(	$1.6 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.0 \\ 0.8 \end{smallmatrix}$	$) \times 10^{-7}$		2616
$K^0 \mu^+ \mu^-$	B1	(	3.39 ± 0.34	$) \times 10^{-7}$		2612
$K^0 \nu \bar{\nu}$	B1	<	2.6	$\times 10^{-5}$	CL=90%	2616
$\rho^0 \nu \bar{\nu}$	B1	<	4.0	$\times 10^{-5}$	CL=90%	2583
$K^*(892)^0 \ell^+ \ell^-$	B1 [III]	(	$9.9 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.2 \\ 1.1 \end{smallmatrix}$	$) \times 10^{-7}$		2565
$K^*(892)^0 e^+ e^-$	B1	(	$1.03 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 0.19 \\ 0.17 \end{smallmatrix}$	$) \times 10^{-6}$		2565
$K^*(892)^0 \mu^+ \mu^-$	B1	(	9.4 ± 0.5	$) \times 10^{-7}$		2560
$\pi^+ \pi^- \mu^+ \mu^-$	B1	(	2.1 ± 0.5	$) \times 10^{-8}$		2626
$K^*(892)^0 \nu \bar{\nu}$	B1	<	1.8	$\times 10^{-5}$	CL=90%	2565
invisible	B1	<	2.4	$\times 10^{-5}$	CL=90%	–

$\nu\bar{\nu}\gamma$	$B1$	< 1.7	$\times 10^{-5}$	CL=90%	2640
$\phi\nu\bar{\nu}$	$B1$	< 1.27	$\times 10^{-4}$	CL=90%	2541
$e^{\pm}\mu^{\mp}$	LF	$[bb] < 1.0$	$\times 10^{-9}$	CL=90%	2639
$\pi^0 e^{\pm}\mu^{\mp}$	LF	< 1.4	$\times 10^{-7}$	CL=90%	2637
$K^0 e^{\pm}\mu^{\mp}$	LF	< 2.7	$\times 10^{-7}$	CL=90%	2615
$K^*(892)^0 e^+ \mu^-$	LF	< 1.6	$\times 10^{-7}$	CL=90%	2563
$K^*(892)^0 e^- \mu^+$	LF	< 1.2	$\times 10^{-7}$	CL=90%	2563
$K^*(892)^0 e^{\pm}\mu^{\mp}$	LF	< 1.8	$\times 10^{-7}$	CL=90%	2563
$e^{\pm}\tau^{\mp}$	LF	$[bb] < 2.8$	$\times 10^{-5}$	CL=90%	2341
$\mu^{\pm}\tau^{\mp}$	LF	$[bb] < 1.4$	$\times 10^{-5}$	CL=95%	2339
$\Lambda_c^+ \mu^-$	L,B	< 1.4	$\times 10^{-6}$	CL=90%	2143
$\Lambda_c^+ e^-$	L,B	< 4	$\times 10^{-6}$	CL=90%	2145

B[±]/B⁰ ADMIXTURE

CP violation

$$A_{CP}(B \rightarrow K^*(892)\gamma) = -0.003 \pm 0.011$$

$$A_{CP}(B \rightarrow s\gamma) = 0.015 \pm 0.011$$

$$A_{CP}(B \rightarrow (s+d)\gamma) = 0.010 \pm 0.031$$

$$A_{CP}(B \rightarrow X_s \ell^+ \ell^-) = 0.04 \pm 0.11$$

$$A_{CP}(B \rightarrow X_s \ell^+ \ell^-) (1.0 < q^2 < 6.0 \text{ GeV}^2/c^4) = -0.06 \pm 0.22$$

$$A_{CP}(B \rightarrow X_s \ell^+ \ell^-) (10.1 < q^2 < 12.9 \text{ or } q^2 > 14.2 \text{ GeV}^2/c^4) = 0.19 \pm 0.18$$

$$A_{CP}(B \rightarrow K^* e^+ e^-) = -0.18 \pm 0.15$$

$$A_{CP}(B \rightarrow K^* \mu^+ \mu^-) = -0.03 \pm 0.13$$

$$A_{CP}(B \rightarrow K^* \ell^+ \ell^-) = -0.04 \pm 0.07$$

$$A_{CP}(B \rightarrow \eta \text{ anything}) = -0.13^{+0.04}_{-0.05}$$

$$\Delta A_{CP}(X_s \gamma) = A_{CP}(B^{\pm} \rightarrow X_s \gamma) - A_{CP}(B^0 \rightarrow X_s \gamma) = 0.041 \pm 0.023$$

$$\bar{A}_{CP}(B \rightarrow X_s \gamma) = (A_{CP}(B^+ \rightarrow X_s \gamma) + A_{CP}(B^0 \rightarrow X_s \gamma))/2 = 0.009 \pm 0.012$$

$$\Delta A_{CP}(B \rightarrow K^* \gamma) = A_{CP}(B^+ \rightarrow K^{*+} \gamma) - A_{CP}(B^0 \rightarrow K^{*0} \gamma) = 0.024 \pm 0.028$$

$$\bar{A}_{CP}(B \rightarrow K^* \gamma) = (A_{CP}(B^+ \rightarrow K^{*+} \gamma) + A_{CP}(B^0 \rightarrow K^{*0} \gamma))/2 = -0.001 \pm 0.014$$

The branching fraction measurements are for an admixture of B mesons at the $\Upsilon(4S)$. The values quoted assume that $B(\Upsilon(4S) \rightarrow B\bar{B}) = 100\%$.

For inclusive branching fractions, e.g., $B \rightarrow D^\pm$ anything, the treatment of multiple D 's in the final state must be defined. One possibility would be to count the number of events with one-or-more D 's and divide by the total number of B 's. Another possibility would be to count the total number of D 's and divide by the total number of B 's, which is the definition of average multiplicity. The two definitions are identical if only one D is allowed in the final state. Even though the "one-or-more" definition seems sensible, for practical reasons inclusive branching fractions are almost always measured using the multiplicity definition. For heavy final state particles, authors call their results inclusive branching fractions while for light particles some authors call their results multiplicities. In the B sections, we list all results as inclusive branching fractions, adopting a multiplicity definition. This means that inclusive branching fractions can exceed 100% and that inclusive partial widths can exceed total widths, just as inclusive cross sections can exceed total cross section.

\bar{B} modes are charge conjugates of the modes below. Reactions indicate the weak decay vertex and do not include mixing.

B DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level(MeV/c)	p
Semileptonic and leptonic modes			
$\ell^+ \nu_\ell$ anything	[III,bbaa] (10.86 ± 0.16) %		—
$D^- \ell^+ \nu_\ell$ anything	[III] (2.6 ± 0.5) %		—
$\bar{D}^0 \ell^+ \nu_\ell$ anything	[III] (7.3 ± 1.5) %		—
$\bar{D} \ell^+ \nu_\ell$	(2.42 ± 0.12) %		2310
$D^{*-} \ell^+ \nu_\ell$ anything	[ccaa] (6.7 ± 1.3) × 10 ⁻³		—
$D^* \ell^+ \nu_\ell$	[ddaa] (4.95 ± 0.11) %		2257
$\bar{D}^{**} \ell^+ \nu_\ell$	[III,eeaa] (2.7 ± 0.7) %		—
$\bar{D}_1(2420) \ell^+ \nu_\ell$ anything	(3.8 ± 1.3) × 10 ⁻³	S=2.4	—
$D \pi \ell^+ \nu_\ell$ anything + $D^* \pi \ell^+ \nu_\ell$ anything	(2.6 ± 0.5) %	S=1.5	—
$D \pi \ell^+ \nu_\ell$ anything	(1.5 ± 0.6) %		—
$D^* \pi \ell^+ \nu_\ell$ anything	(1.9 ± 0.4) %		—
$\bar{D}_2^*(2460) \ell^+ \nu_\ell$ anything	(4.4 ± 1.6) × 10 ⁻³		—
$D^{*-} \pi^+ \ell^+ \nu_\ell$ anything	(1.00 ± 0.34) %		—
$\bar{D} \pi^+ \pi^- \ell^+ \nu_\ell$	(1.62 ± 0.32) × 10 ⁻³		2301
$\bar{D}^* \pi^+ \pi^- \ell^+ \nu_\ell$	(9.4 ± 3.2) × 10 ⁻⁴		2247
$D_s^- \ell^+ \nu_\ell$ anything	[III] < 7 × 10 ⁻³	CL=90%	—
$D_s^- \ell^+ \nu_\ell K^+$ anything	[III] < 5 × 10 ⁻³	CL=90%	—
$D_s^- \ell^+ \nu_\ell K^0$ anything	[III] < 7 × 10 ⁻³	CL=90%	—
$X_c \ell^+ \nu_\ell$	(10.65 ± 0.16) %		—
$X_u \ell^+ \nu_\ell$	(2.13 ± 0.30) × 10 ⁻³		—
$K^+ \ell^+ \nu_\ell$ anything	[III] (6.3 ± 0.6) %		—

$K^- \ell^+ \nu_\ell$ anything	[///]	(10 ± 4) × 10 ⁻³		—
$K^0 / \bar{K}^0 \ell^+ \nu_\ell$ anything	[///]	(4.6 ± 0.5) %		—
$\bar{D} \tau^+ \nu_\tau$		(9.9 ± 1.2) × 10 ⁻³		1911
$D^* \tau^+ \nu_\tau$		(1.50 ± 0.08) %		1838

D, D*, or D_s modes

D^\pm anything		(23.1 ± 1.2) %		—
D^0 / \bar{D}^0 anything		(61.5 ± 2.9) %	S=1.3	—
$D^*(2010)^\pm$ anything		(22.5 ± 1.5) %		—
$D^*(2007)^0$ anything		(26.0 ± 2.7) %		—
D_s^\pm anything	[bb]	(8.3 ± 0.8) %		—
$D_s^{*\pm}$ anything		(6.3 ± 1.0) %		—
$D_s^{*\pm} \bar{D}^*(*)$		(3.4 ± 0.6) %		—
$\bar{D} D_{s0}(2317)$	seen			1605
$\bar{D} D_{sJ}(2457)$	seen			—
$D^*(*) \bar{D}^*(*) K^0 + D^*(*) \bar{D}^*(*) K^\pm$	[bb,ffaa]	(7.1 + 2.7 / - 1.7) %		—
$b \rightarrow c \bar{c} s$		(22 ± 4) %		—
$D_s^*(*) \bar{D}^*(*)$	[bb,ffaa]	(3.9 ± 0.4) %		—
$D^* D^*(2010)^\pm$	[bb]	< 5.9 × 10 ⁻³	CL=90%	1711
$DD^*(2010)^\pm + D^* D^\pm$	[bb]	< 5.5 × 10 ⁻³	CL=90%	—
DD^\pm	[bb]	< 3.1 × 10 ⁻³	CL=90%	1866
$D_s^*(*)^\pm \bar{D}^*(*) X(n\pi^\pm)$	[bb,ffaa]	(9 + 5 / - 4) %		—
$D^*(2010)\gamma$		< 1.1 × 10 ⁻³	CL=90%	2257
$D_s^+ \pi^-, D_s^{*+} \pi^-, D_s^+ \rho^-, D_s^{*+} \rho^-, D_s^+ \pi^0, D_s^{*+} \pi^0, D_s^+ \eta, D_s^{*+} \eta, D_s^+ \rho^0, D_s^{*+} \rho^0, D_s^+ \omega, D_s^{*+} \omega$	[bb]	< 4 × 10 ⁻⁴	CL=90%	—
$D_{s1}(2536)^+$ anything		< 9.5 × 10 ⁻³	CL=90%	—

Charmonium modes

$J/\psi(1S)$ anything		(1.094 ± 0.032) %	S=1.1	—
$J/\psi(1S)$ (direct) anything		(7.8 ± 0.4) × 10 ⁻³	S=1.1	—
$\psi(2S)$ anything		(3.07 ± 0.21) × 10 ⁻³		—
$\chi_{c1}(1P)$ anything		(3.55 ± 0.27) × 10 ⁻³	S=1.3	—
$\chi_{c1}(1P)$ (direct) anything		(3.08 ± 0.19) × 10 ⁻³		—
$\chi_{c2}(1P)$ anything		(10.0 ± 1.7) × 10 ⁻⁴	S=1.6	—
$\chi_{c2}(1P)$ (direct) anything		(7.5 ± 1.1) × 10 ⁻⁴		—
$\eta_c(1S)$ anything		< 9 × 10 ⁻³	CL=90%	—
$K \chi_{c1}(3872), \chi_{c1} \rightarrow D^0 \bar{D}^0 \pi^0$		(1.2 ± 0.4) × 10 ⁻⁴		1141

$K \chi_{c1}(3872), \chi_{c1} \rightarrow D^{*0} D^0$	(8.0 ± 2.2) × 10 ⁻⁵	1141
$K X(3940), X \rightarrow D^{*0} D^0$	< 6.7 × 10 ⁻⁵ CL=90%	1084
$K X(3915), X \rightarrow \omega J/\psi$ [ggaa]	(7.1 ± 3.4) × 10 ⁻⁵	1103

K or K* modes

K^\pm anything	[bb] (78.9 ± 2.5) %	—
K^+ anything	(66 ± 5) %	—
K^- anything	(13 ± 4) %	—
K^0/\bar{K}^0 anything	[bb] (64 ± 4) %	—
$K^*(892)^\pm$ anything	(18 ± 6) %	—
$K^*(892)^0/\bar{K}^*(892)^0$ anything	[bb] (14.6 ± 2.6) %	—
$K^*(892)\gamma$	(4.2 ± 0.6) × 10 ⁻⁵	2565
$\eta K \gamma$	(8.5 $\begin{smallmatrix} + 1.8 \\ - 1.6 \end{smallmatrix}$) × 10 ⁻⁶	2588
$K_1(1400)\gamma$	< 1.27 × 10 ⁻⁴ CL=90%	2454
$K_2^*(1430)\gamma$	(1.7 $\begin{smallmatrix} + 0.6 \\ - 0.5 \end{smallmatrix}$) × 10 ⁻⁵	2447
$K_2(1770)\gamma$	< 1.2 × 10 ⁻³ CL=90%	2342
$K_3^*(1780)\gamma$	< 3.7 × 10 ⁻⁵ CL=90%	2341
$K_4^*(2045)\gamma$	< 1.0 × 10 ⁻³ CL=90%	2243
$K \eta'(958)$	(8.3 ± 1.1) × 10 ⁻⁵	2528
$K^*(892)\eta'(958)$	(4.1 ± 1.1) × 10 ⁻⁶	2472
$K \eta$	< 5.2 × 10 ⁻⁶ CL=90%	2588
$K^*(892)\eta$	(1.8 ± 0.5) × 10 ⁻⁵	2534
$K \phi \phi$	(2.3 ± 0.9) × 10 ⁻⁶	2306
$\bar{b} \rightarrow \bar{s} \gamma$	(3.49 ± 0.19) × 10 ⁻⁴	—
$\bar{b} \rightarrow \bar{d} \gamma$	(9.2 ± 3.0) × 10 ⁻⁶	—
$\bar{b} \rightarrow \bar{s}$ gluon	< 6.8 % CL=90%	—
η anything	(2.6 $\begin{smallmatrix} + 0.5 \\ - 0.8 \end{smallmatrix}$) × 10 ⁻⁴	—
η' anything	(4.2 ± 0.9) × 10 ⁻⁴	—
K^+ gluon (charmless)	< 1.87 × 10 ⁻⁴ CL=90%	—
K^0 gluon (charmless)	(1.9 ± 0.7) × 10 ⁻⁴	—

Light unflavored meson modes

$\rho \gamma$	(1.39 ± 0.25) × 10 ⁻⁶	S=1.2	2583
$\rho/\omega \gamma$	(1.30 ± 0.23) × 10 ⁻⁶	S=1.2	—
π^\pm anything	[bb,hhaa] (358 ± 7) %	—	
π^0 anything	(235 ± 11) %	—	
η anything	(17.6 ± 1.6) %	—	
ρ^0 anything	(21 ± 5) %	—	
ω anything	< 81 % CL=90%	—	
ϕ anything	(3.43 ± 0.12) %	—	
$\phi K^*(892)$	< 2.2 × 10 ⁻⁵ CL=90%	2460	
π^+ gluon (charmless)	(3.7 ± 0.8) × 10 ⁻⁴	—	

Baryon modes

$\Lambda_c^+ / \bar{\Lambda}_c^-$ anything	(	3.6 ± 0.4) %		—
Λ_c^+ anything	<	1.3	%	CL=90%	—
$\bar{\Lambda}_c^-$ anything	<	7	%	CL=90%	—
$\bar{\Lambda}_c^- \ell^+$ anything	<	9	$\times 10^{-4}$	CL=90%	—
$\bar{\Lambda}_c^- e^+$ anything	<	1.8	$\times 10^{-3}$	CL=90%	—
$\bar{\Lambda}_c^- \mu^+$ anything	< —	1.4	$\times 10^{-3}$	CL=90%	—
$\bar{\Lambda}_c^- p$ anything	(	2.04 ± 0.33) %		—
$\bar{\Lambda}_c^- p e^+ \nu_e$	<	8	$\times 10^{-4}$	CL=90%	2021
$\bar{\Sigma}_c^{--}$ anything	(	3.3 ± 1.7	) $\times 10^{-3}$		—
$\bar{\Sigma}_c^-$ anything	<	8	$\times 10^{-3}$	CL=90%	—
$\bar{\Sigma}_c^0$ anything	(	3.7 ± 1.7	) $\times 10^{-3}$		—
$\bar{\Sigma}_c^0 N (N = p \text{ or } n)$	<	1.2	$\times 10^{-3}$	CL=90%	1938
Ξ_c^0 anything, $\Xi_c^0 \rightarrow \Xi^- \pi^+$	(	1.93 ± 0.30	) $\times 10^{-4}$	S=1.1	—
$\Xi_c^+, \Xi_c^+ \rightarrow \Xi^- \pi^+ \pi^+$	(	4.5 $\begin{smallmatrix} + 1.3 \\ - 1.2 \end{smallmatrix}$	) $\times 10^{-4}$		—
p/\bar{p} anything	[bb]	(	8.0 ± 0.4) %	—
p/\bar{p} (direct) anything	[bb]	(	5.5 ± 0.5) %	—
$\bar{p} e^+ \nu_e$ anything	<	5.9	$\times 10^{-4}$	CL=90%	—
$\Lambda/\bar{\Lambda}$ anything	[bb]	(	4.0 ± 0.5) %	—
Λ anything		seen			—
$\bar{\Lambda}$ anything		seen			—
$\Xi^- / \bar{\Xi}^+$ anything	[bb]	(	2.7 ± 0.6	) $\times 10^{-3}$	—
baryons anything	(	6.8 ± 0.6) %		—
$p\bar{p}$ anything	(	2.47 ± 0.23) %		—
$\Lambda\bar{p}/\bar{\Lambda}p$ anything	[bb]	(	2.5 ± 0.4) %	—
$\Lambda\bar{\Lambda}$ anything	<	5	$\times 10^{-3}$	CL=90%	—

Lepton Family number (LF) violating modes or $\Delta B = 1$ weak neutral current (B1) modes

se^+e^-	B1	(	6.7 ± 1.7	) $\times 10^{-6}$	S=2.0	—
$s\mu^+\mu^-$	B1	(	4.3 ± 1.0	) $\times 10^{-6}$		—
$sl^+\ell^-$	B1	[///]	(5.8 ± 1.3) $\times 10^{-6}$	S=1.8	—
$\pi\ell^+\ell^-$	B1	<	5.9	$\times 10^{-8}$	CL=90%	2638	
πe^+e^-	B1	<	1.10	$\times 10^{-7}$	CL=90%	2638	
$\pi\mu^+\mu^-$	B1	<	5.0	$\times 10^{-8}$	CL=90%	2634	
Ke^+e^-	B1	(	4.4 ± 0.6	) $\times 10^{-7}$		2617
$K^*(892)e^+e^-$	B1	(	1.19 ± 0.20	) $\times 10^{-6}$	S=1.2	2565
$K\mu^+\mu^-$	B1	(	4.4 ± 0.4	) $\times 10^{-7}$		2612
$K^*(892)\mu^+\mu^-$	B1	(	1.06 ± 0.09	) $\times 10^{-6}$		2560
$K\ell^+\ell^-$	B1	(	4.8 ± 0.4	) $\times 10^{-7}$		2617
$K^*(892)\ell^+\ell^-$	B1	(	1.05 ± 0.10	) $\times 10^{-6}$		2565
$K\nu\bar{\nu}$	B1	<	1.6	$\times 10^{-5}$	CL=90%	2617	

$K^* \nu \bar{\nu}$	$B1$	<	2.7	$\times 10^{-5}$	CL=90%	—	
$\pi \nu \bar{\nu}$	$B1$	<	8	$\times 10^{-6}$	CL=90%	2638	
$\rho \nu \bar{\nu}$	$B1$	<	2.8	$\times 10^{-5}$	CL=90%	2583	
$s e^\pm \mu^\mp$	LF	[bb]	<	2.2	$\times 10^{-5}$	CL=90%	—
$\pi e^\pm \mu^\mp$	LF	<	9.2	$\times 10^{-8}$	CL=90%	2637	
$\rho e^\pm \mu^\mp$	LF	<	3.2	$\times 10^{-6}$	CL=90%	2582	
$K e^\pm \mu^\mp$	LF	<	3.8	$\times 10^{-8}$	CL=90%	2616	
$K^*(892) e^\pm \mu^\mp$	LF	<	5.1	$\times 10^{-7}$	CL=90%	2563	

$B^\pm/B^0/B_s^0/b$ -baryon ADMIXTURE

These measurements are for an admixture of bottom particles at high energy (LHC, LEP, Tevatron, $S\bar{p}\bar{p}S$).

$$\text{Mean life } \tau = (1.5668 \pm 0.0028) \times 10^{-12} \text{ s}$$

$$\text{Mean life } \tau = (1.72 \pm 0.10) \times 10^{-12} \text{ s} \quad \text{Charged } b\text{-hadron admixture}$$

$$\text{Mean life } \tau = (1.58 \pm 0.14) \times 10^{-12} \text{ s} \quad \text{Neutral } b\text{-hadron admixture}$$

$$\tau_{\text{charged } b\text{-hadron}}/\tau_{\text{neutral } b\text{-hadron}} = 1.09 \pm 0.13$$

$$|\Delta\tau_b|/\tau_{b,\bar{b}} = -0.001 \pm 0.014$$

The branching fraction measurements are for an admixture of B mesons and baryons at energies above the $\Upsilon(4S)$. Only the highest energy results (LHC, LEP, Tevatron, $S\bar{p}\bar{p}S$) are used in the branching fraction averages. In the following, we assume that the production fractions are the same at the LHC, LEP, and at the Tevatron.

For inclusive branching fractions, *e.g.*, $B \rightarrow D^\pm$ anything, the values usually are multiplicities, not branching fractions. They can be greater than one.

The modes below are listed for a \bar{b} initial state. b modes are their charge conjugates. Reactions indicate the weak decay vertex and do not include mixing.

\bar{b} DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
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PRODUCTION FRACTIONS

The production fractions for weakly decaying b -hadrons at high energy have been calculated from the best values of mean lives, mixing parameters, and branching fractions in this edition by the Heavy Flavor Averaging Group (HFLAV) as described in the note “ B^0 - \bar{B}^0 Mixing” in the B^0 Particle Listings. We no longer provide world averages of the b -hadron production fractions, where results from LEP, Tevatron and LHC are averaged together; indeed the available data (from CDF and LHCb) shows that the fractions depend on the kinematics (in particular the p_T) of the

produced b hadron. Hence we would like to list the fractions in Z decays instead, which are well-defined physics observables. The production fractions in $p\bar{p}$ collisions at the Tevatron are also listed at the end of the section. Values assume

$$\begin{aligned} B(\bar{b} \rightarrow B^+) &= B(\bar{b} \rightarrow B^0) \\ B(\bar{b} \rightarrow B^+) + B(\bar{b} \rightarrow B^0) + B(\bar{b} \rightarrow B_s^0) + B(b \rightarrow b\text{-baryon}) &= 100\%. \end{aligned}$$

The correlation coefficients between production fractions are also reported:

$$\begin{aligned} \text{cor}(B_s^0, b\text{-baryon}) &= 0.064 \\ \text{cor}(B_s^0, B^\pm=B^0) &= -0.633 \\ \text{cor}(b\text{-baryon}, B^\pm=B^0) &= -0.813. \end{aligned}$$

The notation for production fractions varies in the literature (f_d , d_{B^0} , $f(b \rightarrow \bar{B}^0)$, $\text{Br}(b \rightarrow \bar{B}^0)$). We use our own branching fraction notation here, $B(\bar{b} \rightarrow B^0)$.

Note these production fractions are b -hadronization fractions, not the conventional branching fractions of b -quark to a B -hadron, which may have considerable dependence on the initial and final state kinematic and production environment.

B^+	(40.8 ± 0.7) %	—
B^0	(40.8 ± 0.7) %	—
B_s^0	(10.0 ± 0.8) %	—
b -baryon	(8.4 ± 1.1) %	—

DECAY MODES

Semileptonic and leptonic modes

ν anything	(23.1 ± 1.5) %	—
$l^+ \nu_l$ anything	[III] (10.69 ± 0.22) %	—
$e^+ \nu_e$ anything	(10.86 ± 0.35) %	—
$\mu^+ \nu_\mu$ anything	(10.95 ^{+0.29} _{-0.25}) %	—
$D^- l^+ \nu_l$ anything	[III] (2.2 ± 0.4) %	S=1.9 —
$D^- \pi^+ l^+ \nu_l$ anything	(4.9 ± 1.9) × 10 ⁻³	—
$D^- \pi^- l^+ \nu_l$ anything	(2.6 ± 1.6) × 10 ⁻³	—
$\bar{D}^0 l^+ \nu_l$ anything	[III] (6.79 ± 0.34) %	—
$\bar{D}^0 \pi^- l^+ \nu_l$ anything	(1.07 ± 0.27) %	—
$\bar{D}^0 \pi^+ l^+ \nu_l$ anything	(2.3 ± 1.6) × 10 ⁻³	—
$D^{*-} l^+ \nu_l$ anything	[III] (2.75 ± 0.19) %	—
$D^{*-} \pi^- l^+ \nu_l$ anything	(6 ± 7) × 10 ⁻⁴	—
$D^{*-} \pi^+ l^+ \nu_l$ anything	(4.8 ± 1.0) × 10 ⁻³	—
$\bar{D}_j^0 l^+ \nu_l$ anything × $B(\bar{D}_j^0 \rightarrow D^{*+} \pi^-)$	[III, iiaa] (2.6 ± 0.9) × 10 ⁻³	—

$D_j^- \ell^+ \nu_\ell$ anything \times	[III, <i>iiaa</i>]	$(7.0 \pm 2.3) \times 10^{-3}$	—
$B(D_j^- \rightarrow D^0 \pi^-)$			
$\bar{D}_2^*(2460)^0 \ell^+ \nu_\ell$ anything	<	1.4×10^{-3}	CL=90% —
$\times B(\bar{D}_2^*(2460)^0 \rightarrow$			
$D^{*-} \pi^+)$			
$D_2^*(2460)^- \ell^+ \nu_\ell$ anything		$(4.2 \begin{smallmatrix} + 1.5 \\ - 1.8 \end{smallmatrix}) \times 10^{-3}$	—
$\times B(D_2^*(2460)^- \rightarrow$			
$D^0 \pi^-)$			
$\bar{D}_2^*(2460)^0 \ell^+ \nu_\ell$ anything		$(1.6 \pm 0.8) \times 10^{-3}$	—
$\times B(\bar{D}_2^*(2460)^0 \rightarrow$			
$D^- \pi^+)$			
charmless $\ell \bar{\nu}_\ell$	[III]	$(1.7 \pm 0.5) \times 10^{-3}$	—
$\tau^+ \nu_\tau$ anything		$(2.41 \pm 0.23) \%$	—
$D^{*-} \tau \nu_\tau$ anything		$(9 \pm 4) \times 10^{-3}$	—
$\bar{c} \rightarrow \ell^- \bar{\nu}_\ell$ anything	[III]	$(8.02 \pm 0.19) \%$	—
$c \rightarrow \ell^+ \nu$ anything		$(1.6 \begin{smallmatrix} + 0.4 \\ - 0.5 \end{smallmatrix}) \%$	—

Charmed meson and baryon modes

\bar{D}^0 anything		$(58.7 \pm 2.8) \%$	—
$D^0 D_s^\pm$ anything	[<i>bb</i>]	$(9.1 \begin{smallmatrix} + 4.0 \\ - 2.8 \end{smallmatrix}) \%$	—
$D^\mp D_s^\pm$ anything	[<i>bb</i>]	$(4.0 \begin{smallmatrix} + 2.3 \\ - 1.8 \end{smallmatrix}) \%$	—
$\bar{D}^0 D^0$ anything	[<i>bb</i>]	$(5.1 \begin{smallmatrix} + 2.0 \\ - 1.8 \end{smallmatrix}) \%$	—
$D^0 D^\pm$ anything	[<i>bb</i>]	$(2.7 \begin{smallmatrix} + 1.8 \\ - 1.6 \end{smallmatrix}) \%$	—
$D^\pm D^\mp$ anything	[<i>bb</i>]	< 9×10^{-3}	CL=90% —
D^- anything		$(22.7 \pm 1.6) \%$	—
$D^*(2010)^+$ anything		$(17.3 \pm 2.0) \%$	—
$D_1(2420)^0$ anything		$(5.0 \pm 1.5) \%$	—
$D^*(2010)^\mp D_s^\pm$ anything	[<i>bb</i>]	$(3.3 \begin{smallmatrix} + 1.6 \\ - 1.3 \end{smallmatrix}) \%$	—
$D^0 D^*(2010)^\pm$ anything	[<i>bb</i>]	$(3.0 \begin{smallmatrix} + 1.1 \\ - 0.9 \end{smallmatrix}) \%$	—
$D^*(2010)^\pm D^\mp$ anything	[<i>bb</i>]	$(2.5 \begin{smallmatrix} + 1.2 \\ - 1.0 \end{smallmatrix}) \%$	—
$D^*(2010)^\pm D^*(2010)^\mp$ anything	[<i>bb</i>]	$(1.2 \pm 0.4) \%$	—
$\bar{D} D$ anything		$(10 \begin{smallmatrix} + 11 \\ - 10 \end{smallmatrix}) \%$	—
$D_2^*(2460)^0$ anything		$(4.7 \pm 2.7) \%$	—
D_s^- anything		$(14.7 \pm 2.1) \%$	—
D_s^+ anything		$(10.1 \pm 3.1) \%$	—
Λ_c^+ anything		$(7.7 \pm 1.1) \%$	—
\bar{c}/c anything	[<i>hhaa</i>]	$(116.2 \pm 3.2) \%$	—

Charmonium modes

$J/\psi(1S)$ anything	(1.16 ± 0.10) %	—
$\psi(2S)$ anything	(2.86 ± 0.28) × 10 ⁻³	—
$\chi_{c0}(1P)$ anything	(1.5 ± 0.6) %	—
$\chi_{c1}(1P)$ anything	(1.4 ± 0.4) %	—
$\chi_{c2}(1P)$ anything	(6.2 ± 2.9) × 10 ⁻³	—
$\chi_c(2P)$ anything, $\chi_c \rightarrow \phi\phi$	< 2.8 × 10 ⁻⁷ CL=95%	—
$\eta_c(1S)$ anything	(4.5 ± 1.9) %	—
$\eta_c(2S)$ anything, $\eta_c \rightarrow \phi\phi$	(3.2 ± 1.7) × 10 ⁻⁶	—
$\chi_{c1}(3872)$ anything, $\chi_{c1} \rightarrow \phi\phi$	< 4.5 × 10 ⁻⁷ CL=95%	—
$X(3915)$ anything, $X \rightarrow \phi\phi$	< 3.1 × 10 ⁻⁷ CL=95%	—

K or K* modes

$\bar{S}\gamma$	(3.1 ± 1.1) × 10 ⁻⁴	—
$\bar{S}\nu\nu$	$B1$ < 6.4 × 10 ⁻⁴ CL=90%	—
K^\pm anything	(74 ± 6) %	—
K_S^0 anything	(29.0 ± 2.9) %	—

Pion modes

π^\pm anything	(397 ± 21) %	—
π^0 anything	[hhaa] (278 ± 60) %	—
ϕ anything	(2.82 ± 0.23) %	—

Baryon modes

p/\bar{p} anything	(13.1 ± 1.1) %	—
$\Lambda/\bar{\Lambda}$ anything	(5.9 ± 0.6) %	—
b -baryon anything	(10.2 ± 2.8) %	—

Other modes

charged anything	[hhaa] (497 ± 7) %	—
hadron ⁺ hadron ⁻	(1.7 \pm $\frac{1.0}{0.7}$) × 10 ⁻⁵	—
charmless	(7 ± 21) × 10 ⁻³	—

$\Delta B = 1$ weak neutral current ($B1$) modes

$\mu^+ \mu^-$ anything	$B1$ < 3.2 × 10 ⁻⁴ CL=90%	—
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$$I(J^P) = \frac{1}{2}(1^-)$$

I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

$$\text{Mass } m_{B^*} = 5324.70 \pm 0.21 \text{ MeV}$$

$$m_{B^*} - m_B = 45.21 \pm 0.21 \text{ MeV}$$

$$m_{B^{*+}} - m_{B^+} = 45.37 \pm 0.21 \text{ MeV}$$

B^* DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B\gamma$	seen	45

 $B_1(5721)^+$

$$I(J^P) = \frac{1}{2}(1^+)$$

I, J, P need confirmation.

$$\text{Mass } m = 5725.9^{+2.5}_{-2.7} \text{ MeV}$$

$$m_{B_1^+} - m_{B^{*0}} = 401.2^{+2.4}_{-2.7} \text{ MeV}$$

$$\text{Full width } \Gamma = 31 \pm 6 \text{ MeV} \quad (S = 1.1)$$

$B_1(5721)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^{*0}\pi^+$	seen	363

 $B_1(5721)^0$

$$I(J^P) = \frac{1}{2}(1^+)$$

I, J, P need confirmation.

$$B_1(5721)^0 \text{ MASS} = 5726.1 \pm 1.3 \text{ MeV} \quad (S = 1.2)$$

$$m_{B_1^0} - m_{B^+} = 446.7 \pm 1.3 \text{ MeV} \quad (S = 1.2)$$

$$m_{B_1^0} - m_{B^{*+}} = 401.4 \pm 1.2 \text{ MeV} \quad (S = 1.2)$$

$$\text{Full width } \Gamma = 27.5 \pm 3.4 \text{ MeV} \quad (S = 1.1)$$

$B_1(5721)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^{*+}\pi^-$	seen	363

 $B_2^*(5747)^+$

$$I(J^P) = \frac{1}{2}(2^+)$$

I, J, P need confirmation.

$$\text{Mass } m = 5737.2 \pm 0.7 \text{ MeV}$$

$$m_{B_2^{*+}} - m_{B^0} = 457.5 \pm 0.7 \text{ MeV}$$

$$\text{Full width } \Gamma = 20 \pm 5 \text{ MeV} \quad (S = 2.2)$$

$B_2^*(5747)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^0\pi^+$	seen	418
$B^{*0}\pi^+$	seen	374

$B_2^*(5747)^0$

$$I(J^P) = \frac{1}{2}(2^+)$$

I, J, P need confirmation.

$$B_2^*(5747)^0 \text{ MASS} = 5739.5 \pm 0.7 \text{ MeV} \quad (S = 1.4)$$

$$m_{B_2^{*0}} - m_{B_1^0} = 13.4 \pm 1.4 \text{ MeV} \quad (S = 1.3)$$

$$m_{B_2^{*0}} - m_{B^+} = 460.2 \pm 0.6 \text{ MeV} \quad (S = 1.4)$$

$$\text{Full width } \Gamma = 24.2 \pm 1.7 \text{ MeV}$$

$B_2^*(5747)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^+ \pi^-$	seen	421
$B^{*+} \pi^-$	seen	376

 $B_J(5970)^+$

$$I(J^P) = \frac{1}{2}(??)$$

I, J, P need confirmation.

$$\text{Mass } m = 5964 \pm 5 \text{ MeV}$$

$$m_{B_J(5970)^+} - m_{B^0} = 685 \pm 5 \text{ MeV}$$

$$\text{Full width } \Gamma = 62 \pm 20 \text{ MeV}$$

$B_J(5970)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^0 \pi^+$	possibly seen	632
$B^{*0} \pi^+$	seen	591

 $B_J(5970)^0$

$$I(J^P) = \frac{1}{2}(??)$$

I, J, P need confirmation.

$$\text{Mass } m = 5971 \pm 5 \text{ MeV}$$

$$m_{B_J(5970)^0} - m_{B^+} = 691 \pm 5 \text{ MeV}$$

$$\text{Full width } \Gamma = 81 \pm 12 \text{ MeV}$$

$B_J(5970)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^+ \pi^-$	possibly seen	638
$B^{*+} \pi^-$	seen	596

BOTTOM, STRANGE MESONS

($B = \pm 1, S = \mp 1$)

$$B_s^0 = s\bar{b}, \bar{B}_s^0 = \bar{s}b, \quad \text{similarly for } B_s^{*'}s$$

B_s^0

$$I(J^P) = 0(0^-)$$

I, J, P need confirmation. Quantum numbers shown are quark-model predictions.

$$\text{Mass } m_{B_s^0} = 5366.88 \pm 0.14 \text{ MeV}$$

$$m_{B_s^0} - m_B = 87.38 \pm 0.16 \text{ MeV}$$

$$\text{Mean life } \tau = (1.515 \pm 0.004) \times 10^{-12} \text{ s}$$

$$c\tau = 454.2 \text{ } \mu\text{m}$$

$$\Delta\Gamma_{B_s^0} = \Gamma_{B_{sL}^0} - \Gamma_{B_{sH}^0} = (0.085 \pm 0.004) \times 10^{12} \text{ s}^{-1}$$

B_s^0 - \bar{B}_s^0 mixing parameters

$$\begin{aligned} \Delta m_{B_s^0} &= m_{B_{sH}^0} - m_{B_{sL}^0} = (17.749 \pm 0.020) \times 10^{12} \hbar \text{ s}^{-1} \\ &= (1.1683 \pm 0.0013) \times 10^{-8} \text{ MeV} \end{aligned}$$

$$x_s = \Delta m_{B_s^0} / \Gamma_{B_s^0} = 26.89 \pm 0.07$$

$$\chi_s = 0.499312 \pm 0.000004$$

CP violation parameters in B_s^0

$$\text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2) = (-0.15 \pm 0.70) \times 10^{-3}$$

$$C_{KK}(B_s^0 \rightarrow K^+ K^-) = 0.14 \pm 0.11$$

$$S_{KK}(B_s^0 \rightarrow K^+ K^-) = 0.30 \pm 0.13$$

$$r_B(B_s^0 \rightarrow D_s^\mp K^\pm) = 0.37_{-0.09}^{+0.10}$$

$$\delta_B(B_s^0 \rightarrow D_s^\pm K^\mp) = (358 \pm 14)^\circ$$

$$\text{CP Violation phase } \beta_s = (2.55 \pm 1.15) \times 10^{-2} \text{ rad}$$

$$|\lambda| (B_s^0 \rightarrow J/\psi(1S)\phi) = 1.012 \pm 0.017$$

$$|\lambda| = 0.999 \pm 0.017$$

$$A, \text{ CP violation parameter} = -0.75 \pm 0.12$$

$$C, \text{ CP violation parameter} = 0.19 \pm 0.06$$

$$S, \text{ CP violation parameter} = 0.17 \pm 0.06$$

$$A_{CP}^L(B_s \rightarrow J/\psi \bar{K}^*(892)^0) = -0.05 \pm 0.06$$

$$A_{CP}^{\parallel}(B_s \rightarrow J/\psi \bar{K}^*(892)^0) = 0.17 \pm 0.15$$

$$A_{CP}^{\perp}(B_s \rightarrow J/\psi \bar{K}^*(892)^0) = -0.05 \pm 0.10$$

$$A_{CP}(B_s \rightarrow \pi^+ K^-) = 0.221 \pm 0.015$$

$$A_{CP}(B_s^0 \rightarrow [K^+ K^-]_D \bar{K}^*(892)^0) = -0.04 \pm 0.07$$

$$\begin{aligned}
 A_{CP}(B_s^0 \rightarrow [\pi^+ K^-]_D K^*(892)^0) &= -0.01 \pm 0.04 \\
 A_{CP}(B_s^0 \rightarrow [\pi^+ \pi^-]_D K^*(892)^0) &= 0.06 \pm 0.13 \\
 S(B_s^0 \rightarrow \phi \gamma) &= 0.43 \pm 0.32 \\
 C(B_s^0 \rightarrow \phi \gamma) &= 0.11 \pm 0.31 \\
 A^\Delta(B_s \rightarrow \phi \gamma) &= -0.7 \pm 0.4 \\
 \Delta a_\perp &< 1.2 \times 10^{-12} \text{ GeV, CL} = 95\% \\
 \Delta a_\parallel &= (-0.9 \pm 1.5) \times 10^{-14} \text{ GeV} \\
 \Delta a_\chi &= (1.0 \pm 2.2) \times 10^{-14} \text{ GeV} \\
 \Delta a_\gamma &= (-3.8 \pm 2.2) \times 10^{-14} \text{ GeV} \\
 \text{Re}(\xi) &= -0.022 \pm 0.033 \\
 \text{Im}(\xi) &= 0.004 \pm 0.011
 \end{aligned}$$

These branching fractions all scale with $B(\bar{b} \rightarrow B_s^0)$.

The branching fraction $B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{ anything})$ is not a pure measurement since the measured product branching fraction $B(\bar{b} \rightarrow B_s^0) \times B(B_s^0 \rightarrow D_s^- \ell^+ \nu_\ell \text{ anything})$ was used to determine $B(\bar{b} \rightarrow B_s^0)$, as described in the note on “ B^0 - \bar{B}^0 Mixing”

For inclusive branching fractions, *e.g.*, $B \rightarrow D^\pm \text{ anything}$, the values usually are multiplicities, not branching fractions. They can be greater than one.

B_s^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
D_s^- anything	(93 ± 25) %		–
$\ell \nu_\ell X$	(9.6 ± 0.8) %		–
$e^+ \nu X^-$	(9.1 ± 0.8) %		–
$\mu^+ \nu X^-$	(10.2 ± 1.0) %		–
$D_s^- \ell^+ \nu_\ell$ anything	[jja] (8.1 ± 1.3) %		–
$D_s^{*-} \ell^+ \nu_\ell$ anything	(5.4 ± 1.1) %		–
$D_{s1}(2536)^- \mu^+ \nu_\mu, D_{s1}^- \rightarrow D_s^{*-} K_S^0$	(2.7 ± 0.7) × 10 ⁻³		–
$D_{s1}(2536)^- X \mu^+ \nu, D_{s1}^- \rightarrow \bar{D}^0 K^+$	(4.4 ± 1.3) × 10 ⁻³		–
$D_{s2}(2573)^- X \mu^+ \nu, D_{s2}^- \rightarrow \bar{D}^0 K^+$	(2.7 ± 1.0) × 10 ⁻³		–
$D_s^- \pi^+$	(3.00 ± 0.23) × 10 ⁻³		2320
$D_s^- \rho^+$	(6.9 ± 1.4) × 10 ⁻³		2249
$D_s^- \pi^+ \pi^+ \pi^-$	(6.1 ± 1.0) × 10 ⁻³		2301
$D_{s1}(2536)^- \pi^+, D_{s1}^- \rightarrow D_s^- \pi^+ \pi^-$	(2.5 ± 0.8) × 10 ⁻⁵		–
$D_s^\mp K^\pm$	(2.27 ± 0.19) × 10 ⁻⁴		2293

$D_s^- K^+ \pi^+ \pi^-$	$(3.2 \pm 0.6) \times 10^{-4}$		2249
$D_s^+ D_s^-$	$(4.4 \pm 0.5) \times 10^{-3}$		1824
$D_s^- D^+$	$(2.8 \pm 0.5) \times 10^{-4}$		1875
$D^+ D^-$	$(2.2 \pm 0.6) \times 10^{-4}$		1925
$D^0 \bar{D}^0$	$(1.9 \pm 0.5) \times 10^{-4}$		1930
$D_s^{*-} \pi^+$	$(2.0 \pm 0.5) \times 10^{-3}$		2265
$D_s^{*\mp} K^\pm$	$(1.33 \pm 0.35) \times 10^{-4}$		–
$D_s^{*-} \rho^+$	$(9.6 \pm 2.1) \times 10^{-3}$		2191
$D_s^{*+} D_s^- + D_s^{*-} D_s^+$	$(1.39 \pm 0.17) \%$		1742
$D_s^{*+} D_s^{*-}$	$(1.44 \pm 0.21) \%$	S=1.1	1655
$D_s^{(*)+} D_s^{(*)-}$	$(4.5 \pm 1.4) \%$		–
$\bar{D}^{*0} \bar{K}^0$	$(2.8 \pm 1.1) \times 10^{-4}$		2278
$\bar{D}^0 \bar{K}^0$	$(4.3 \pm 0.9) \times 10^{-4}$		2330
$\bar{D}^0 K^- \pi^+$	$(1.04 \pm 0.13) \times 10^{-3}$		2312
$\bar{D}^0 \bar{K}^*(892)^0$	$(4.4 \pm 0.6) \times 10^{-4}$		2264
$\bar{D}^0 \bar{K}^*(1410)$	$(3.9 \pm 3.5) \times 10^{-4}$		2117
$\bar{D}^0 \bar{K}_0^*(1430)$	$(3.0 \pm 0.7) \times 10^{-4}$		2113
$\bar{D}^0 \bar{K}_2^*(1430)$	$(1.1 \pm 0.4) \times 10^{-4}$		2112
$\bar{D}^0 \bar{K}^*(1680)$	$< 7.8 \times 10^{-5}$	CL=90%	1997
$\bar{D}^0 \bar{K}_0^*(1950)$	$< 1.1 \times 10^{-4}$	CL=90%	1890
$\bar{D}^0 \bar{K}_3^*(1780)$	$< 2.6 \times 10^{-5}$	CL=90%	1971
$\bar{D}^0 \bar{K}_4^*(2045)$	$< 3.1 \times 10^{-5}$	CL=90%	1835
$\bar{D}^0 K^- \pi^+$ (non-resonant)	$(2.1 \pm 0.8) \times 10^{-4}$		2312
$D_{s2}^*(2573)^- \pi^+, D_{s2}^* \rightarrow \bar{D}^0 K^-$	$(2.6 \pm 0.4) \times 10^{-4}$		–
$D_{s1}^*(2700)^- \pi^+, D_{s1}^* \rightarrow \bar{D}^0 K^-$	$(1.6 \pm 0.8) \times 10^{-5}$		–
$D_{s1}^*(2860)^- \pi^+, D_{s1}^* \rightarrow \bar{D}^0 K^-$	$(5 \pm 4) \times 10^{-5}$		–
$D_{s3}^*(2860)^- \pi^+, D_{s3}^* \rightarrow \bar{D}^0 K^-$	$(2.2 \pm 0.6) \times 10^{-5}$		–
$\bar{D}^0 K^+ K^-$	$(5.5 \pm 0.8) \times 10^{-5}$		2243
$\bar{D}^0 f_0(980)$	$< 3.1 \times 10^{-6}$	CL=90%	2242
$\bar{D}^0 \phi$	$(3.0 \pm 0.5) \times 10^{-5}$		2235
$\bar{D}^{*0} \phi$	$(3.7 \pm 0.6) \times 10^{-5}$		2178
$D^{*\mp} \pi^\pm$	$< 6.1 \times 10^{-6}$	CL=90%	–
$\eta_c \phi$	$(5.0 \pm 0.9) \times 10^{-4}$		1663
$\eta_c \pi^+ \pi^-$	$(1.8 \pm 0.7) \times 10^{-4}$		1840
$J/\psi(1S) \phi$	$(1.08 \pm 0.08) \times 10^{-3}$		1588
$J/\psi(1S) \phi \phi$	$(1.24^+_{-0.19}) \times 10^{-5}$		764
$J/\psi(1S) \pi^0$	$< 1.2 \times 10^{-3}$	CL=90%	1787
$J/\psi(1S) \eta$	$(4.0 \pm 0.7) \times 10^{-4}$	S=1.4	1733

$J/\psi(1S)K_S^0$	$(1.88 \pm 0.15) \times 10^{-5}$		1743
$J/\psi(1S)\bar{K}^*(892)^0$	$(4.1 \pm 0.4) \times 10^{-5}$		1637
$J/\psi(1S)\eta'$	$(3.3 \pm 0.4) \times 10^{-4}$		1612
$J/\psi(1S)\pi^+\pi^-$	$(2.09 \pm 0.23) \times 10^{-4}$	S=1.3	1775
$J/\psi(1S)f_0(500), f_0 \rightarrow \pi^+\pi^-$	$< 4 \times 10^{-6}$	CL=90%	—
$J/\psi(1S)\rho, \rho \rightarrow \pi^+\pi^-$	$< 4 \times 10^{-6}$	CL=90%	—
$J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-$	$(1.28 \pm 0.18) \times 10^{-4}$	S=1.7	—
$J/\psi(1S)f_2(1270), f_2 \rightarrow \pi^+\pi^-$	$(1.1 \pm 0.4) \times 10^{-6}$		—
$J/\psi(1S)f_2(1270)_0, f_2 \rightarrow \pi^+\pi^-$	$(7.5 \pm 1.8) \times 10^{-7}$		—
$J/\psi(1S)f_2(1270)_\parallel, f_2 \rightarrow \pi^+\pi^-$	$(1.09 \pm 0.34) \times 10^{-6}$		—
$J/\psi(1S)f_2(1270)_\perp, f_2 \rightarrow \pi^+\pi^-$	$(1.3 \pm 0.8) \times 10^{-6}$		—
$J/\psi(1S)f_0(1370), f_0 \rightarrow \pi^+\pi^-$	$(4.5 \pm_{-4.0}^{0.7}) \times 10^{-5}$		—
$J/\psi(1S)f_0(1500), f_0 \rightarrow \pi^+\pi^-$	$(2.11 \pm_{0.29}^{0.40}) \times 10^{-5}$		—
$J/\psi(1S)f_2'(1525)_0, f_2' \rightarrow \pi^+\pi^-$	$(1.07 \pm 0.24) \times 10^{-6}$		—
$J/\psi(1S)f_2'(1525)_\parallel, f_2' \rightarrow \pi^+\pi^-$	$(1.3 \pm_{0.9}^{2.7}) \times 10^{-7}$		—
$J/\psi(1S)f_2'(1525)_\perp, f_2' \rightarrow \pi^+\pi^-$	$(5 \pm 4) \times 10^{-7}$		—
$J/\psi(1S)f_0(1790), f_0 \rightarrow \pi^+\pi^-$	$(5.0 \pm_{1.1}^{11.0}) \times 10^{-6}$		—
$J/\psi(1S)\pi^+\pi^-$ (nonresonant)	$(1.8 \pm_{0.4}^{1.1}) \times 10^{-5}$		1775
$J/\psi(1S)\bar{K}^0\pi^+\pi^-$	$< 4.4 \times 10^{-5}$	CL=90%	1675
$J/\psi(1S)K^+K^-$	$(7.9 \pm 0.7) \times 10^{-4}$		1601
$J/\psi(1S)K^0K^-\pi^+ + \text{c.c.}$	$(9.2 \pm 1.3) \times 10^{-4}$		1538
$J/\psi(1S)\bar{K}^0K^+K^-$	$< 1.2 \times 10^{-5}$	CL=90%	1333
$J/\psi(1S)f_2'(1525)$	$(2.6 \pm 0.6) \times 10^{-4}$		1310
$J/\psi(1S)\rho\bar{\rho}$	$(3.6 \pm 0.4) \times 10^{-6}$		982
$J/\psi(1S)\gamma$	$< 7.3 \times 10^{-6}$	CL=90%	1790
$J/\psi(1S)\pi^+\pi^-\pi^+\pi^-$	$(7.8 \pm 1.0) \times 10^{-5}$		1731
$J/\psi(1S)f_1(1285)$	$(7.2 \pm 1.4) \times 10^{-5}$		1460
$\psi(2S)\eta$	$(3.3 \pm 0.9) \times 10^{-4}$		1338
$\psi(2S)\eta'$	$(1.29 \pm 0.35) \times 10^{-4}$		1158
$\psi(2S)\pi^+\pi^-$	$(7.1 \pm 1.3) \times 10^{-5}$		1397
$\psi(2S)\phi$	$(5.4 \pm 0.6) \times 10^{-4}$		1120
$\psi(2S)K^-\pi^+$	$(3.1 \pm 0.4) \times 10^{-5}$		1310

$\psi(2S)\bar{K}^*(892)^0$	$(3.3 \pm 0.5) \times 10^{-5}$		1196
$\chi_{c1}\phi$	$(2.04 \pm 0.30) \times 10^{-4}$		1274
$\pi^+\pi^-$	$(7.0 \pm 1.0) \times 10^{-7}$		2680
$\pi^0\pi^0$	$< 2.1 \times 10^{-4}$	CL=90%	2680
$\eta\pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	2654
$\eta\eta$	$< 1.5 \times 10^{-3}$	CL=90%	2627
$\rho^0\rho^0$	$< 3.20 \times 10^{-4}$	CL=90%	2569
$\eta'\eta'$	$(3.3 \pm 0.7) \times 10^{-5}$		2507
$\eta'\phi$	$< 8.2 \times 10^{-7}$	CL=90%	2495
$\phi f_0(980), f_0(980) \rightarrow \pi^+\pi^-$	$(1.12 \pm 0.21) \times 10^{-6}$		—
$\phi f_2(1270), f_2(1270) \rightarrow \pi^+\pi^-$	$(6.1 \pm 1.8) \times 10^{-7}$		—
$\phi\rho^0$	$(2.7 \pm 0.8) \times 10^{-7}$		2526
$\phi\pi^+\pi^-$	$(3.5 \pm 0.5) \times 10^{-6}$		2579
$\phi\phi$	$(1.87 \pm 0.15) \times 10^{-5}$		2482
$\phi\phi\phi$	$(2.2 \pm 0.7) \times 10^{-6}$		2165
π^+K^-	$(5.8 \pm 0.7) \times 10^{-6}$		2659
K^+K^-	$(2.66 \pm 0.22) \times 10^{-5}$		2638
$K^0\bar{K}^0$	$(2.0 \pm 0.6) \times 10^{-5}$		2637
$K^0\pi^+\pi^-$	$(9.5 \pm 2.1) \times 10^{-6}$		2653
$K^0K^\pm\pi^\mp$	$(8.4 \pm 0.9) \times 10^{-5}$		2622
$K^*(892)^-\pi^+$	$(2.9 \pm 1.1) \times 10^{-6}$		2607
$K^*(892)^\pm K^\mp$	$(1.9 \pm 0.5) \times 10^{-5}$		2585
$K_0^*(1430)^\pm K^\mp$	$(3.1 \pm 2.5) \times 10^{-5}$		—
$K_2^*(1430)^\pm K^\mp$	$(1.0 \pm 1.7) \times 10^{-5}$		—
$K^*(892)^0\bar{K}^0 + \text{c.c.}$	$(2.0 \pm 0.6) \times 10^{-5}$		2585
$K_0^*(1430)\bar{K}^0 + \text{c.c.}$	$(3.3 \pm 1.0) \times 10^{-5}$		2468
$K_2^*(1430)^0\bar{K}^0 + \text{c.c.}$	$(1.7 \pm 2.2) \times 10^{-5}$		2467
$K_S^0\bar{K}^*(892)^0 + \text{c.c.}$	$(1.6 \pm 0.4) \times 10^{-5}$		2585
$K^0K^+K^-$	$(1.3 \pm 0.6) \times 10^{-6}$		2568
$\bar{K}^*(892)^0\rho^0$	$< 7.67 \times 10^{-4}$	CL=90%	2550
$\bar{K}^*(892)^0K^*(892)^0$	$(1.11 \pm 0.27) \times 10^{-5}$		2531
$\phi K^*(892)^0$	$(1.14 \pm 0.30) \times 10^{-6}$		2507
$p\bar{p}$	$< 1.5 \times 10^{-8}$	CL=90%	2514
$p\bar{p}K^+K^-$	$(4.5 \pm 0.5) \times 10^{-6}$		2231
$p\bar{p}K^+\pi^-$	$(1.39 \pm 0.26) \times 10^{-6}$		2355
$p\bar{p}\pi^+\pi^-$	$(4.3 \pm 2.0) \times 10^{-7}$		2454
$p\bar{\Lambda}K^- + \text{c.c.}$	$(5.5 \pm 1.0) \times 10^{-6}$		2358
$\Lambda_c^-\Lambda\pi^+$	$(3.6 \pm 1.6) \times 10^{-4}$		1979
$\Lambda_c^-\Lambda_c^+$	$< 8.0 \times 10^{-5}$	CL=95%	1405

**Lepton Family number (*LF*) violating modes or
 $\Delta B = 1$ weak neutral current (*B1*) modes**

$\gamma\gamma$	<i>B1</i>	$< 3.1 \times 10^{-6}$	CL=90%	2683
$\phi\gamma$	<i>B1</i>	$(3.4 \pm 0.4) \times 10^{-5}$		2587
$\mu^+\mu^-$	<i>B1</i>	$(3.0 \pm 0.4) \times 10^{-9}$		2681
e^+e^-	<i>B1</i>	$< 2.8 \times 10^{-7}$	CL=90%	2683
$\tau^+\tau^-$	<i>B1</i>	$< 6.8 \times 10^{-3}$	CL=95%	2011
$\mu^+\mu^-\mu^+\mu^-$	<i>B1</i>	$< 2.5 \times 10^{-9}$	CL=95%	2673
$SP, S \rightarrow \mu^+\mu^-$, $P \rightarrow \mu^+\mu^-$	<i>B1</i> [aaaa]	$< 2.2 \times 10^{-9}$	CL=95%	—
$\phi(1020)\mu^+\mu^-$	<i>B1</i>	$(8.2 \pm 1.2) \times 10^{-7}$		2582
$\bar{K}^*(892)^0\mu^+\mu^-$		$(2.9 \pm 1.1) \times 10^{-8}$		2605
$\pi^+\pi^-\mu^+\mu^-$	<i>B1</i>	$(8.4 \pm 1.7) \times 10^{-8}$		2670
$\phi\nu\bar{\nu}$	<i>B1</i>	$< 5.4 \times 10^{-3}$	CL=90%	2587
$e^\pm\mu^\mp$	<i>LF</i> [bb]	$< 5.4 \times 10^{-9}$	CL=90%	2682
$\mu^\pm\tau^\mp$		$< 4.2 \times 10^{-5}$	CL=95%	2388

B_s^*

$$I(J^P) = 0(1^-)$$

I, J, P need confirmation. Quantum numbers shown are quark-model predictions.

$$\text{Mass } m = 5415.4^{+1.8}_{-1.5} \text{ MeV} \quad (S = 2.9)$$

$$m_{B_s^*} - m_{B_s} = 48.6^{+1.8}_{-1.5} \text{ MeV} \quad (S = 2.9)$$

B_s^* DECAY MODES	Fraction (Γ_i/Γ)	<i>p</i> (MeV/c)
$B_s\gamma$	seen	48

$B_{s1}(5830)^0$

$$I(J^P) = 0(1^+)$$

I, J, P need confirmation.

$$\text{Mass } m = 5828.70 \pm 0.20 \text{ MeV}$$

$$m_{B_{s1}^0} - m_{B^{*+}} = 504.00 \pm 0.17 \text{ MeV}$$

$$\text{Full width } \Gamma = 0.5 \pm 0.4 \text{ MeV}$$

$B_{s1}(5830)^0$ DECAY MODES	Fraction (Γ_i/Γ)	<i>p</i> (MeV/c)
$B^{*+}K^-$	seen	97

$B_{s2}^*(5840)^0$

$I(J^P) = 0(2^+)$
 I, J, P need confirmation.

Mass $m = 5839.86 \pm 0.12$ MeV
 $m_{B_{s2}^{*0}} - m_{B^+} = 560.52 \pm 0.14$ MeV
 Full width $\Gamma = 1.49 \pm 0.27$ MeV

$B_{s2}^*(5840)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^+ K^-$	DEFINED AS 1	252
$B^{*+} K^-$	0.093 ± 0.018	141
$B^0 K_S^0$	0.43 ± 0.11	245
$B^{*0} K_S^0$	0.04 ± 0.04	—

BOTTOM, CHARMED MESONS ($B = C = \pm 1$)

$B_c^+ = c\bar{b}, B_c^- = \bar{c}b,$ similarly for B_c^{*} 's

B_c^+

$I(J^P) = 0(0^-)$
 I, J, P need confirmation.

Quantum numbers shown are quark-model predictions.

Mass $m = 6274.9 \pm 0.8$ MeV
 Mean life $\tau = (0.510 \pm 0.009) \times 10^{-12}$ s

B_c^- modes are charge conjugates of the modes below.

B_c^+ DECAY MODES $\times B(\bar{b} \rightarrow B_c)$	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
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The following quantities are not pure branching ratios; rather the fraction $\Gamma_i/\Gamma \times B(\bar{b} \rightarrow B_c)$.

$J/\psi(1S) \ell^+ \nu_\ell$ anything	$(8.1 \pm 1.2) \times 10^{-5}$		—
$J/\psi(1S) \pi^+$	seen		2371
$J/\psi(1S) K^+$	seen		2341
$J/\psi(1S) \pi^+ \pi^+ \pi^-$	seen		2350
$J/\psi(1S) a_1(1260)$	$< 1.2 \times 10^{-3}$	90%	2169
$J/\psi(1S) K^+ K^- \pi^+$	seen		2203
$J/\psi(1S) \pi^+ \pi^+ \pi^+ \pi^- \pi^-$	seen		2309
$\psi(2S) \pi^+$	seen		2052
$J/\psi(1S) D^0 K^+$	seen		1539

$J/\psi(1S) D^*(2007)^0 K^+$	seen			1412
$J/\psi(1S) D^*(2010)^+ K^{*0}$	seen			920
$J/\psi(1S) D^+ K^{*0}$	seen			1123
$J/\psi(1S) D_s^+$	seen			1822
$J/\psi(1S) D_s^{*+}$	seen			1728
$J/\psi(1S) \rho \bar{\rho} \pi^+$	seen			1792
$\chi_c^0 \pi^+$	$(2.4^{+0.9}_{-0.8}) \times 10^{-5}$			2205
$\rho \bar{\rho} \pi^+$	not seen			2970
$D^0 K^+$	$(3.8^{+1.2}_{-1.1}) \times 10^{-7}$			2837
$D^0 \pi^+$	< 1.6	$\times 10^{-7}$	95%	2858
$D^{*0} \pi^+$	< 4	$\times 10^{-7}$	95%	2815
$D^{*0} K^+$	< 4	$\times 10^{-7}$	95%	2793
$D_s^+ \bar{D}^0$	< 1.4	$\times 10^{-7}$	90%	2484
$D_s^+ D^0$	< 6	$\times 10^{-8}$	90%	2484
$D^+ \bar{D}^0$	< 3.0	$\times 10^{-6}$	90%	2521
$D^+ D^0$	< 1.9	$\times 10^{-6}$	90%	2521
$D^*(2010)^+ \bar{D}^0$	< 6.2	$\times 10^{-3}$	90%	2467
$D_s^{*+} \bar{D}^*(2007)^0$	< 1.7	$\times 10^{-6}$	90%	2366
$D_s^{*+} D^*(2007)^0$	< 3.1	$\times 10^{-6}$	90%	2366
$D^*(2010)^+ \bar{D}^*(2007)^0$	< 1.0	$\times 10^{-4}$	90%	2410
$D^*(2010)^+ D^*(2007)^0$	< 2.0	$\times 10^{-5}$	90%	2410
$D^+ K^{*0}$	< 0.20	$\times 10^{-6}$	90%	2783
$D^+ \bar{K}^{*0}$	< 0.16	$\times 10^{-6}$	90%	2783
$D_s^+ K^{*0}$	< 0.28	$\times 10^{-6}$	90%	2751
$D_s^+ \bar{K}^{*0}$	< 0.4	$\times 10^{-6}$	90%	2751
$D_s^+ \phi$	< 0.32	$\times 10^{-6}$	90%	2727
$K^+ K^0$	< 4.6	$\times 10^{-7}$	90%	3098
$B_s^0 \pi^+ / B(\bar{b} \rightarrow B_s)$	$(2.37^{+0.37}_{-0.35}) \times 10^{-3}$			—

$c\bar{c}$ MESONS

(including possibly non- $q\bar{q}$ states)

 $\eta_c(1S)$

$$I^G(J^{PC}) = 0^+(0^{-+})$$

Mass $m = 2983.9 \pm 0.5$ MeV ($S = 1.3$)Full width $\Gamma = 32.0 \pm 0.7$ MeV

$\eta_c(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
Decays involving hadronic resonances			
$\eta'(958)\pi\pi$	(4.1 \pm 1.7) %		1323
$\rho\rho$	(1.8 \pm 0.5) %		1275
$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(2.0 \pm 0.7) %		1278
$K^*(892)\bar{K}^*(892)$	(7.0 \pm 1.3) $\times 10^{-3}$		1196
$K^*(892)^0 \bar{K}^*(892)^0 \pi^+ \pi^-$	(1.1 \pm 0.5) %		1073
$\phi K^+ K^-$	(2.9 \pm 1.4) $\times 10^{-3}$		1104
$\phi\phi$	(1.77 \pm 0.19) $\times 10^{-3}$		1089
$\phi 2(\pi^+ \pi^-)$	$< 4 \times 10^{-3}$	90%	1251
$a_0(980)\pi$	< 2 %	90%	1327
$a_2(1320)\pi$	< 2 %	90%	1197
$K^*(892)\bar{K} + \text{c.c.}$	< 1.28 %	90%	1310
$f_2(1270)\eta$	< 1.1 %	90%	1145
$\omega\omega$	(2.9 \pm 0.8) $\times 10^{-3}$		1270
$\omega\phi$	$< 2.5 \times 10^{-4}$	90%	1185
$f_2(1270)f_2(1270)$	(9.8 \pm 2.5) $\times 10^{-3}$		774
$f_2(1270)f_2'(1525)$	(9.7 \pm 3.2) $\times 10^{-3}$		524
$f_0(980)\eta$	seen		1264
$f_0(1500)\eta$	seen		1025
$f_0(2200)\eta$	seen		498
$a_0(980)\pi$	seen		1327
$a_0(1320)\pi$	seen		-
$a_0(1450)\pi$	seen		1123
$a_0(1950)\pi$	seen		860
$K_0^*(1430)\bar{K}$	seen		-
$K_2^*(1430)\bar{K}$	seen		-
$K_0^*(1950)\bar{K}$	seen		-

Decays into stable hadrons

$K\bar{K}\pi$	(7.3 ± 0.4) %		1381
$K\bar{K}\eta$	(1.36 ± 0.15) %		1265
$\eta\pi^+\pi^-$	(1.7 ± 0.5) %		1428
$\eta 2(\pi^+\pi^-)$	(4.4 ± 1.3) %		1386
$K^+K^-\pi^+\pi^-$	(6.9 ± 1.0) × 10 ⁻³		1345
$K^+K^-\pi^+\pi^-\pi^0$	(3.5 ± 0.6) %		1304
$K^0K^-\pi^+\pi^-\pi^+ + c.c.$	(5.6 ± 1.5) %		–
$K^+K^- 2(\pi^+\pi^-)$	(7.5 ± 2.4) × 10 ⁻³		1254
$2(K^+K^-)$	(1.46 ± 0.30) × 10 ⁻³		1056
$\pi^+\pi^-\pi^0$	< 5 × 10 ⁻⁴	90%	1476
$\pi^+\pi^-\pi^0\pi^0$	(4.7 ± 1.0) %		1460
$2(\pi^+\pi^-)$	(9.7 ± 1.2) × 10 ⁻³		1459
$2(\pi^+\pi^-\pi^0)$	(16.1 ± 2.0) %		1409
$3(\pi^+\pi^-)$	(1.8 ± 0.4) %		1407
$p\bar{p}$	(1.45 ± 0.14) × 10 ⁻³		1160
$p\bar{p}\pi^0$	(3.6 ± 1.3) × 10 ⁻³		1101
$\Lambda\bar{\Lambda}$	(1.07 ± 0.24) × 10 ⁻³		991
$K^+\bar{p}\Lambda + c.c.$	(2.6 ± 0.4) × 10 ⁻³		772
$\bar{\Lambda}(1520)\Lambda + c.c.$	(3.1 ± 1.4) × 10 ⁻³		694
$\Sigma^+\bar{\Sigma}^-$	(2.1 ± 0.6) × 10 ⁻³		901
$\Xi^-\bar{\Xi}^+$	(9.0 ± 2.6) × 10 ⁻⁴		692
$\pi^+\pi^-p\bar{p}$	(5.3 ± 1.8) × 10 ⁻³		1027

Radiative decays

$\gamma\gamma$	(1.58 ± 0.11) × 10 ⁻⁴		1492
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**Charge conjugation (C), Parity (P),
Lepton family number (LF) violating modes**

$\pi^+\pi^-$	P, CP	< 1.1 × 10 ⁻⁴	90%	1485
$\pi^0\pi^0$	P, CP	< 4 × 10 ⁻⁵	90%	1486
K^+K^-	P, CP	< 6 × 10 ⁻⁴	90%	1408
$K_S^0K_S^0$	P, CP	< 3.1 × 10 ⁻⁴	90%	1407

J/ψ(1S)

$$J^G(J^{PC}) = 0^-(1^{--})$$

Mass $m = 3096.900 \pm 0.006$ MeV

Full width $\Gamma = 92.9 \pm 2.8$ keV (S = 1.1)

$\Gamma_{ee} = 5.53 \pm 0.10$ keV

$\Gamma_{ee} < 5.4$ eV, CL = 90%

$J/\psi(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level (MeV/c)	p
hadrons	(87.7 \pm 0.5) %		—
virtual $\gamma \rightarrow$ hadrons	(13.50 \pm 0.30) %		—
$g g g$	(64.1 \pm 1.0) %		—
$\gamma g g$	(8.8 \pm 1.1) %		—
$e^+ e^-$	(5.971 \pm 0.032) %		1548
$e^+ e^- \gamma$	[kkaa] (8.8 \pm 1.4) $\times 10^{-3}$		1548
$\mu^+ \mu^-$	(5.961 \pm 0.033) %		1545

Decays involving hadronic resonances

$\rho\pi$	(1.69 \pm 0.15) %	S=2.4	1448
$\rho^0\pi^0$	(5.6 \pm 0.7) $\times 10^{-3}$		1448
$\rho(770)^\mp K^\pm K_S^0$	(1.9 \pm 0.4) $\times 10^{-3}$		—
$\rho(1450)\pi \rightarrow \pi^+\pi^-\pi^0$	(2.3 \pm 0.7) $\times 10^{-3}$		—
$\rho(1450)^\pm\pi^\mp \rightarrow K_S^0 K^\pm\pi^\mp$	(3.5 \pm 0.6) $\times 10^{-4}$		—
$\rho(1450)^0\pi^0 \rightarrow K^+K^-\pi^0$	(2.7 \pm 0.6) $\times 10^{-4}$		—
$\rho(1450)\eta'(958) \rightarrow$ $\pi^+\pi^-\eta'(958)$	(3.3 \pm 0.7) $\times 10^{-6}$		—
$\rho(1700)\pi \rightarrow \pi^+\pi^-\pi^0$	(1.7 \pm 1.1) $\times 10^{-4}$		—
$\rho(2150)\pi \rightarrow \pi^+\pi^-\pi^0$	(8 \pm 40) $\times 10^{-6}$		—
$a_2(1320)\rho$	(1.09 \pm 0.22) %		1124
$\omega\pi^+\pi^+\pi^-\pi^-$	(8.5 \pm 3.4) $\times 10^{-3}$		1392
$\omega\pi^+\pi^-\pi^0$	(4.0 \pm 0.7) $\times 10^{-3}$		1418
$\omega\pi^+\pi^-$	(7.2 \pm 1.0) $\times 10^{-3}$		1435
$\omega f_2(1270)$	(4.3 \pm 0.6) $\times 10^{-3}$		1142
$K^*(892)^0 \bar{K}^*(892)^0$	(2.3 \pm 0.6) $\times 10^{-4}$		1266
$K^*(892)^\pm K^*(892)^\mp$	(1.00 \pm 0.22) $\times 10^{-3}$ — 0.40		1266
$K^*(892)^\pm K^*(700)^\mp$	(1.1 \pm 1.0) $\times 10^{-3}$ — 0.6		—
$K_S^0\pi^- K^*(892)^+ + \text{c.c.}$	(2.0 \pm 0.5) $\times 10^{-3}$		1342
$K_S^0\pi^- K^*(892)^+ + \text{c.c.} \rightarrow$ $K_S^0 K_S^0\pi^+\pi^-$	(6.7 \pm 2.2) $\times 10^{-4}$		—
$K_S^0 K^*(892)^0 \rightarrow \gamma K_S^0 K_S^0$	(6.3 \pm 0.6) $\times 10^{-6}$ — 0.5		—
$K_2^*(1430)^+ K^- + \text{c.c.} \rightarrow$ $K^+ K^- \pi^0$	(2.69 \pm 0.25) $\times 10^{-4}$ — 0.19		—
$K_2^*(1980)^+ K^- + \text{c.c.} \rightarrow$ $K^+ K^- \pi^0$	(1.10 \pm 0.60) $\times 10^{-5}$ — 0.14		—
$K_4^*(2045)^+ K^- + \text{c.c.} \rightarrow$ $K^+ K^- \pi^0$	(6.2 \pm 2.9) $\times 10^{-6}$ — 1.6		—
$\eta K^*(892)^0 \bar{K}^*(892)^0$	(1.15 \pm 0.26) $\times 10^{-3}$		1003
$\eta' K^{*\pm} K^\mp$	(1.48 \pm 0.13) $\times 10^{-3}$		—

$\eta' K^{*0} \bar{K}^0 + \text{c.c.}$	$(1.66 \pm 0.21) \times 10^{-3}$	1000
$\eta' h_1(1415) \rightarrow \eta' K^* \bar{K} + \text{c.c.}$	$(2.16 \pm 0.31) \times 10^{-4}$	—
$\eta' h_1(1415) \rightarrow \eta' K^{*\pm} K^\mp$	$(1.51 \pm 0.23) \times 10^{-4}$	—
$K^*(1410) \bar{K} + \text{c.c.} \rightarrow$ $K^\pm K^\mp \pi^0$	$(7 \pm 4) \times 10^{-5}$	—
$K^*(1410) \bar{K} + \text{c.c.} \rightarrow$ $K_S^0 K^\pm \pi^\mp$	$(8 \pm 6) \times 10^{-5}$	—
$K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow$ $K^\pm K^\mp \pi^0$	$(1.0 \pm 0.5) \times 10^{-4}$	—
$K_2^*(1430) \bar{K} + \text{c.c.} \rightarrow$ $K_S^0 K^\pm \pi^\mp$	$(4.0 \pm 1.0) \times 10^{-4}$	—
$K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}$	$(4.66 \pm 0.31) \times 10^{-3}$	1011
$K^*(892)^+ K_2^*(1430)^- + \text{c.c.}$	$(3.4 \pm 2.9) \times 10^{-3}$	1011
$K^*(892)^+ K_2^*(1430)^- + \text{c.c.} \rightarrow$ $K^*(892)^+ K_S^0 \pi^- + \text{c.c.}$	$(4 \pm 4) \times 10^{-4}$	—
$K^*(892)^0 \bar{K}_2(1770)^0 + \text{c.c.} \rightarrow$ $K^*(892)^0 K^- \pi^+ + \text{c.c.}$	$(6.9 \pm 0.9) \times 10^{-4}$	—
$\omega K^*(892) \bar{K} + \text{c.c.}$	$(6.1 \pm 0.9) \times 10^{-3}$	1097
$\bar{K} K^*(892) + \text{c.c.} \rightarrow$ $K_S^0 K^\pm \pi^\mp$	$(5.0 \pm 0.5) \times 10^{-3}$	—
$K^+ K^*(892)^- + \text{c.c.}$	$(6.0 \pm_{-1.0}^{0.8}) \times 10^{-3}$	S=2.9 1373
$K^+ K^*(892)^- + \text{c.c.} \rightarrow$ $K^+ K^- \pi^0$	$(2.69 \pm_{-0.20}^{0.13}) \times 10^{-3}$	—
$K^+ K^*(892)^- + \text{c.c.} \rightarrow$ $K^0 K^\pm \pi^\mp + \text{c.c.}$	$(3.0 \pm 0.4) \times 10^{-3}$	—
$K^0 \bar{K}^*(892)^0 + \text{c.c.}$	$(4.2 \pm 0.4) \times 10^{-3}$	1373
$K^0 \bar{K}^*(892)^0 + \text{c.c.} \rightarrow$ $K^0 K^\pm \pi^\mp + \text{c.c.}$	$(3.2 \pm 0.4) \times 10^{-3}$	—
$K_1(1400)^\pm K^\mp$	$(3.8 \pm 1.4) \times 10^{-3}$	1170
$\bar{K}^*(892)^0 K^+ \pi^- + \text{c.c.}$	$(7.7 \pm 1.6) \times 10^{-3}$	1343
$K^*(892)^\pm K^\mp \pi^0$	$(4.1 \pm 1.3) \times 10^{-3}$	1344
$K^*(892)^0 K_S^0 \pi^0$	$(6 \pm 4) \times 10^{-4}$	1343
$\omega \pi^0 \pi^0$	$(3.4 \pm 0.8) \times 10^{-3}$	1436
$\omega \pi^0 \eta$	$(3.4 \pm 1.7) \times 10^{-4}$	1363
$b_1(1235)^\pm \pi^\mp$	[bb] $(3.0 \pm 0.5) \times 10^{-3}$	1300
$\omega K^\pm K_S^0 \pi^\mp$	[bb] $(3.4 \pm 0.5) \times 10^{-3}$	1210
$b_1(1235)^0 \pi^0$	$(2.3 \pm 0.6) \times 10^{-3}$	1300
$\eta K^\pm K_S^0 \pi^\mp$	[bb] $(2.2 \pm 0.4) \times 10^{-3}$	1278
$\phi K^*(892) \bar{K} + \text{c.c.}$	$(2.18 \pm 0.23) \times 10^{-3}$	969
$\omega K \bar{K}$	$(1.9 \pm 0.4) \times 10^{-3}$	1268
$\omega f_0(1710) \rightarrow \omega K \bar{K}$	$(4.8 \pm 1.1) \times 10^{-4}$	878
$\phi 2(\pi^+ \pi^-)$	$(1.60 \pm 0.32) \times 10^{-3}$	1318
$\Delta(1232)^{++} \bar{p} \pi^-$	$(1.6 \pm 0.5) \times 10^{-3}$	1030

$\omega\eta$		$(1.74 \pm 0.20) \times 10^{-3}$	S=1.6	1394
$\omega\eta'\pi^+\pi^-$		$(1.12 \pm 0.13) \times 10^{-3}$		1173
$\phi K\bar{K}$		$(1.77 \pm 0.16) \times 10^{-3}$	S=1.3	1179
$\phi K_S^0 K_S^0$		$(5.9 \pm 1.5) \times 10^{-4}$		1176
$\phi f_0(1710) \rightarrow \phi K\bar{K}$		$(3.6 \pm 0.6) \times 10^{-4}$		875
$\phi K^+ K^-$		$(8.3 \pm 1.2) \times 10^{-4}$		1179
$\phi f_2(1270)$		$(3.2 \pm 0.6) \times 10^{-4}$		1036
$\Delta(1232)^{++}\bar{\Delta}(1232)^{--}$		$(1.10 \pm 0.29) \times 10^{-3}$		938
$\Sigma(1385)^-\bar{\Sigma}(1385)^+$ (or c.c.)	[bb]	$(1.16 \pm 0.05) \times 10^{-3}$		697
$\Sigma(1385)^0\bar{\Sigma}(1385)^0$		$(1.07 \pm 0.08) \times 10^{-3}$		697
$K^+ K^- f_2'(1525)$		$(1.05 \pm 0.35) \times 10^{-3}$		897
$\phi f_2'(1525)$		$(8 \pm 4) \times 10^{-4}$	S=2.7	877
$\phi\pi^+\pi^-$		$(9.4 \pm 1.5) \times 10^{-4}$	S=1.7	1365
$\phi\pi^0\pi^0$		$(5.0 \pm 1.0) \times 10^{-4}$		1366
$\phi K^\pm K_S^0\pi^\mp$	[bb]	$(7.2 \pm 0.8) \times 10^{-4}$		1114
$\omega f_1(1420)$		$(6.8 \pm 2.4) \times 10^{-4}$		1062
$\phi\eta$		$(7.4 \pm 0.8) \times 10^{-4}$	S=1.5	1320
$\Xi^0\Xi^0$		$(1.17 \pm 0.04) \times 10^{-3}$		818
$\Xi(1530)^-\Xi^+$ + c.c.		$(3.18 \pm 0.08) \times 10^{-4}$		600
$\rho K^-\bar{\Sigma}(1385)^0$		$(5.1 \pm 3.2) \times 10^{-4}$		646
$\omega\pi^0$		$(4.5 \pm 0.5) \times 10^{-4}$	S=1.4	1446
$\omega\pi^0 \rightarrow \pi^+\pi^-\pi^0$		$(1.7 \pm 0.8) \times 10^{-5}$		–
$\phi\eta'(958)$		$(4.6 \pm 0.5) \times 10^{-4}$	S=2.2	1192
$\phi f_0(980)$		$(3.2 \pm 0.9) \times 10^{-4}$	S=1.9	1178
$\phi f_0(980) \rightarrow \phi\pi^+\pi^-$		$(2.59 \pm 0.34) \times 10^{-4}$		–
$\phi f_0(980) \rightarrow \phi\pi^0\pi^0$		$(1.8 \pm 0.5) \times 10^{-4}$		–
$\phi\eta\eta'$		$(2.32 \pm 0.17) \times 10^{-4}$		885
$\phi\pi^0 f_0(980) \rightarrow \phi\pi^0\pi^+\pi^-$		$(4.5 \pm 1.0) \times 10^{-6}$		–
$\phi\pi^0 f_0(980) \rightarrow \phi\pi^0\rho^0\pi^0$		$(1.7 \pm 0.6) \times 10^{-6}$		1045
$\eta\phi f_0(980) \rightarrow \eta\phi\pi^+\pi^-$		$(3.2 \pm 1.0) \times 10^{-4}$		–
$\phi a_0(980)^0 \rightarrow \phi\eta\pi^0$		$(4.4 \pm 1.4) \times 10^{-6}$		–
$\Xi(1530)^0\Xi^0$		$(3.2 \pm 1.4) \times 10^{-4}$		608
$\Sigma(1385)^-\bar{\Sigma}^+$ (or c.c.)	[bb]	$(3.1 \pm 0.5) \times 10^{-4}$		855
$\phi f_1(1285)$		$(2.6 \pm 0.5) \times 10^{-4}$		1032
$\phi f_1(1285) \rightarrow$		$(9.4 \pm 2.8) \times 10^{-7}$		952
$\phi\pi^0 f_0(980) \rightarrow$				
$\phi\pi^0\pi^+\pi^-$				
$\phi f_1(1285) \rightarrow$		$(2.1 \pm 2.2) \times 10^{-7}$		955
$\phi\pi^0 f_0(980) \rightarrow$				
$\phi\pi^0\pi^0\pi^0$				
$\eta\pi^+\pi^-$		$(3.8 \pm 0.7) \times 10^{-4}$		1487
$\eta\rho$		$(1.93 \pm 0.23) \times 10^{-4}$		1396
$\omega\eta'(958)$		$(1.89 \pm 0.18) \times 10^{-4}$		1279
$\omega f_0(980)$		$(1.4 \pm 0.5) \times 10^{-4}$		1267

$\rho\eta'(958)$	$(8.1 \pm 0.8) \times 10^{-5}$	S=1.6	1281
$a_2(1320)^\pm \pi^\mp$	$[bb] < 4.3 \times 10^{-3}$	CL=90%	1264
$K\bar{K}_2^*(1430) + \text{c.c.}$	$< 4.0 \times 10^{-3}$	CL=90%	1158
$K_1(1270)^\pm K^\mp$	$< 3.0 \times 10^{-3}$	CL=90%	1240
$K_1(1270)K_S^0 \rightarrow \gamma K_S^0 K_S^0$	$(8.5 \pm 2.5) \times 10^{-7}$		–
$K_S^0 \pi^- K_2^*(1430)^+ + \text{c.c.}$	$(3.6 \pm 1.8) \times 10^{-3}$		1116
$K_2^*(1430)^0 \bar{K}_2^*(1430)^0$	$< 2.9 \times 10^{-3}$	CL=90%	601
$\phi\pi^0$	3×10^{-6} or 1×10^{-7}		1377
$\phi\eta(1405) \rightarrow \phi\eta\pi^+\pi^-$	$(2.0 \pm 1.0) \times 10^{-5}$		946
$\omega f_2'(1525)$	$< 2.2 \times 10^{-4}$	CL=90%	1007
$\omega X(1835) \rightarrow \omega p\bar{p}$	$< 3.9 \times 10^{-6}$	CL=95%	–
$\omega X(1835), X \rightarrow \eta'\pi^+\pi^-$	$< 6.2 \times 10^{-5}$		–
$\phi X(1835) \rightarrow \phi p\bar{p}$	$< 2.1 \times 10^{-7}$	CL=90%	–
$\phi X(1835) \rightarrow \phi\eta\pi^+\pi^-$	$< 2.8 \times 10^{-4}$	CL=90%	578
$\phi X(1870) \rightarrow \phi\eta\pi^+\pi^-$	$< 6.13 \times 10^{-5}$	CL=90%	–
$\eta\phi(2170) \rightarrow \eta\phi f_0(980) \rightarrow$ $\eta\phi\pi^+\pi^-$	$(1.2 \pm 0.4) \times 10^{-4}$		628
$\eta\phi(2170) \rightarrow$ $\eta K^*(892)^0 \bar{K}^*(892)^0$	$< 2.52 \times 10^{-4}$	CL=90%	–
$\Sigma(1385)^0 \bar{\Lambda} + \text{c.c.}$	$< 8.2 \times 10^{-6}$	CL=90%	912
$\Delta(1232)^+ \bar{p}$	$< 1 \times 10^{-4}$	CL=90%	1100
$\Lambda(1520) \bar{\Lambda} + \text{c.c.} \rightarrow \gamma \Lambda \bar{\Lambda}$	$< 4.1 \times 10^{-6}$	CL=90%	–
$\bar{\Lambda}(1520) \Lambda + \text{c.c.}$	$< 1.80 \times 10^{-3}$	CL=90%	807
$\Theta(1540) \bar{\Theta}(1540) \rightarrow$ $K_S^0 p K^- \bar{n} + \text{c.c.}$	$< 1.1 \times 10^{-5}$	CL=90%	–
$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	$< 2.1 \times 10^{-5}$	CL=90%	–
$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	$< 1.6 \times 10^{-5}$	CL=90%	–
$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	$< 5.6 \times 10^{-5}$	CL=90%	–
$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	$< 1.1 \times 10^{-5}$	CL=90%	–

Decays into stable hadrons

$2(\pi^+\pi^-)\pi^0$	$(3.73 \pm 0.32) \%$	S=1.4	1496
$3(\pi^+\pi^-)\pi^0$	$(2.9 \pm 0.6) \%$		1433
$\pi^+\pi^-\pi^0$	$(2.10 \pm 0.08) \%$	S=1.6	1533
$\pi^+\pi^-\pi^0\pi^0\pi^0$	$(2.71 \pm 0.29) \%$		1497
$\rho^\pm\pi^\mp\pi^0\pi^0$	$(1.41 \pm 0.22) \%$		1421
$\rho^+\rho^-\pi^0$	$(6.0 \pm 1.1) \times 10^{-3}$		1298
$\pi^+\pi^-\pi^0 K^+ K^-$	$(1.20 \pm 0.30) \%$		1368
$4(\pi^+\pi^-)\pi^0$	$(9.0 \pm 3.0) \times 10^{-3}$		1345
$\pi^+\pi^- K^+ K^-$	$(6.84 \pm 0.32) \times 10^{-3}$		1407
$\pi^+\pi^- K_S^0 K_L^0$	$(3.8 \pm 0.6) \times 10^{-3}$		1406
$\pi^+\pi^- K_S^0 K_S^0$	$(1.68 \pm 0.19) \times 10^{-3}$		1406
$\pi^\pm\pi^0 K^\mp K_S^0$	$(5.7 \pm 0.5) \times 10^{-3}$		1408
$K^+ K^- K_S^0 K_S^0$	$(4.1 \pm 0.8) \times 10^{-4}$		1127

$\pi^+\pi^-K^+K^-\eta$	$(4.7 \pm 0.7) \times 10^{-3}$		1221
$\pi^0\pi^0K^+K^-$	$(2.12 \pm 0.23) \times 10^{-3}$		1410
$\pi^0\pi^0K_S^0K_L^0$	$(1.9 \pm 0.4) \times 10^{-3}$		1408
$K\bar{K}\pi$	$(6.1 \pm 1.0) \times 10^{-3}$		1442
$K^+K^-\pi^0$	$(2.88 \pm 0.12) \times 10^{-3}$		1442
$K_S^0K^\pm\pi^\mp$	$(5.6 \pm 0.5) \times 10^{-3}$		1440
$K_S^0K_L^0\pi^0$	$(2.06 \pm 0.27) \times 10^{-3}$		1440
$K^*(892)^0\bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0K_L^0\pi^0$	$(1.21 \pm 0.18) \times 10^{-3}$		–
$K_2^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0K_L^0\pi^0$	$(4.3 \pm 1.3) \times 10^{-4}$		–
$K_S^0K_L^0\eta$	$(1.44 \pm 0.34) \times 10^{-3}$		1328
$2(\pi^+\pi^-)$	$(3.57 \pm 0.30) \times 10^{-3}$		1517
$3(\pi^+\pi^-)$	$(4.3 \pm 0.4) \times 10^{-3}$		1466
$2(\pi^+\pi^-\pi^0)$	$(1.61 \pm 0.21) \%$		1468
$2(\pi^+\pi^-)\eta$	$(2.26 \pm 0.28) \times 10^{-3}$		1446
$3(\pi^+\pi^-)\eta$	$(7.2 \pm 1.5) \times 10^{-4}$		1379
$\pi^+\pi^-\pi^0\pi^0\eta$	$(2.3 \pm 0.5) \times 10^{-3}$		1448
$\rho^\pm\pi^\mp\pi^0\eta$	$(1.9 \pm 0.8) \times 10^{-3}$		1326
$p\bar{p}$	$(2.121 \pm 0.029) \times 10^{-3}$		1232
$p\bar{p}\pi^0$	$(1.19 \pm 0.08) \times 10^{-3}$	S=1.1	1176
$p\bar{p}\pi^+\pi^-$	$(6.0 \pm 0.5) \times 10^{-3}$	S=1.3	1107
$p\bar{p}\pi^+\pi^-\pi^0$	[/aa] $(2.3 \pm 0.9) \times 10^{-3}$	S=1.9	1033
$p\bar{p}\eta$	$(2.00 \pm 0.12) \times 10^{-3}$		948
$p\bar{p}\rho$	< 3.1 $\times 10^{-4}$	CL=90%	774
$p\bar{p}\omega$	$(9.8 \pm 1.0) \times 10^{-4}$	S=1.3	768
$p\bar{p}\eta'(958)$	$(1.29 \pm 0.14) \times 10^{-4}$	S=2.0	596
$p\bar{p}a_0(980) \rightarrow p\bar{p}\pi^0\eta$	$(6.8 \pm 1.8) \times 10^{-5}$		–
$p\bar{p}\phi$	$(5.19 \pm 0.33) \times 10^{-5}$		527
$n\bar{n}$	$(2.09 \pm 0.16) \times 10^{-3}$		1231
$n\bar{n}\pi^+\pi^-$	$(4 \pm 4) \times 10^{-3}$		1106
$\Sigma^+\bar{\Sigma}^-$	$(1.50 \pm 0.24) \times 10^{-3}$		992
$\Sigma^0\bar{\Sigma}^0$	$(1.172 \pm 0.032) \times 10^{-3}$	S=1.4	988
$2(\pi^+\pi^-)K^+K^-$	$(3.1 \pm 1.3) \times 10^{-3}$		1320
$p\bar{n}\pi^-$	$(2.12 \pm 0.09) \times 10^{-3}$		1174
$nN(1440)$	seen		978
$nN(1520)$	seen		928
$nN(1535)$	seen		917
$\Xi^-\bar{\Xi}^+$	$(9.7 \pm 0.8) \times 10^{-4}$	S=1.4	807
$\Lambda\bar{\Lambda}$	$(1.89 \pm 0.09) \times 10^{-3}$	S=2.8	1074
$\Lambda\bar{\Sigma}^-\pi^+$ (or c.c.)	[/bb] $(8.3 \pm 0.7) \times 10^{-4}$	S=1.2	950
$pK^-\bar{\Lambda} + \text{c.c.}$	$(8.7 \pm 1.1) \times 10^{-4}$		876
$2(K^+K^-)$	$(7.2 \pm 0.8) \times 10^{-4}$		1131
$pK^-\bar{\Sigma}^0$	$(2.9 \pm 0.8) \times 10^{-4}$		819

$K^+ K^-$	$(2.86 \pm 0.21) \times 10^{-4}$		1468
$K_S^0 K_L^0$	$(1.95 \pm 0.11) \times 10^{-4}$	S=2.4	1466
$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(4.3 \pm 1.0) \times 10^{-3}$		903
$\Lambda \bar{\Lambda} \eta$	$(1.62 \pm 0.17) \times 10^{-4}$		672
$\Lambda \bar{\Lambda} \pi^0$	$(3.8 \pm 0.4) \times 10^{-5}$		998
$\bar{\Lambda} n K_S^0 + \text{c.c.}$	$(6.5 \pm 1.1) \times 10^{-4}$		872
$\pi^+ \pi^-$	$(1.47 \pm 0.14) \times 10^{-4}$		1542
$\Lambda \bar{\Sigma} + \text{c.c.}$	$(2.83 \pm 0.23) \times 10^{-5}$		1034
$K_S^0 K_S^0$	$< 1.4 \times 10^{-8}$	CL=95%	1466

Radiative decays

3γ	$(1.16 \pm 0.22) \times 10^{-5}$		1548
4γ	$< 9 \times 10^{-6}$	CL=90%	1548
5γ	$< 1.5 \times 10^{-5}$	CL=90%	1548
$\gamma \pi^0 \pi^0$	$(1.15 \pm 0.05) \times 10^{-3}$		1543
$\gamma \eta \pi^0$	$(2.14 \pm 0.31) \times 10^{-5}$		1497
$\gamma a_0(980)^0 \rightarrow \gamma \eta \pi^0$	$< 2.5 \times 10^{-6}$	CL=95%	–
$\gamma a_2(1320)^0 \rightarrow \gamma \eta \pi^0$	$< 6.6 \times 10^{-6}$	CL=95%	–
$\gamma K_S^0 K_S^0$	$(8.1 \pm 0.4) \times 10^{-4}$		1466
$\gamma \eta_c(1S)$	$(1.7 \pm 0.4) \%$	S=1.5	111
$\gamma \eta_c(1S) \rightarrow 3\gamma$	$(3.8 \begin{smallmatrix} + \\ - \end{smallmatrix} \begin{smallmatrix} 1.3 \\ 1.0 \end{smallmatrix}) \times 10^{-6}$	S=1.1	–
$\gamma \pi^+ \pi^- 2\pi^0$	$(8.3 \pm 3.1) \times 10^{-3}$		1518
$\gamma \eta \pi \pi$	$(6.1 \pm 1.0) \times 10^{-3}$		1487
$\gamma \eta_2(1870) \rightarrow \gamma \eta \pi^+ \pi^-$	$(6.2 \pm 2.4) \times 10^{-4}$		–
$\gamma \eta(1405/1475) \rightarrow \gamma K \bar{K} \pi$ [nnaa]	$(2.8 \pm 0.6) \times 10^{-3}$	S=1.6	1223
$\gamma \eta(1405/1475) \rightarrow \gamma \gamma \rho^0$	$(7.8 \pm 2.0) \times 10^{-5}$	S=1.8	1223
$\gamma \eta(1405/1475) \rightarrow \gamma \eta \pi^+ \pi^-$	$(3.0 \pm 0.5) \times 10^{-4}$		–
$\gamma \eta(1405/1475) \rightarrow \gamma \gamma \phi$	$< 8.2 \times 10^{-5}$	CL=95%	–
$\gamma \eta(1405) \rightarrow \gamma \gamma \gamma$	$< 2.63 \times 10^{-6}$	CL=90%	–
$\gamma \eta(1475) \rightarrow \gamma \gamma \gamma$	$< 1.86 \times 10^{-6}$	CL=90%	–
$\gamma \rho \rho$	$(4.5 \pm 0.8) \times 10^{-3}$		1340
$\gamma \rho \omega$	$< 5.4 \times 10^{-4}$	CL=90%	1338
$\gamma \rho \phi$	$< 8.8 \times 10^{-5}$	CL=90%	1258
$\gamma \eta'(958)$	$(5.25 \pm 0.07) \times 10^{-3}$	S=1.3	1400
$\gamma 2\pi^+ 2\pi^-$	$(2.8 \pm 0.5) \times 10^{-3}$	S=1.9	1517
$\gamma f_2(1270) f_2(1270)$	$(9.5 \pm 1.7) \times 10^{-4}$		878
$\gamma f_2(1270) f_2(1270)$ (non resonant)	$(8.2 \pm 1.9) \times 10^{-4}$		–
$\gamma K^+ K^- \pi^+ \pi^-$	$(2.1 \pm 0.6) \times 10^{-3}$		1407
$\gamma f_4(2050)$	$(2.7 \pm 0.7) \times 10^{-3}$		891
$\gamma \omega \omega$	$(1.61 \pm 0.33) \times 10^{-3}$		1336
$\gamma \eta(1405/1475) \rightarrow \gamma \rho^0 \rho^0$	$(1.7 \pm 0.4) \times 10^{-3}$	S=1.3	1223
$\gamma f_2(1270)$	$(1.64 \pm 0.12) \times 10^{-3}$	S=1.3	1286

$\gamma f_2(1270) \rightarrow \gamma K_S^0 K_S^0$	$(2.58 \pm_{-0.22}^{+0.60}) \times 10^{-5}$		–
$\gamma f_0(1370) \rightarrow \gamma K \bar{K}$	$(4.2 \pm 1.5) \times 10^{-4}$		–
$\gamma f_0(1370) \rightarrow \gamma K_S^0 K_S^0$	$(1.1 \pm 0.4) \times 10^{-5}$		–
$\gamma f_0(1500) \rightarrow \gamma K_S^0 K_S^0$	$(1.59 \pm_{-0.60}^{+0.24}) \times 10^{-5}$		–
$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	$(9.5 \pm_{-0.5}^{+1.0}) \times 10^{-4}$	S=1.5	1075
$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	$(3.8 \pm 0.5) \times 10^{-4}$		–
$\gamma f_0(1710) \rightarrow \gamma \omega \omega$	$(3.1 \pm 1.0) \times 10^{-4}$		–
$\gamma f_0(1710) \rightarrow \gamma \eta \eta$	$(2.4 \pm_{-0.7}^{+1.2}) \times 10^{-4}$		–
$\gamma \eta$	$(1.108 \pm 0.027) \times 10^{-3}$		1500
$\gamma f_1(1420) \rightarrow \gamma K \bar{K} \pi$	$(7.9 \pm 1.3) \times 10^{-4}$		1220
$\gamma f_1(1285)$	$(6.1 \pm 0.8) \times 10^{-4}$		1283
$\gamma f_1(1510) \rightarrow \gamma \eta \pi^+ \pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$		–
$\gamma f_2'(1525)$	$(5.7 \pm_{-0.5}^{+0.8}) \times 10^{-4}$	S=1.5	1177
$\gamma f_2'(1525) \rightarrow \gamma K_S^0 K_S^0$	$(8.0 \pm_{-0.5}^{+0.7}) \times 10^{-5}$		–
$\gamma f_2'(1525) \rightarrow \gamma \eta \eta$	$(3.4 \pm 1.4) \times 10^{-5}$		–
$\gamma f_2(1640) \rightarrow \gamma \omega \omega$	$(2.8 \pm 1.8) \times 10^{-4}$		–
$\gamma f_2(1910) \rightarrow \gamma \omega \omega$	$(2.0 \pm 1.4) \times 10^{-4}$		–
$\gamma f_0(1750) \rightarrow \gamma K_S^0 K_S^0$	$(1.11 \pm_{-0.33}^{+0.20}) \times 10^{-5}$		–
$\gamma f_0(1800) \rightarrow \gamma \omega \phi$	$(2.5 \pm 0.6) \times 10^{-4}$		–
$\gamma f_2(1810) \rightarrow \gamma \eta \eta$	$(5.4 \pm_{-2.4}^{+3.5}) \times 10^{-5}$		–
$\gamma f_2(1950) \rightarrow$	$(7.0 \pm 2.2) \times 10^{-4}$		–
$\gamma K^*(892) \bar{K}^*(892)$			
$\gamma K^*(892) \bar{K}^*(892)$	$(4.0 \pm 1.3) \times 10^{-3}$		1266
$\gamma \phi \phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	1166
$\gamma p \bar{p}$	$(3.8 \pm 1.0) \times 10^{-4}$		1232
$\gamma \eta(2225)$	$(3.14 \pm_{-0.19}^{+0.50}) \times 10^{-4}$		752
$\gamma \eta(1760) \rightarrow \gamma \rho^0 \rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		1048
$\gamma \eta(1760) \rightarrow \gamma \omega \omega$	$(1.98 \pm 0.33) \times 10^{-3}$		–
$\gamma \eta(1760) \rightarrow \gamma \gamma \gamma$	$< 4.80 \times 10^{-6}$	CL=90%	–
$\gamma X(1835) \rightarrow \gamma \pi^+ \pi^- \eta'$	$(2.77 \pm_{-0.40}^{+0.34}) \times 10^{-4}$	S=1.1	1006
$\gamma X(1835) \rightarrow \gamma p \bar{p}$	$(7.7 \pm_{-0.9}^{+1.5}) \times 10^{-5}$		–
$\gamma X(1835) \rightarrow \gamma K_S^0 K_S^0 \eta$	$(3.3 \pm_{-1.3}^{+2.0}) \times 10^{-5}$		–
$\gamma X(1835) \rightarrow \gamma \gamma \gamma$	$< 3.56 \times 10^{-6}$	CL=90%	–
$\gamma X(1840) \rightarrow \gamma 3(\pi^+ \pi^-)$	$(2.4 \pm_{-0.8}^{+0.7}) \times 10^{-5}$		–
$\gamma(K \bar{K} \pi) [J^{PC} = 0^{-+}]$	$(7 \pm 4) \times 10^{-4}$	S=2.1	1442
$\gamma \pi^0$	$(3.56 \pm 0.17) \times 10^{-5}$		1546

$\gamma p \bar{p} \pi^+ \pi^-$	< 7.9	$\times 10^{-4}$	CL=90%	1107
$\gamma \Lambda \bar{\Lambda}$	< 1.3	$\times 10^{-4}$	CL=90%	1074
$\gamma f_0(2100) \rightarrow \gamma \eta \eta$	(1.13 ± 0.60)	$\times 10^{-4}$		—
$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	(6.2 ± 1.0)	$\times 10^{-4}$		—
$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	(5.9 ± 1.3)	$\times 10^{-4}$		—
$\gamma f_0(2200) \rightarrow \gamma K_S^0 K_S^0$	(2.72 ± 0.19)	$\times 10^{-4}$		—
$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	< 3.9	$\times 10^{-5}$	CL=90%	—
$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	< 4.1	$\times 10^{-5}$	CL=90%	—
$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	(1.5 ± 0.8)	$\times 10^{-5}$		—
$\gamma f_0(2330) \rightarrow \gamma K_S^0 K_S^0$	(4.9 ± 0.7)	$\times 10^{-5}$		—
$\gamma f_2(2340) \rightarrow \gamma \eta \eta$	(5.6 ± 2.4)	$\times 10^{-5}$		—
$\gamma f_2(2340) \rightarrow \gamma K_S^0 K_S^0$	(5.5 ± 4.0)	$\times 10^{-5}$		—
$\gamma f_0(1500) \rightarrow \gamma \pi \pi$	(1.09 ± 0.24)	$\times 10^{-4}$		1183
$\gamma f_0(1500) \rightarrow \gamma \eta \eta$	(1.7 ± 0.6)	$\times 10^{-5}$		—
$\gamma A \rightarrow \gamma \text{invisible}$	[<i>oaaa</i>] < 6.3	$\times 10^{-6}$	CL=90%	—
$\gamma A^0 \rightarrow \gamma \mu^+ \mu^-$	[<i>ppaa</i>] < 5	$\times 10^{-6}$	CL=90%	—

Dalitz decays

$\pi^0 e^+ e^-$	(7.6 ± 1.4)	$\times 10^{-7}$		1546
$\eta e^+ e^-$	(1.43 ± 0.07)	$\times 10^{-5}$		1500
$\eta'(958) e^+ e^-$	(6.59 ± 0.18)	$\times 10^{-5}$		1400
$\eta U \rightarrow \eta e^+ e^-$	< 9.11	$\times 10^{-7}$	CL=90%	—
$\eta'(958) U \rightarrow \eta'(958) e^+ e^-$	< 2.0	$\times 10^{-7}$	CL=90%	—
$\phi e^+ e^-$	< 1.2	$\times 10^{-7}$	CL=90%	1381

Weak decays

$D^- e^+ \nu_e + \text{c.c.}$	< 1.2	$\times 10^{-5}$	CL=90%	984
$\bar{D}^0 e^+ e^- + \text{c.c.}$	< 8.5	$\times 10^{-8}$	CL=90%	987
$D_s^- e^+ \nu_e + \text{c.c.}$	< 1.3	$\times 10^{-6}$	CL=90%	923
$D_s^{*-} e^+ \nu_e + \text{c.c.}$	< 1.8	$\times 10^{-6}$	CL=90%	828
$D^- \pi^+ + \text{c.c.}$	< 7.5	$\times 10^{-5}$	CL=90%	977
$\bar{D}^0 \bar{K}^0 + \text{c.c.}$	< 1.7	$\times 10^{-4}$	CL=90%	898
$\bar{D}^0 \bar{K}^{*0} + \text{c.c.}$	< 2.5	$\times 10^{-6}$	CL=90%	670
$D_s^- \pi^+ + \text{c.c.}$	< 1.3	$\times 10^{-4}$	CL=90%	915
$D_s^- \rho^+ + \text{c.c.}$	< 1.3	$\times 10^{-5}$	CL=90%	663

Charge conjugation (C), Parity (P), Lepton Family number (LF) violating modes

$\gamma \gamma$	C	< 2.7	$\times 10^{-7}$	CL=90%	1548
$\gamma \phi$	C	< 1.4	$\times 10^{-6}$	CL=90%	1381
$e^\pm \mu^\mp$	LF	< 1.6	$\times 10^{-7}$	CL=90%	1547

$e^\pm \tau^\mp$	LF	< 8.3	$\times 10^{-6}$	CL=90%	1039
$\mu^\pm \tau^\mp$	LF	< 2.0	$\times 10^{-6}$	CL=90%	1035
$\Lambda_c^+ e^- + c.c.$		< 6.9	$\times 10^{-8}$	CL=90%	–

Other decays

invisible		< 7	$\times 10^{-4}$	CL=90%	–
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$\chi_{c0}(1P)$

$$J^G(J^{PC}) = 0^+(0^{++})$$

Mass $m = 3414.71 \pm 0.30$ MeV

Full width $\Gamma = 10.8 \pm 0.6$ MeV

$\chi_{c0}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
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Hadronic decays

$2(\pi^+ \pi^-)$	(2.34 ± 0.18) %		1679
$\rho^0 \pi^+ \pi^-$	$(9.1 \pm 2.9) \times 10^{-3}$		1607
$f_0(980) f_0(980)$	$(6.6 \pm 2.1) \times 10^{-4}$		1391
$\pi^+ \pi^- \pi^0 \pi^0$	(3.3 ± 0.4) %		1680
$\rho^+ \pi^- \pi^0 + c.c.$	(2.9 ± 0.4) %		1607
$4\pi^0$	$(3.3 \pm 0.4) \times 10^{-3}$		1681
$\pi^+ \pi^- K^+ K^-$	(1.81 ± 0.14) %		1580
$K_0^*(1430)^0 \bar{K}_0^*(1430)^0 \rightarrow$ $\pi^+ \pi^- K^+ K^-$	$(9.8 \begin{smallmatrix} +4.0 \\ -2.8 \end{smallmatrix}) \times 10^{-4}$		–
$K_0^*(1430)^0 \bar{K}_2^*(1430)^0 + c.c. \rightarrow$ $\pi^+ \pi^- K^+ K^-$	$(8.0 \begin{smallmatrix} +2.0 \\ -2.4 \end{smallmatrix}) \times 10^{-4}$		–
$K_1(1270)^+ K^- + c.c. \rightarrow$ $\pi^+ \pi^- K^+ K^-$	$(6.3 \pm 1.9) \times 10^{-3}$		–
$K_1(1400)^+ K^- + c.c. \rightarrow$ $\pi^+ \pi^- K^+ K^-$	$< 2.7 \times 10^{-3}$	CL=90%	–
$f_0(980) f_0(980)$	$(1.6 \begin{smallmatrix} +1.0 \\ -0.9 \end{smallmatrix}) \times 10^{-4}$		1391
$f_0(980) f_0(2200)$	$(7.9 \begin{smallmatrix} +2.0 \\ -2.5 \end{smallmatrix}) \times 10^{-4}$		586
$f_0(1370) f_0(1370)$	$< 2.7 \times 10^{-4}$	CL=90%	1019
$f_0(1370) f_0(1500)$	$< 1.7 \times 10^{-4}$	CL=90%	920
$f_0(1370) f_0(1710)$	$(6.7 \begin{smallmatrix} +3.5 \\ -2.3 \end{smallmatrix}) \times 10^{-4}$		740
$f_0(1500) f_0(1370)$	$< 1.3 \times 10^{-4}$	CL=90%	920
$f_0(1500) f_0(1500)$	$< 5 \times 10^{-5}$	CL=90%	804
$f_0(1500) f_0(1710)$	$< 7 \times 10^{-5}$	CL=90%	581
$K^+ K^- \pi^+ \pi^- \pi^0$	$(8.6 \pm 0.9) \times 10^{-3}$		1545
$K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(4.2 \pm 0.4) \times 10^{-3}$		1543
$K^+ K^- \pi^0 \pi^0$	$(5.6 \pm 0.9) \times 10^{-3}$		1582
$K^+ \pi^- \bar{K}^0 \pi^0 + c.c.$	(2.49 ± 0.33) %		1581

$\rho^+ K^- K^0 + \text{c.c.}$	$(1.21 \pm 0.21) \%$		1458
$K^*(892)^- K^+ \pi^0 \rightarrow$	$(4.6 \pm 1.2) \times 10^{-3}$		—
$K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.}$			
$K_S^0 K_S^0 \pi^+ \pi^-$	$(5.7 \pm 1.1) \times 10^{-3}$		1579
$K^+ K^- \eta \pi^0$	$(3.0 \pm 0.7) \times 10^{-3}$		1468
$3(\pi^+ \pi^-)$	$(1.20 \pm 0.18) \%$		1633
$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(7.5 \pm 1.6) \times 10^{-3}$		1523
$K^*(892)^0 \bar{K}^*(892)^0$	$(1.7 \pm 0.6) \times 10^{-3}$		1456
$\pi \pi$	$(8.51 \pm 0.33) \times 10^{-3}$		1702
$\pi^0 \eta$	$< 1.8 \times 10^{-4}$		1661
$\pi^0 \eta'$	$< 1.1 \times 10^{-3}$		1570
$\pi^0 \eta_c$	$< 1.6 \times 10^{-3}$	CL=90%	383
$\eta \eta$	$(3.01 \pm 0.19) \times 10^{-3}$		1617
$\eta \eta'$	$(9.1 \pm 1.1) \times 10^{-5}$		1521
$\eta' \eta'$	$(2.17 \pm 0.12) \times 10^{-3}$		1413
$\omega \omega$	$(9.7 \pm 1.1) \times 10^{-4}$		1517
$\omega \phi$	$(1.41 \pm 0.13) \times 10^{-4}$		1447
$\omega K^+ K^-$	$(1.94 \pm 0.21) \times 10^{-3}$		1457
$K^+ K^-$	$(6.05 \pm 0.31) \times 10^{-3}$		1634
$K_S^0 K_S^0$	$(3.16 \pm 0.17) \times 10^{-3}$		1633
$\pi^+ \pi^- \eta$	$< 2.0 \times 10^{-4}$	CL=90%	1651
$\pi^+ \pi^- \eta'$	$< 4 \times 10^{-4}$	CL=90%	1560
$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$< 9 \times 10^{-5}$	CL=90%	1610
$K^+ K^- \pi^0$	$< 6 \times 10^{-5}$	CL=90%	1611
$K^+ K^- \eta$	$< 2.3 \times 10^{-4}$	CL=90%	1512
$K^+ K^- K_S^0 K_S^0$	$(1.4 \pm 0.5) \times 10^{-3}$		1331
$K_S^0 K_S^0 K_S^0 K_S^0$	$(5.8 \pm 0.5) \times 10^{-4}$		1327
$K^+ K^- K^+ K^-$	$(2.82 \pm 0.29) \times 10^{-3}$		1333
$K^+ K^- \phi$	$(9.7 \pm 2.5) \times 10^{-4}$		1381
$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.7 \pm 0.6) \times 10^{-3}$		1326
$K^+ K^- \pi^0 \phi$	$(1.90 \pm 0.35) \times 10^{-3}$		1329
$\phi \pi^+ \pi^- \pi^0$	$(1.18 \pm 0.15) \times 10^{-3}$		1525
$\phi \phi$	$(8.0 \pm 0.7) \times 10^{-4}$		1370
$\phi \phi \eta$	$(8.4 \pm 1.0) \times 10^{-4}$		1100
$\rho \bar{\rho}$	$(2.21 \pm 0.08) \times 10^{-4}$		1426
$\rho \bar{\rho} \pi^0$	$(7.0 \pm 0.7) \times 10^{-4}$	S=1.3	1379
$\rho \bar{\rho} \eta$	$(3.5 \pm 0.4) \times 10^{-4}$		1187
$\rho \bar{\rho} \omega$	$(5.2 \pm 0.6) \times 10^{-4}$		1043
$\rho \bar{\rho} \phi$	$(6.0 \pm 1.4) \times 10^{-5}$		876
$\rho \bar{\rho} \pi^+ \pi^-$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	1320
$\rho \bar{\rho} \pi^0 \pi^0$	$(1.04 \pm 0.28) \times 10^{-3}$		1324
$\rho \bar{\rho} K^+ K^- (\text{non-resonant})$	$(1.22 \pm 0.26) \times 10^{-4}$		890
$\rho \bar{\rho} K_S^0 K_S^0$	$< 8.8 \times 10^{-4}$	CL=90%	884
$\rho \bar{\rho} \pi^-$	$(1.27 \pm 0.11) \times 10^{-3}$		1376

$\bar{p}n\pi^+$	$(1.37 \pm 0.12) \times 10^{-3}$		1376
$p\bar{n}\pi^-\pi^0$	$(2.34 \pm 0.21) \times 10^{-3}$		1321
$\bar{p}n\pi^+\pi^0$	$(2.21 \pm 0.18) \times 10^{-3}$		1321
$\Lambda\bar{\Lambda}$	$(3.27 \pm 0.24) \times 10^{-4}$		1292
$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(1.18 \pm 0.13) \times 10^{-3}$		1153
$\Lambda\bar{\Lambda}\pi^+\pi^-$ (non-resonant)	$< 5 \times 10^{-4}$	CL=90%	1153
$\Sigma(1385)^+\bar{\Lambda}\pi^- + c.c.$	$< 5 \times 10^{-4}$	CL=90%	1083
$\Sigma(1385)^-\bar{\Lambda}\pi^+ + c.c.$	$< 5 \times 10^{-4}$	CL=90%	1083
$K^+\bar{p}\Lambda + c.c.$	$(1.25 \pm 0.12) \times 10^{-3}$	S=1.3	1132
$K^*(892)^+\bar{p}\Lambda + c.c.$	$(4.8 \pm 0.9) \times 10^{-4}$		845
$K^+\bar{p}\Lambda(1520) + c.c.$	$(2.9 \pm 0.7) \times 10^{-4}$		859
$\Lambda(1520)\bar{\Lambda}(1520)$	$(3.1 \pm 1.2) \times 10^{-4}$		780
$\Sigma^0\bar{\Sigma}^0$	$(4.68 \pm 0.32) \times 10^{-4}$		1222
$\Sigma^+\bar{p}K_S^0 + c.c.$	$(3.52 \pm 0.27) \times 10^{-4}$		1089
$\Sigma^+\bar{\Sigma}^-$	$(4.6 \pm 0.8) \times 10^{-4}$	S=2.6	1225
$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$(1.6 \pm 0.6) \times 10^{-4}$		1001
$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$(2.3 \pm 0.7) \times 10^{-4}$		1001
$K^-\Lambda\bar{\Xi}^+ + c.c.$	$(1.94 \pm 0.35) \times 10^{-4}$		873
$\Xi^0\bar{\Xi}^0$	$(3.1 \pm 0.8) \times 10^{-4}$		1089
$\Xi^-\bar{\Xi}^+$	$(4.8 \pm 0.7) \times 10^{-4}$		1081
$\eta_c\pi^+\pi^-$	$< 7 \times 10^{-4}$	CL=90%	307

Radiative decays

$\gamma J/\psi(1S)$	$(1.40 \pm 0.05) \%$		303
$\gamma\rho^0$	$< 9 \times 10^{-6}$	CL=90%	1619
$\gamma\omega$	$< 8 \times 10^{-6}$	CL=90%	1618
$\gamma\phi$	$< 6 \times 10^{-6}$	CL=90%	1555
$\gamma\gamma$	$(2.04 \pm 0.09) \times 10^{-4}$		1707
$e^+e^- J/\psi(1S)$	$(1.33 \pm 0.29) \times 10^{-4}$		303
$\mu^+\mu^- J/\psi(1S)$	$< 1.9 \times 10^{-5}$	CL=90%	226

$\chi_{c1}(1P)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

$$\text{Mass } m = 3510.67 \pm 0.05 \text{ MeV} \quad (S = 1.2)$$

$$\text{Full width } \Gamma = 0.84 \pm 0.04 \text{ MeV}$$

$\chi_{c1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
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Hadronic decays

$3(\pi^+\pi^-)$	$(5.8 \pm 1.4) \times 10^{-3}$	S=1.2	1683
$2(\pi^+\pi^-)$	$(7.6 \pm 2.6) \times 10^{-3}$		1728

$\pi^+\pi^-\pi^0\pi^0$	(1.19±0.15) %		1729
$\rho^+\pi^-\pi^0 + \text{c.c.}$	(1.45±0.24) %		1658
$\rho^0\pi^+\pi^-$	(3.9 ±3.5) × 10 ⁻³		1657
$4\pi^0$	(5.4 ±0.8) × 10 ⁻⁴		1729
$\pi^+\pi^-K^+K^-$	(4.5 ±1.0) × 10 ⁻³		1632
$K^+K^-\pi^0\pi^0$	(1.12±0.27) × 10 ⁻³		1634
$K^+K^-\pi^+\pi^-\pi^0$	(1.15±0.13) %		1598
$K_S^0K^\pm\pi^\mp\pi^+\pi^-$	(7.5 ±0.8) × 10 ⁻³		1596
$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(8.6 ±1.4) × 10 ⁻³		1632
$\rho^-K^+\bar{K}^0 + \text{c.c.}$	(5.0 ±1.2) × 10 ⁻³		1514
$K^*(892)^0\bar{K}^0\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(2.3 ±0.6) × 10 ⁻³		—
$K^+K^-\eta\pi^0$	(1.12±0.34) × 10 ⁻³		1523
$\pi^+\pi^-K_S^0K_S^0$	(6.9 ±2.9) × 10 ⁻⁴		1630
$K^+K^-\eta$	(3.2 ±1.0) × 10 ⁻⁴		1566
$\bar{K}^0K^+\pi^- + \text{c.c.}$	(7.0 ±0.6) × 10 ⁻³		1661
$K^*(892)^0\bar{K}^0 + \text{c.c.}$	(10 ±4) × 10 ⁻⁴		1602
$K^*(892)^+K^- + \text{c.c.}$	(1.4 ±0.6) × 10 ⁻³		1602
$K_J^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0K^+\pi^- + \text{c.c.}$	< 8 × 10 ⁻⁴	CL=90%	—
$K_J^*(1430)^+K^- + \text{c.c.} \rightarrow$ $K_S^0K^+\pi^- + \text{c.c.}$	< 2.1 × 10 ⁻³	CL=90%	—
$K^+K^-\pi^0$	(1.81±0.24) × 10 ⁻³		1662
$\eta\pi^+\pi^-$	(4.62±0.23) × 10 ⁻³		1701
$a_0(980)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	(3.2 ±0.4) × 10 ⁻³	S=2.2	—
$a_2(1320)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	(1.76±0.24) × 10 ⁻⁴		—
$a_2(1700)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	(4.6 ±0.7) × 10 ⁻⁵		—
$f_2(1270)\eta \rightarrow \eta\pi^+\pi^-$	(3.5 ±0.6) × 10 ⁻⁴		—
$f_4(2050)\eta \rightarrow \eta\pi^+\pi^-$	(2.5 ±0.9) × 10 ⁻⁵		—
$\pi_1(1400)^+\pi^- + \text{c.c.} \rightarrow$ $\eta\pi^+\pi^-$	< 5 × 10 ⁻⁵	CL=90%	—
$\pi_1(1600)^+\pi^- + \text{c.c.} \rightarrow$ $\eta\pi^+\pi^-$	< 1.5 × 10 ⁻⁵	CL=90%	—
$\pi_1(2015)^+\pi^- + \text{c.c.} \rightarrow$ $\eta\pi^+\pi^-$	< 8 × 10 ⁻⁶	CL=90%	—
$f_2(1270)\eta$	(6.7 ±1.1) × 10 ⁻⁴		1467
$\pi^+\pi^-\eta'$	(2.2 ±0.4) × 10 ⁻³		1612
$K^+K^-\eta'(958)$	(8.8 ±0.9) × 10 ⁻⁴		1461
$K_0^*(1430)^+K^- + \text{c.c.}$	(6.4 $\begin{smallmatrix} +2.2 \\ -2.8 \end{smallmatrix}$) × 10 ⁻⁴		—
$f_0(980)\eta'(958)$	(1.6 $\begin{smallmatrix} +1.4 \\ -0.7 \end{smallmatrix}$) × 10 ⁻⁴		1460
$f_0(1710)\eta'(958)$	(7 $\begin{smallmatrix} +7 \\ -5 \end{smallmatrix}$) × 10 ⁻⁵		1118
$f_2'(1525)\eta'(958)$	(9 ±6) × 10 ⁻⁵		1229

$\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-$	$(3.5 \pm 0.9) \times 10^{-7}$		—
$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(3.2 \pm 2.1) \times 10^{-3}$		1577
$K^*(892)^0 \bar{K}^*(892)^0$	$(1.4 \pm 0.4) \times 10^{-3}$		1512
$K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	CL=90%	1390
$K_S^0 K_S^0 K_S^0 K_S^0$	$(3.5 \pm 1.0) \times 10^{-5}$		1387
$K^+ K^- K^+ K^-$	$(5.4 \pm 1.1) \times 10^{-4}$		1393
$K^+ K^- \phi$	$(4.1 \pm 1.5) \times 10^{-4}$		1440
$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.3 \pm 0.5) \times 10^{-3}$		1387
$K^+ K^- \pi^0 \phi$	$(1.62 \pm 0.30) \times 10^{-3}$		1390
$\phi \pi^+ \pi^- \pi^0$	$(7.5 \pm 1.0) \times 10^{-4}$		1578
$\omega \omega$	$(5.7 \pm 0.7) \times 10^{-4}$		1571
$\omega K^+ K^-$	$(7.8 \pm 0.9) \times 10^{-4}$		1513
$\omega \phi$	$(2.7 \pm 0.4) \times 10^{-5}$		1503
$\phi \phi$	$(4.2 \pm 0.5) \times 10^{-4}$		1429
$\phi \phi \eta$	$(3.0 \pm 0.5) \times 10^{-4}$		1172
$p \bar{p}$	$(7.60 \pm 0.34) \times 10^{-5}$		1484
$p \bar{p} \pi^0$	$(1.55 \pm 0.18) \times 10^{-4}$		1438
$p \bar{p} \eta$	$(1.45 \pm 0.25) \times 10^{-4}$		1254
$p \bar{p} \omega$	$(2.12 \pm 0.31) \times 10^{-4}$		1117
$p \bar{p} \phi$	$< 1.7 \times 10^{-5}$	CL=90%	962
$p \bar{p} \pi^+ \pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$		1381
$p \bar{p} \pi^0 \pi^0$	$< 5 \times 10^{-4}$	CL=90%	1385
$p \bar{p} K^+ K^- (\text{non-resonant})$	$(1.27 \pm 0.22) \times 10^{-4}$		974
$p \bar{p} K_S^0 K_S^0$	$< 4.5 \times 10^{-4}$	CL=90%	968
$p \bar{n} \pi^-$	$(3.8 \pm 0.5) \times 10^{-4}$		1435
$\bar{p} n \pi^+$	$(3.9 \pm 0.5) \times 10^{-4}$		1435
$p \bar{n} \pi^- \pi^0$	$(1.03 \pm 0.12) \times 10^{-3}$		1383
$\bar{p} n \pi^+ \pi^0$	$(1.01 \pm 0.12) \times 10^{-3}$		1383
$\Lambda \bar{\Lambda}$	$(1.14 \pm 0.11) \times 10^{-4}$		1355
$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(2.9 \pm 0.5) \times 10^{-4}$		1223
$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$(2.5 \pm 0.6) \times 10^{-4}$		1223
$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	1157
$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%	1157
$K^+ \bar{p} \Lambda + \text{c.c.}$	$(4.2 \pm 0.4) \times 10^{-4}$	S=1.2	1203
$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	$(4.9 \pm 0.7) \times 10^{-4}$		935
$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(1.7 \pm 0.4) \times 10^{-4}$		951
$\Lambda(1520) \bar{\Lambda}(1520)$	$< 9 \times 10^{-5}$	CL=90%	880
$\Sigma^0 \bar{\Sigma}^0$	$(4.2 \pm 0.6) \times 10^{-5}$		1288
$\Sigma^+ \bar{p} K_S^0 + \text{c.c.}$	$(1.53 \pm 0.12) \times 10^{-4}$		1163
$\Sigma^+ \bar{\Sigma}^-$	$(3.6 \pm 0.7) \times 10^{-5}$		1291
$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$< 9 \times 10^{-5}$	CL=90%	1081
$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$< 5 \times 10^{-5}$	CL=90%	1081
$K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$	$(1.35 \pm 0.24) \times 10^{-4}$		963
$\Xi^0 \bar{\Xi}^0$	$< 6 \times 10^{-5}$	CL=90%	1163

$\Xi^- \Xi^+$	$(8.0 \pm 2.1) \times 10^{-5}$		1155
$\pi^+ \pi^- + K^+ K^-$	$< 2.1 \times 10^{-3}$		—
$K_S^0 K_S^0$	$< 6 \times 10^{-5}$	CL=90%	1683
$\eta_c \pi^+ \pi^-$	$< 3.2 \times 10^{-3}$	CL=90%	413

Radiative decays

$\gamma J/\psi(1S)$	$(34.3 \pm 1.0) \%$		389
$\gamma \rho^0$	$(2.16 \pm 0.17) \times 10^{-4}$		1670
$\gamma \omega$	$(6.8 \pm 0.8) \times 10^{-5}$		1668
$\gamma \phi$	$(2.4 \pm 0.5) \times 10^{-5}$		1607
$\gamma \gamma$	$< 6.3 \times 10^{-6}$	CL=90%	1755
$e^+ e^- J/\psi(1S)$	$(3.46 \pm 0.22) \times 10^{-3}$		389
$\mu^+ \mu^- J/\psi(1S)$	$(2.33 \pm 0.29) \times 10^{-4}$		335

$h_c(1P)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

Mass $m = 3525.38 \pm 0.11$ MeV

Full width $\Gamma = 0.7 \pm 0.4$ MeV

$h_c(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	ρ (MeV/c)
$J/\psi(1S) \pi \pi$	not seen		312
$J/\psi(1S) \pi^+ \pi^-$	$< 2.3 \times 10^{-3}$	90%	305
$p \bar{p}$	$< 1.5 \times 10^{-4}$	90%	1492
$p \bar{p} \pi^+ \pi^-$	$(2.9 \pm 0.6) \times 10^{-3}$		1390
$\pi^+ \pi^- \pi^0$	$(1.6 \pm 0.5) \times 10^{-3}$		1749
$2\pi^+ 2\pi^- \pi^0$	$(8.1 \pm 1.8) \times 10^{-3}$		1716
$3\pi^+ 3\pi^- \pi^0$	$< 9 \times 10^{-3}$	90%	1661
$K^+ K^- \pi^+ \pi^-$	$< 6 \times 10^{-4}$	90%	1640

Radiative decays

$\gamma \eta$	$(4.7 \pm 2.1) \times 10^{-4}$		1720
$\gamma \eta'(958)$	$(1.5 \pm 0.4) \times 10^{-3}$		1633
$\gamma \eta_c(1S)$	$(51 \pm 6) \%$		500

$\chi_{c2}(1P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass $m = 3556.17 \pm 0.07$ MeV

Full width $\Gamma = 1.97 \pm 0.09$ MeV

$\chi_{c2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level (ρ MeV/c)
Hadronic decays		
$2(\pi^+\pi^-)$	(1.02±0.09) %	1751
$\pi^+\pi^-\pi^0\pi^0$	(1.83±0.23) %	1752
$\rho^+\pi^-\pi^0 + \text{c.c.}$	(2.19±0.34) %	1682
$4\pi^0$	(1.11±0.15) $\times 10^{-3}$	1752
$K^+K^-\pi^0\pi^0$	(2.1 ±0.4) $\times 10^{-3}$	1658
$K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(1.38±0.20) %	1657
$\rho^-K^+\bar{K}^0 + \text{c.c.}$	(4.1 ±1.2) $\times 10^{-3}$	1540
$K^*(892)^0K^-\pi^+ \rightarrow$ $K^-\pi^+K^0\pi^0 + \text{c.c.}$	(2.9 ±0.8) $\times 10^{-3}$	—
$K^*(892)^0\bar{K}^0\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(3.8 ±0.9) $\times 10^{-3}$	—
$K^*(892)^-K^+\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(3.7 ±0.8) $\times 10^{-3}$	—
$K^*(892)^+\bar{K}^0\pi^- \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	(2.9 ±0.8) $\times 10^{-3}$	—
$K^+K^-\eta\pi^0$	(1.3 ±0.4) $\times 10^{-3}$	1549
$K^+K^-\pi^+\pi^-$	(8.4 ±0.9) $\times 10^{-3}$	1656
$K^+K^-\pi^+\pi^-\pi^0$	(1.17±0.13) %	1623
$K_S^0K^\pm\pi^\mp\pi^+\pi^-$	(7.3 ±0.8) $\times 10^{-3}$	1621
$K^+\bar{K}^*(892)^0\pi^- + \text{c.c.}$	(2.1 ±1.1) $\times 10^{-3}$	1602
$K^*(892)^0\bar{K}^*(892)^0$	(2.3 ±0.4) $\times 10^{-3}$	1538
$3(\pi^+\pi^-)$	(8.6 ±1.8) $\times 10^{-3}$	1707
$\phi\phi$	(1.06±0.09) $\times 10^{-3}$	1457
$\phi\phi\eta$	(5.3 ±0.6) $\times 10^{-4}$	1206
$\omega\omega$	(8.4 ±1.0) $\times 10^{-4}$	1597
ωK^+K^-	(7.3 ±0.9) $\times 10^{-4}$	1540
$\omega\phi$	(9.6 ±2.7) $\times 10^{-6}$	1529
$\pi\pi$	(2.23±0.09) $\times 10^{-3}$	1773
$\rho^0\pi^+\pi^-$	(3.7 ±1.6) $\times 10^{-3}$	1682
$\pi^+\pi^-\pi^0$ (non-resonant)	(2.0 ±0.4) $\times 10^{-5}$	1765
$\rho(770)^\pm\pi^\mp$	(6 ±4) $\times 10^{-6}$	—
$\pi^+\pi^-\eta$	(4.8 ±1.3) $\times 10^{-4}$	1724
$\pi^+\pi^-\eta'$	(5.0 ±1.8) $\times 10^{-4}$	1636
$\eta\eta$	(5.4 ±0.4) $\times 10^{-4}$	1692
K^+K^-	(1.01±0.06) $\times 10^{-3}$	1708
$K_S^0K_S^0$	(5.2 ±0.4) $\times 10^{-4}$	1707
$K^*(892)^\pm K^\mp$	(1.44±0.21) $\times 10^{-4}$	1627
$K^*(892)^0\bar{K}^0 + \text{c.c.}$	(1.24±0.27) $\times 10^{-4}$	1627
$K_2^*(1430)^\pm K^\mp$	(1.48±0.12) $\times 10^{-3}$	—
$K_2^*(1430)^0\bar{K}^0 + \text{c.c.}$	(1.24±0.17) $\times 10^{-3}$	1443
$K_3^*(1780)^\pm K^\mp$	(5.2 ±0.8) $\times 10^{-4}$	—

$K_3^*(1780)^0 \bar{K}^0 + \text{c.c.}$	$(5.6 \pm 2.1) \times 10^{-4}$		1276
$a_2(1320)^0 \pi^0$	$(1.29 \pm 0.34) \times 10^{-3}$		—
$a_2(1320)^\pm \pi^\mp$	$(1.8 \pm 0.6) \times 10^{-3}$		1531
$\bar{K}^0 K^+ \pi^- + \text{c.c.}$	$(1.28 \pm 0.18) \times 10^{-3}$		1685
$K^+ K^- \pi^0$	$(3.0 \pm 0.8) \times 10^{-4}$		1686
$K^+ K^- \eta$	$< 3.2 \times 10^{-4}$	90%	1592
$K^+ K^- \eta'(958)$	$(1.94 \pm 0.34) \times 10^{-4}$		1488
$\eta \eta'$	$(2.2 \pm 0.5) \times 10^{-5}$		1600
$\eta' \eta'$	$(4.6 \pm 0.6) \times 10^{-5}$		1498
$\pi^+ \pi^- K_S^0 K_S^0$	$(2.2 \pm 0.5) \times 10^{-3}$		1655
$K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	90%	1418
$K_S^0 K_S^0 K_S^0 K_S^0$	$(1.13 \pm 0.18) \times 10^{-4}$		1415
$K^+ K^- K^+ K^-$	$(1.65 \pm 0.20) \times 10^{-3}$		1421
$K^+ K^- \phi$	$(1.42 \pm 0.29) \times 10^{-3}$		1468
$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(4.8 \pm 0.7) \times 10^{-3}$		1416
$K^+ K^- \pi^0 \phi$	$(2.7 \pm 0.5) \times 10^{-3}$		1419
$\phi \pi^+ \pi^- \pi^0$	$(9.3 \pm 1.2) \times 10^{-4}$		1603
$p \bar{p}$	$(7.33 \pm 0.33) \times 10^{-5}$		1510
$p \bar{p} \pi^0$	$(4.7 \pm 0.4) \times 10^{-4}$		1465
$p \bar{p} \eta$	$(1.74 \pm 0.25) \times 10^{-4}$		1285
$p \bar{p} \omega$	$(3.6 \pm 0.4) \times 10^{-4}$		1152
$p \bar{p} \phi$	$(2.8 \pm 0.9) \times 10^{-5}$		1002
$p \bar{p} \pi^+ \pi^-$	$(1.32 \pm 0.34) \times 10^{-3}$		1410
$p \bar{p} \pi^0 \pi^0$	$(7.8 \pm 2.3) \times 10^{-4}$		1414
$p \bar{p} K^+ K^- (\text{non-resonant})$	$(1.91 \pm 0.32) \times 10^{-4}$		1013
$p \bar{p} K_S^0 K_S^0$	$< 7.9 \times 10^{-4}$	90%	1007
$p \bar{n} \pi^-$	$(8.5 \pm 0.9) \times 10^{-4}$		1463
$\bar{p} n \pi^+$	$(8.9 \pm 0.8) \times 10^{-4}$		1463
$p \bar{n} \pi^- \pi^0$	$(2.17 \pm 0.18) \times 10^{-3}$		1411
$\bar{p} n \pi^+ \pi^0$	$(2.11 \pm 0.18) \times 10^{-3}$		1411
$\Lambda \bar{\Lambda}$	$(1.84 \pm 0.15) \times 10^{-4}$		1384
$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(1.25 \pm 0.15) \times 10^{-3}$		1255
$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$(6.6 \pm 1.5) \times 10^{-4}$		1255
$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 4 \times 10^{-4}$	90%	1192
$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 6 \times 10^{-4}$	90%	1192
$K^+ \bar{p} \Lambda + \text{c.c.}$	$(7.8 \pm 0.5) \times 10^{-4}$		1236
$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	$(8.2 \pm 1.1) \times 10^{-4}$		976
$K^+ \bar{p} \Lambda(1520) + \text{c.c.}$	$(2.8 \pm 0.7) \times 10^{-4}$		992
$\Lambda(1520) \bar{\Lambda}(1520)$	$(4.6 \pm 1.5) \times 10^{-4}$		924
$\Sigma^0 \bar{\Sigma}^0$	$(3.7 \pm 0.6) \times 10^{-5}$		1319
$\Sigma^+ \bar{p} K_S^0 + \text{c.c.}$	$(8.2 \pm 0.9) \times 10^{-5}$		1197
$\Sigma^+ \bar{\Sigma}^-$	$(3.4 \pm 0.7) \times 10^{-5}$		1322
$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$< 1.6 \times 10^{-4}$	90%	1118
$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$< 8 \times 10^{-5}$	90%	1118

$K^- \Lambda \Xi^+ + \text{c.c.}$	$(1.76 \pm 0.32) \times 10^{-4}$		1004
$\Xi^0 \Xi^0$	$< 1.0 \times 10^{-4}$	90%	1197
$\Xi^- \Xi^+$	$(1.42 \pm 0.32) \times 10^{-4}$		1189
$J/\psi(1S) \pi^+ \pi^- \pi^0$	$< 1.5 \%$	90%	185
$\pi^0 \eta_c$	$< 3.2 \times 10^{-3}$	90%	511
$\eta_c(1S) \pi^+ \pi^-$	$< 5.4 \times 10^{-3}$	90%	459

Radiative decays

$\gamma J/\psi(1S)$	$(19.0 \pm 0.5) \%$		430
$\gamma \rho^0$	$< 1.9 \times 10^{-5}$	90%	1694
$\gamma \omega$	$< 6 \times 10^{-6}$	90%	1692
$\gamma \phi$	$< 7 \times 10^{-6}$	90%	1632
$\gamma \gamma$	$(2.85 \pm 0.10) \times 10^{-4}$		1778
$e^+ e^- J/\psi(1S)$	$(2.15 \pm 0.14) \times 10^{-3}$		430
$\mu^+ \mu^- J/\psi(1S)$	$(2.02 \pm 0.33) \times 10^{-4}$		381

$\eta_c(2S)$

$$J^{PC} = 0^+(0^-+)$$

Quantum numbers are quark model predictions.

$$\text{Mass } m = 3637.5 \pm 1.1 \text{ MeV} \quad (S = 1.2)$$

$$\text{Full width } \Gamma = 11.3_{-2.9}^{+3.2} \text{ MeV}$$

$\eta_c(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
hadrons	not seen		—
$K \bar{K} \pi$	$(1.9 \pm 1.2) \%$		1729
$K \bar{K} \eta$	$(5 \pm 4) \times 10^{-3}$		1637
$2\pi^+ 2\pi^-$	not seen		1792
$\rho^0 \rho^0$	not seen		1645
$3\pi^+ 3\pi^-$	not seen		1749
$K^+ K^- \pi^+ \pi^-$	not seen		1700
$K^{*0} \bar{K}^{*0}$	not seen		1585
$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.4 \pm 1.0) \%$		1667
$K^+ K^- 2\pi^+ 2\pi^-$	not seen		1627
$K_S^0 K^- 2\pi^+ \pi^- + \text{c.c.}$	seen		1666
$2K^+ 2K^-$	not seen		1470
$\phi \phi$	not seen		1506
$p \bar{p}$	seen		1558
$p \bar{p} \pi^+ \pi^-$	seen		1461
$\gamma \gamma$	$(1.9 \pm 1.3) \times 10^{-4}$		1819
$\gamma J/\psi(1S)$	$< 1.4 \%$	90%	500

$\pi^+ \pi^- \eta$	not seen	1766
$\pi^+ \pi^- \eta'$	not seen	1680
$\pi^+ \pi^- \eta_c(1S)$	< 25 %	90% 537

$\psi(2S)$

$$J^{PC} = 0^-(1^--)$$

Mass $m = 3686.10 \pm 0.06$ MeV ($S = 5.9$)

Full width $\Gamma = 294 \pm 8$ keV

$\Gamma_{ee} = 2.33 \pm 0.04$ keV

$\psi(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons	(97.85 \pm 0.13) %		—
virtual $\gamma \rightarrow$ hadrons	(1.73 \pm 0.14) %	S=1.5	—
$g g g$	(10.6 \pm 1.6) %		—
$\gamma g g$	(1.03 \pm 0.29) %		—
light hadrons	(15.4 \pm 1.5) %		—
$e^+ e^-$	(7.93 \pm 0.17) $\times 10^{-3}$		1843
$\mu^+ \mu^-$	(8.0 \pm 0.6) $\times 10^{-3}$		1840
$\tau^+ \tau^-$	(3.1 \pm 0.4) $\times 10^{-3}$		489

Decays into $J/\psi(1S)$ and anything

$J/\psi(1S)$ anything	(61.4 \pm 0.6) %	—
$J/\psi(1S)$ neutrals	(25.38 \pm 0.32) %	—
$J/\psi(1S) \pi^+ \pi^-$	(34.68 \pm 0.30) %	477
$J/\psi(1S) \pi^0 \pi^0$	(18.24 \pm 0.31) %	481
$J/\psi(1S) \eta$	(3.37 \pm 0.05) %	199
$J/\psi(1S) \pi^0$	(1.268 \pm 0.032) $\times 10^{-3}$	528

Hadronic decays

$\pi^0 h_c(1P)$	(8.6 \pm 1.3) $\times 10^{-4}$	85
$3(\pi^+ \pi^-) \pi^0$	(3.5 \pm 1.6) $\times 10^{-3}$	1746
$2(\pi^+ \pi^-) \pi^0$	(2.9 \pm 1.0) $\times 10^{-3}$	S=4.7 1799
$\rho a_2(1320)$	(2.6 \pm 0.9) $\times 10^{-4}$	1501
$\pi^+ \pi^- \pi^0 \pi^0 \pi^0$	(5.3 \pm 0.9) $\times 10^{-3}$	1800
$\rho^\pm \pi^\mp \pi^0 \pi^0$	< 2.7 $\times 10^{-3}$	CL=90% 1737
$p \bar{p}$	(2.94 \pm 0.08) $\times 10^{-4}$	1586
$n \bar{n}$	(3.06 \pm 0.15) $\times 10^{-4}$	1586
$\Delta^{++} \bar{\Delta}^{--}$	(1.28 \pm 0.35) $\times 10^{-4}$	1371
$\Lambda \bar{\Lambda} \pi^0$	< 2.9 $\times 10^{-6}$	CL=90% 1412
$\Lambda \bar{\Lambda} \eta$	(2.5 \pm 0.4) $\times 10^{-5}$	1197
$\Lambda \bar{\Lambda} K^+$	(1.00 \pm 0.14) $\times 10^{-4}$	1327
$K^*(892)^+ \bar{p} \Lambda + \text{c.c.}$	(6.3 \pm 0.7) $\times 10^{-5}$	1087
$\Lambda \bar{p} K^+ \pi^+ \pi^-$	(1.8 \pm 0.4) $\times 10^{-4}$	1167

$\Lambda\bar{\Lambda}\pi^+\pi^-$	$(2.8 \pm 0.6) \times 10^{-4}$		1346
$\Lambda\bar{\Lambda}$	$(3.81 \pm 0.13) \times 10^{-4}$	S=1.4	1467
$\Lambda\bar{\Sigma}^+\pi^- + \text{c.c.}$	$(1.40 \pm 0.13) \times 10^{-4}$		1376
$\Lambda\bar{\Sigma}^-\pi^+ + \text{c.c.}$	$(1.54 \pm 0.14) \times 10^{-4}$		1379
$\Lambda\bar{\Sigma}^0$	$(1.23 \pm 0.24) \times 10^{-5}$		1437
$\Sigma^0\bar{p}K^+ + \text{c.c.}$	$(1.67 \pm 0.18) \times 10^{-5}$		1291
$\Sigma^+\bar{\Sigma}^-$	$(2.32 \pm 0.12) \times 10^{-4}$		1408
$\Sigma^0\bar{\Sigma}^0$	$(2.35 \pm 0.09) \times 10^{-4}$	S=1.1	1405
$\Sigma(1385)^+\bar{\Sigma}(1385)^-$	$(8.5 \pm 0.7) \times 10^{-5}$		1218
$\Sigma(1385)^-\bar{\Sigma}(1385)^+$	$(8.5 \pm 0.8) \times 10^{-5}$		1218
$\Sigma(1385)^0\bar{\Sigma}(1385)^0$	$(6.9 \pm 0.7) \times 10^{-5}$		1218
$\Xi^-\bar{\Xi}^+$	$(2.87 \pm 0.11) \times 10^{-4}$	S=1.1	1284
$\Xi^0\bar{\Xi}^0$	$(2.3 \pm 0.4) \times 10^{-4}$	S=4.2	1291
$\Xi(1530)^0\bar{\Xi}(1530)^0$	$(5.2 \begin{smallmatrix} +3.2 \\ -1.2 \end{smallmatrix}) \times 10^{-5}$		1025
$K^-\Lambda\bar{\Xi}^+ + \text{c.c.}$	$(3.9 \pm 0.4) \times 10^{-5}$		1114
$\Xi(1530)^-\bar{\Xi}(1530)^+$	$(1.15 \pm 0.07) \times 10^{-4}$		1025
$\Xi(1530)^-\bar{\Xi}^+$	$(7.0 \pm 1.2) \times 10^{-6}$		1165
$\Xi(1690)^-\bar{\Xi}^+ \rightarrow K^-\Lambda\bar{\Xi}^+ +$	$(5.2 \pm 1.6) \times 10^{-6}$		—
c.c.			
$\Xi(1820)^-\bar{\Xi}^+ \rightarrow K^-\Lambda\bar{\Xi}^+ +$	$(1.20 \pm 0.32) \times 10^{-5}$		—
$K^-\Sigma^0\bar{\Xi}^+ + \text{c.c.}$	$(3.7 \pm 0.4) \times 10^{-5}$		1060
$\Omega^-\bar{\Omega}^+$	$(5.2 \pm 0.4) \times 10^{-5}$		774
$\pi^0\rho\bar{p}$	$(1.53 \pm 0.07) \times 10^{-4}$		1543
$N(940)\bar{p} + \text{c.c.} \rightarrow \pi^0\rho\bar{p}$	$(6.4 \begin{smallmatrix} +1.8 \\ -1.3 \end{smallmatrix}) \times 10^{-5}$		—
$N(1440)\bar{p} + \text{c.c.} \rightarrow \pi^0\rho\bar{p}$	$(7.3 \begin{smallmatrix} +1.7 \\ -1.5 \end{smallmatrix}) \times 10^{-5}$	S=2.5	—
$N(1520)\bar{p} + \text{c.c.} \rightarrow \pi^0\rho\bar{p}$	$(6.4 \begin{smallmatrix} +2.3 \\ -1.8 \end{smallmatrix}) \times 10^{-6}$		—
$N(1535)\bar{p} + \text{c.c.} \rightarrow \pi^0\rho\bar{p}$	$(2.5 \pm 1.0) \times 10^{-5}$		—
$N(1650)\bar{p} + \text{c.c.} \rightarrow \pi^0\rho\bar{p}$	$(3.8 \begin{smallmatrix} +1.4 \\ -1.7 \end{smallmatrix}) \times 10^{-5}$		—
$N(1720)\bar{p} + \text{c.c.} \rightarrow \pi^0\rho\bar{p}$	$(1.79 \begin{smallmatrix} +0.26 \\ -0.70 \end{smallmatrix}) \times 10^{-5}$		—
$N(2300)\bar{p} + \text{c.c.} \rightarrow \pi^0\rho\bar{p}$	$(2.6 \begin{smallmatrix} +1.2 \\ -0.7 \end{smallmatrix}) \times 10^{-5}$		—
$N(2570)\bar{p} + \text{c.c.} \rightarrow \pi^0\rho\bar{p}$	$(2.13 \begin{smallmatrix} +0.40 \\ -0.31 \end{smallmatrix}) \times 10^{-5}$		—
$\pi^0 f_0(2100) \rightarrow \pi^0\rho\bar{p}$	$(1.1 \pm 0.4) \times 10^{-5}$		—
$\eta\rho\bar{p}$	$(6.0 \pm 0.4) \times 10^{-5}$		1373
$\eta f_0(2100) \rightarrow \eta\rho\bar{p}$	$(1.2 \pm 0.4) \times 10^{-5}$		—
$N(1535)\bar{p} \rightarrow \eta\rho\bar{p}$	$(4.4 \pm 0.7) \times 10^{-5}$		—
$\omega\rho\bar{p}$	$(6.9 \pm 2.1) \times 10^{-5}$		1247
$\eta'\rho\bar{p}$	$(1.10 \pm 0.13) \times 10^{-5}$		1141
$\phi\rho\bar{p}$	$(6.1 \pm 0.6) \times 10^{-6}$		1109
$\phi X(1835) \rightarrow \phi\rho\bar{p}$	$< 1.82 \times 10^{-7}$	CL=90%	—

$\pi^+ \pi^- \rho \bar{\rho}$	$(6.0 \pm 0.4) \times 10^{-4}$		1491
$p \bar{n} \pi^-$ or c.c.	$(2.48 \pm 0.17) \times 10^{-4}$		–
$p \bar{n} \pi^- \pi^0$	$(3.2 \pm 0.7) \times 10^{-4}$		1492
$2(\pi^+ \pi^- \pi^0)$	$(4.8 \pm 1.5) \times 10^{-3}$		1776
$\eta \pi^+ \pi^-$	< 1.6	$\times 10^{-4}$ CL=90%	1791
$\eta \pi^+ \pi^- \pi^0$	$(9.5 \pm 1.7) \times 10^{-4}$		1778
$2(\pi^+ \pi^-) \eta$	$(1.2 \pm 0.6) \times 10^{-3}$		1758
$\pi^+ \pi^- \pi^0 \pi^0 \eta$	< 4	$\times 10^{-4}$ CL=90%	1760
$\eta' \pi^+ \pi^- \pi^0$	$(4.5 \pm 2.1) \times 10^{-4}$		1692
$\omega \pi^+ \pi^-$	$(7.3 \pm 1.2) \times 10^{-4}$	S=2.1	1748
$b_1^\pm \pi^\mp$	$(4.0 \pm 0.6) \times 10^{-4}$	S=1.1	1635
$b_1^0 \pi^0$	$(2.4 \pm 0.6) \times 10^{-4}$		–
$\omega f_2(1270)$	$(2.2 \pm 0.4) \times 10^{-4}$		1515
$\omega \pi^0 \pi^0$	$(1.11 \pm 0.35) \times 10^{-3}$		1749
$\pi^0 \pi^0 K^+ K^-$	$(2.6 \pm 1.3) \times 10^{-4}$		1728
$\pi^+ \pi^- K^+ K^-$	$(7.3 \pm 0.5) \times 10^{-4}$		1726
$\pi^0 \pi^0 K_S^0 K_L^0$	$(1.3 \pm 0.6) \times 10^{-3}$		1726
$\rho^0 K^+ K^-$	$(2.2 \pm 0.4) \times 10^{-4}$		1616
$K^*(892)^0 \bar{K}_2^*(1430)^0$	$(1.9 \pm 0.5) \times 10^{-4}$		1417
$K^+ K^- \pi^+ \pi^- \eta$	$(1.3 \pm 0.7) \times 10^{-3}$		1574
$K^+ K^- 2(\pi^+ \pi^-) \pi^0$	$(1.00 \pm 0.31) \times 10^{-3}$		1611
$K^+ K^- 2(\pi^+ \pi^-)$	$(1.9 \pm 0.9) \times 10^{-3}$		1654
$K_1(1270)^\pm K^\mp$	$(1.00 \pm 0.28) \times 10^{-3}$		1588
$K_S^0 K_S^0 \pi^+ \pi^-$	$(2.2 \pm 0.4) \times 10^{-4}$		1724
$\rho^0 \rho \bar{\rho}$	$(5.0 \pm 2.2) \times 10^{-5}$		1252
$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(6.7 \pm 2.5) \times 10^{-4}$		1674
$2(\pi^+ \pi^-)$	$(2.4 \pm 0.6) \times 10^{-4}$	S=2.2	1817
$\rho^0 \pi^+ \pi^-$	$(2.2 \pm 0.6) \times 10^{-4}$	S=1.4	1750
$K^+ K^- \pi^+ \pi^- \pi^0$	$(1.26 \pm 0.09) \times 10^{-3}$		1694
$\omega f_0(1710) \rightarrow \omega K^+ K^-$	$(5.9 \pm 2.2) \times 10^{-5}$		–
$K^*(892)^0 K^- \pi^+ \pi^0 + \text{c.c.}$	$(8.6 \pm 2.2) \times 10^{-4}$		–
$K^*(892)^+ K^- \pi^+ \pi^- + \text{c.c.}$	$(9.6 \pm 2.8) \times 10^{-4}$		–
$K^*(892)^+ K^- \rho^0 + \text{c.c.}$	$(7.3 \pm 2.6) \times 10^{-4}$		–
$K^*(892)^0 K^- \rho^+ + \text{c.c.}$	$(6.1 \pm 1.8) \times 10^{-4}$		–
$\eta K^+ K^-$, no $\eta \phi$	$(3.1 \pm 0.4) \times 10^{-5}$		1664
$\omega K^+ K^-$	$(1.62 \pm 0.11) \times 10^{-4}$	S=1.1	1614
$\omega K^*(892)^+ K^- + \text{c.c.}$	$(2.07 \pm 0.26) \times 10^{-4}$		1482
$\omega K_2^*(1430)^+ K^- + \text{c.c.}$	$(6.1 \pm 1.2) \times 10^{-5}$		1252
$\omega \bar{K}^*(892)^0 K^0$	$(1.68 \pm 0.30) \times 10^{-4}$		1481
$\omega \bar{K}_2^*(1430)^0 K^0$	$(5.8 \pm 2.2) \times 10^{-5}$		1250
$\omega X(1440) \rightarrow \omega K_S^0 K^- \pi^+ + \text{c.c.}$	$(1.6 \pm 0.4) \times 10^{-5}$		–
$\omega X(1440) \rightarrow \omega K^+ K^- \pi^0$	$(1.09 \pm 0.26) \times 10^{-5}$		–

$\omega f_1(1285) \rightarrow \omega K_S^0 K^- \pi^+ +$	$(3.0 \pm 1.0) \times 10^{-6}$	—
$\omega f_1(1285) \rightarrow \omega K^+ K^- \pi^0$	$(1.2 \pm 0.7) \times 10^{-6}$	—
$3(\pi^+ \pi^-)$	$(3.5 \pm 2.0) \times 10^{-4}$	S=2.8 1774
$\rho \bar{p} \pi^+ \pi^- \pi^0$	$(7.3 \pm 0.7) \times 10^{-4}$	1435
$K^+ K^-$	$(7.5 \pm 0.5) \times 10^{-5}$	1776
$K_S^0 K_L^0$	$(5.34 \pm 0.33) \times 10^{-5}$	1775
$\pi^+ \pi^- \pi^0$	$(2.01 \pm 0.17) \times 10^{-4}$	S=1.7 1830
$\rho(2150)\pi \rightarrow \pi^+ \pi^- \pi^0$	$(1.9 \begin{smallmatrix} +1.2 \\ -0.4 \end{smallmatrix}) \times 10^{-4}$	—
$\rho(770)\pi \rightarrow \pi^+ \pi^- \pi^0$	$(3.2 \pm 1.2) \times 10^{-5}$	S=1.8 —
$\pi^+ \pi^-$	$(7.8 \pm 2.6) \times 10^{-6}$	1838
$K_1(1400)^\pm K^\mp$	$< 3.1 \times 10^{-4}$	CL=90% 1532
$K_2^*(1430)^\pm K^\mp$	$(7.1 \begin{smallmatrix} +1.3 \\ -0.9 \end{smallmatrix}) \times 10^{-5}$	—
$K^+ K^- \pi^0$	$(4.07 \pm 0.31) \times 10^{-5}$	1754
$K_S^0 K_L^0 \pi^0$	$< 3.0 \times 10^{-4}$	CL=90% 1753
$K_S^0 K_L^0 \eta$	$(1.3 \pm 0.5) \times 10^{-3}$	1661
$K^+ K^*(892)^- + \text{c.c.}$	$(2.9 \pm 0.4) \times 10^{-5}$	S=1.2 1698
$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	$(1.09 \pm 0.20) \times 10^{-4}$	1697
$\phi \pi^+ \pi^-$	$(1.18 \pm 0.26) \times 10^{-4}$	S=1.5 1690
$\phi f_0(980) \rightarrow \pi^+ \pi^-$	$(7.5 \pm 3.3) \times 10^{-5}$	S=1.6 —
$2(K^+ K^-)$	$(6.3 \pm 1.3) \times 10^{-5}$	1499
$\phi K^+ K^-$	$(7.0 \pm 1.6) \times 10^{-5}$	1546
$2(K^+ K^-) \pi^0$	$(1.10 \pm 0.28) \times 10^{-4}$	1440
$\phi \eta$	$(3.10 \pm 0.31) \times 10^{-5}$	1654
$\eta \phi(2170), \phi(2170) \rightarrow$	$< 2.2 \times 10^{-6}$	CL=90% —
$\phi f_0(980), f_0 \rightarrow \pi^+ \pi^-$		
$\phi \eta'$	$(1.54 \pm 0.20) \times 10^{-5}$	1555
$\phi f_1(1285)$	$(3.0 \pm 1.3) \times 10^{-5}$	1436
$\phi \eta(1405) \rightarrow \phi \pi^+ \pi^- \eta$	$(8.5 \pm 1.7) \times 10^{-6}$	—
$\omega \eta'$	$(3.2 \begin{smallmatrix} +2.5 \\ -2.1 \end{smallmatrix}) \times 10^{-5}$	1623
$\omega \pi^0$	$(2.1 \pm 0.6) \times 10^{-5}$	1757
$\rho \eta'$	$(1.9 \begin{smallmatrix} +1.7 \\ -1.2 \end{smallmatrix}) \times 10^{-5}$	1625
$\rho \eta$	$(2.2 \pm 0.6) \times 10^{-5}$	S=1.1 1717
$\omega \eta$	$< 1.1 \times 10^{-5}$	CL=90% 1715
$\phi \pi^0$	$< 4 \times 10^{-7}$	CL=90% 1699
$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$	CL=90% 512
$\bar{p} \bar{p} K^+ K^-$	$(2.7 \pm 0.7) \times 10^{-5}$	1118
$\bar{\Lambda} n K_S^0 + \text{c.c.}$	$(8.1 \pm 1.8) \times 10^{-5}$	1324
$\phi f_2'(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$	1325
$\Theta(1540) \bar{\Theta}(1540) \rightarrow$	$< 8.8 \times 10^{-6}$	CL=90% —
$K_S^0 p K^- \bar{n} + \text{c.c.}$		

$\Theta(1540) K^- \bar{n} \rightarrow K_S^0 p K^- \bar{n}$	< 1.0	$\times 10^{-5}$	CL=90%	—
$\Theta(1540) K_S^0 \bar{p} \rightarrow K_S^0 \bar{p} K^+ n$	< 7.0	$\times 10^{-6}$	CL=90%	—
$\bar{\Theta}(1540) K^+ n \rightarrow K_S^0 \bar{p} K^+ n$	< 2.6	$\times 10^{-5}$	CL=90%	—
$\bar{\Theta}(1540) K_S^0 p \rightarrow K_S^0 p K^- \bar{n}$	< 6.0	$\times 10^{-6}$	CL=90%	—
$K_S^0 K_S^0$	< 4.6	$\times 10^{-6}$		1775
$\Lambda_c^+ \bar{p} e^+ e^- + \text{c.c.}$	< 1.7	$\times 10^{-6}$	CL=90%	830

Radiative decays

$\gamma \chi_{c0}(1P)$	(9.79 \pm 0.20) %			261
$\gamma \chi_{c1}(1P)$	(9.75 \pm 0.24) %			171
$\gamma \chi_{c2}(1P)$	(9.52 \pm 0.20) %			128
$\gamma \eta_c(1S)$	(3.4 \pm 0.5) $\times 10^{-3}$	S=1.3		635
$\gamma \eta_c(2S)$	(7 \pm 5) $\times 10^{-4}$			48
$\gamma \pi^0$	(1.04 \pm 0.22) $\times 10^{-6}$	S=1.4		1841
$\gamma \eta'(958)$	(1.24 \pm 0.04) $\times 10^{-4}$			1719
$\gamma f_2(1270)$	(2.73 $^{+0.29}_{-0.25}$) $\times 10^{-4}$	S=1.8		1622
$\gamma f_0(1370) \rightarrow \gamma K \bar{K}$	(3.1 \pm 1.7) $\times 10^{-5}$			1588
$\gamma f_0(1500)$	(9.3 \pm 1.9) $\times 10^{-5}$			1535
$\gamma f_2'(1525)$	(3.3 \pm 0.8) $\times 10^{-5}$			1531
$\gamma f_0(1710) \rightarrow \gamma \pi \pi$	(3.5 \pm 0.6) $\times 10^{-5}$			—
$\gamma f_0(1710) \rightarrow \gamma K \bar{K}$	(6.6 \pm 0.7) $\times 10^{-5}$			—
$\gamma f_0(2100) \rightarrow \gamma \pi \pi$	(4.8 \pm 1.0) $\times 10^{-6}$			1244
$\gamma f_0(2200) \rightarrow \gamma K \bar{K}$	(3.2 \pm 1.0) $\times 10^{-6}$			1193
$\gamma f_J(2220) \rightarrow \gamma \pi \pi$	< 5.8	$\times 10^{-6}$	CL=90%	1168
$\gamma f_J(2220) \rightarrow \gamma K \bar{K}$	< 9.5	$\times 10^{-6}$	CL=90%	1168
$\gamma \gamma$	< 1.5	$\times 10^{-4}$	CL=90%	1843
$\gamma \eta$	(9.2 \pm 1.8) $\times 10^{-7}$			1802
$\gamma \eta \pi^+ \pi^-$	(8.7 \pm 2.1) $\times 10^{-4}$			1791
$\gamma \eta(1405) \rightarrow \gamma K \bar{K} \pi$	< 9	$\times 10^{-5}$	CL=90%	1569
$\gamma \eta(1405) \rightarrow \eta \pi^+ \pi^-$	(3.6 \pm 2.5) $\times 10^{-5}$			—
$\gamma \eta(1405) \rightarrow \gamma f_0(980) \pi^0 \rightarrow \gamma \pi^+ \pi^- \pi^0$	< 5.0	$\times 10^{-7}$	CL=90%	—
$\gamma \eta(1475) \rightarrow K \bar{K} \pi$	< 1.4	$\times 10^{-4}$	CL=90%	—
$\gamma \eta(1475) \rightarrow \eta \pi^+ \pi^-$	< 8.8	$\times 10^{-5}$	CL=90%	—
$\gamma 2(\pi^+ \pi^-)$	(4.0 \pm 0.6) $\times 10^{-4}$			1817
$\gamma K^{*0} K^+ \pi^- + \text{c.c.}$	(3.7 \pm 0.9) $\times 10^{-4}$			1674
$\gamma K^{*0} \bar{K}^{*0}$	(2.4 \pm 0.7) $\times 10^{-4}$			1613
$\gamma K_S^0 K^+ \pi^- + \text{c.c.}$	(2.6 \pm 0.5) $\times 10^{-4}$			1753
$\gamma K^+ K^- \pi^+ \pi^-$	(1.9 \pm 0.5) $\times 10^{-4}$			1726
$\gamma p \bar{p}$	(3.9 \pm 0.5) $\times 10^{-5}$	S=2.0		1586
$\gamma f_2(1950) \rightarrow \gamma p \bar{p}$	(1.20 \pm 0.22) $\times 10^{-5}$			—
$\gamma f_2(2150) \rightarrow \gamma p \bar{p}$	(7.2 \pm 1.8) $\times 10^{-6}$			—
$\gamma X(1835) \rightarrow \gamma p \bar{p}$	(4.6 $^{+1.8}_{-4.0}$) $\times 10^{-6}$			—

$\gamma X \rightarrow \gamma p \bar{p}$	$[qqaa] < 2$	$\times 10^{-6}$	CL=90%	—
$\gamma \pi^+ \pi^- p \bar{p}$	(2.8 ± 1.4)	$\times 10^{-5}$		1491
$\gamma 2(\pi^+ \pi^-) K^+ K^-$	< 2.2	$\times 10^{-4}$	CL=90%	1654
$\gamma 3(\pi^+ \pi^-)$	< 1.7	$\times 10^{-4}$	CL=90%	1774
$\gamma K^+ K^- K^+ K^-$	< 4	$\times 10^{-5}$	CL=90%	1499
$\gamma \gamma J/\psi$	(3.1 ± 1.0)	$\times 10^{-4}$		542
$e^+ e^- \eta'$	(1.90 ± 0.26)	$\times 10^{-6}$		1719
$e^+ e^- \chi_{c0}(1P)$	(1.06 ± 0.24)	$\times 10^{-3}$		261
$e^+ e^- \chi_{c1}(1P)$	(8.5 ± 0.6)	$\times 10^{-4}$		171
$e^+ e^- \chi_{c2}(1P)$	(7.0 ± 0.8)	$\times 10^{-4}$		128

Weak decays

$D^0 e^+ e^- + \text{c.c.}$	< 1.4	$\times 10^{-7}$	CL=90%	1371
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Other decays

invisible	< 1.6	%	CL=90%	—
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$\psi(3770)$

$$J^{PC} = 0^-(1^- -)$$

Mass $m = 3773.7 \pm 0.4$ MeV (S = 1.4)

Full width $\Gamma = 27.2 \pm 1.0$ MeV

$\Gamma_{ee} = 0.262 \pm 0.018$ keV (S = 1.4)

In addition to the dominant decay mode to $D\bar{D}$, $\psi(3770)$ was found to decay into the final states containing the J/ψ (BAI 05, ADAM 06). ADAMS 06 and HUANG 06A searched for various decay modes with light hadrons and found a statistically significant signal for the decay to $\phi\eta$ only (ADAMS 06).

$\psi(3770)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$D\bar{D}$	(93 ± 8) %	S=2.0	287
$D^0 \bar{D}^0$	(52 ± 4) %	S=2.0	287
$D^+ D^-$	(41 ± 4) %	S=2.0	254
$J/\psi \pi^+ \pi^-$	$(1.93 \pm 0.28) \times 10^{-3}$		561
$J/\psi \pi^0 \pi^0$	$(8.0 \pm 3.0) \times 10^{-4}$		565
$J/\psi \eta$	$(9 \pm 4) \times 10^{-4}$		361
$J/\psi \pi^0$	$< 2.8 \times 10^{-4}$	CL=90%	604
$e^+ e^-$	$(9.6 \pm 0.7) \times 10^{-6}$	S=1.3	1887

Decays to light hadrons

$b_1(1235)\pi$	< 1.4	$\times 10^{-5}$	CL=90%	1684
$\phi\eta'$	< 7	$\times 10^{-4}$	CL=90%	1607
$\omega\eta'$	< 4	$\times 10^{-4}$	CL=90%	1672
$\rho^0\eta'$	< 6	$\times 10^{-4}$	CL=90%	1674

$\phi\eta$	$(3.1 \pm 0.7) \times 10^{-4}$		1703
$\omega\eta$	< 1.4	$\times 10^{-5}$	CL=90% 1762
$\rho^0\eta$	< 5	$\times 10^{-4}$	CL=90% 1764
$\phi\pi^0$	< 3	$\times 10^{-5}$	CL=90% 1746
$\omega\pi^0$	< 6	$\times 10^{-4}$	CL=90% 1803
$\pi^+\pi^-\pi^0$	< 5	$\times 10^{-6}$	CL=90% 1874
$\rho\pi$	< 5	$\times 10^{-6}$	CL=90% 1805
$K^*(892)^+K^- + \text{c.c.}$	< 1.4	$\times 10^{-5}$	CL=90% 1745
$K^*(892)^0\bar{K}^0 + \text{c.c.}$	< 1.2	$\times 10^{-3}$	CL=90% 1745
$K_S^0 K_L^0$	< 1.2	$\times 10^{-5}$	CL=90% 1820
$2(\pi^+\pi^-)$	< 1.12	$\times 10^{-3}$	CL=90% 1861
$2(\pi^+\pi^-)\pi^0$	< 1.06	$\times 10^{-3}$	CL=90% 1844
$2(\pi^+\pi^-\pi^0)$	< 5.85	%	CL=90% 1821
$\omega\pi^+\pi^-$	< 6.0	$\times 10^{-4}$	CL=90% 1794
$3(\pi^+\pi^-)$	< 9.1	$\times 10^{-3}$	CL=90% 1820
$3(\pi^+\pi^-)\pi^0$	< 1.37	%	CL=90% 1792
$3(\pi^+\pi^-)2\pi^0$	< 11.74	%	CL=90% 1760
$\eta\pi^+\pi^-$	< 1.24	$\times 10^{-3}$	CL=90% 1836
$\pi^+\pi^-2\pi^0$	< 8.9	$\times 10^{-3}$	CL=90% 1862
$\rho^0\pi^+\pi^-$	< 6.9	$\times 10^{-3}$	CL=90% 1796
$\eta3\pi$	< 1.34	$\times 10^{-3}$	CL=90% 1824
$\eta2(\pi^+\pi^-)$	< 2.43	%	CL=90% 1804
$\eta\rho^0\pi^+\pi^-$	< 1.45	%	CL=90% 1708
$\eta'3\pi$	< 2.44	$\times 10^{-3}$	CL=90% 1741
$K^+K^-\pi^+\pi^-$	< 9.0	$\times 10^{-4}$	CL=90% 1773
$\phi\pi^+\pi^-$	< 4.1	$\times 10^{-4}$	CL=90% 1737
$K^+K^-2\pi^0$	< 4.2	$\times 10^{-3}$	CL=90% 1774
$4(\pi^+\pi^-)$	< 1.67	%	CL=90% 1757
$4(\pi^+\pi^-)\pi^0$	< 3.06	%	CL=90% 1720
$\phi f_0(980)$	< 4.5	$\times 10^{-4}$	CL=90% 1597
$K^+K^-\pi^+\pi^-\pi^0$	< 2.36	$\times 10^{-3}$	CL=90% 1741
$K^+K^-\rho^0\pi^0$	< 8	$\times 10^{-4}$	CL=90% 1624
$K^+K^-\rho^+\pi^-$	< 1.46	%	CL=90% 1623
ωK^+K^-	< 3.4	$\times 10^{-4}$	CL=90% 1664
$\phi\pi^+\pi^-\pi^0$	< 3.8	$\times 10^{-3}$	CL=90% 1723
$K^{*0}K^-\pi^+\pi^0 + \text{c.c.}$	< 1.62	%	CL=90% 1694
$K^{*+}K^-\pi^+\pi^- + \text{c.c.}$	< 3.23	%	CL=90% 1693
$K^+K^-\pi^+\pi^-2\pi^0$	< 2.67	%	CL=90% 1705
$K^+K^-2(\pi^+\pi^-)$	< 1.03	%	CL=90% 1702
$K^+K^-2(\pi^+\pi^-)\pi^0$	< 3.60	%	CL=90% 1661
ηK^+K^-	< 4.1	$\times 10^{-4}$	CL=90% 1712
$\eta K^+K^-\pi^+\pi^-$	< 1.24	%	CL=90% 1624
$\rho^0 K^+K^-$	< 5.0	$\times 10^{-3}$	CL=90% 1666
$2(K^+K^-)$	< 6.0	$\times 10^{-4}$	CL=90% 1552

$\phi K^+ K^-$	< 7.5	$\times 10^{-4}$	CL=90%	1598
$2(K^+ K^-)\pi^0$	< 2.9	$\times 10^{-4}$	CL=90%	1494
$2(K^+ K^-)\pi^+ \pi^-$	< 3.2	$\times 10^{-3}$	CL=90%	1426
$K_S^0 K^- \pi^+$	< 3.2	$\times 10^{-3}$	CL=90%	1799
$K_S^0 K^- \pi^+ \pi^0$	< 1.33	%	CL=90%	1773
$K_S^0 K^- \rho^+$	< 6.6	$\times 10^{-3}$	CL=90%	1665
$K_S^0 K^- 2\pi^+ \pi^-$	< 8.7	$\times 10^{-3}$	CL=90%	1740
$K_S^0 K^- \pi^+ \rho^0$	< 1.6	%	CL=90%	1621
$K_S^0 K^- \pi^+ \eta$	< 1.3	%	CL=90%	1670
$K_S^0 K^- 2\pi^+ \pi^- \pi^0$	< 4.18	%	CL=90%	1703
$K_S^0 K^- 2\pi^+ \pi^- \eta$	< 4.8	%	CL=90%	1570
$K_S^0 K^- \pi^+ 2(\pi^+ \pi^-)$	< 1.22	%	CL=90%	1658
$K_S^0 K^- \pi^+ 2\pi^0$	< 2.65	%	CL=90%	1742
$K_S^0 K^- K^+ K^- \pi^+$	< 4.9	$\times 10^{-3}$	CL=90%	1491
$K_S^0 K^- K^+ K^- \pi^+ \pi^0$	< 3.0	%	CL=90%	1427
$K_S^0 K^- K^+ K^- \pi^+ \eta$	< 2.2	%	CL=90%	1214
$K^{*0} K^- \pi^+ + \text{c.c.}$	< 9.7	$\times 10^{-3}$	CL=90%	1722
$p\bar{p}\pi^0$	< 4	$\times 10^{-5}$	CL=90%	1595
$p\bar{p}\pi^+ \pi^-$	< 5.8	$\times 10^{-4}$	CL=90%	1544
$\Lambda\bar{\Lambda}$	< 1.2	$\times 10^{-4}$	CL=90%	1522
$p\bar{p}\pi^+ \pi^- \pi^0$	< 1.85	$\times 10^{-3}$	CL=90%	1490
$\omega p\bar{p}$	< 2.9	$\times 10^{-4}$	CL=90%	1310
$\Lambda\bar{\Lambda}\pi^0$	< 7	$\times 10^{-5}$	CL=90%	1469
$p\bar{p}2(\pi^+ \pi^-)$	< 2.6	$\times 10^{-3}$	CL=90%	1426
$\eta p\bar{p}$	< 5.4	$\times 10^{-4}$	CL=90%	1431
$\eta p\bar{p}\pi^+ \pi^-$	< 3.3	$\times 10^{-3}$	CL=90%	1284
$\rho^0 p\bar{p}$	< 1.7	$\times 10^{-3}$	CL=90%	1314
$p\bar{p}K^+ K^-$	< 3.2	$\times 10^{-4}$	CL=90%	1186
$\eta p\bar{p}K^+ K^-$	< 6.9	$\times 10^{-3}$	CL=90%	737
$\pi^0 p\bar{p}K^+ K^-$	< 1.2	$\times 10^{-3}$	CL=90%	1094
$\phi p\bar{p}$	< 1.3	$\times 10^{-4}$	CL=90%	1178
$\Lambda\bar{\Lambda}\pi^+ \pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	1405
$\Lambda\bar{p}K^+$	< 2.8	$\times 10^{-4}$	CL=90%	1387
$\Lambda\bar{p}K^+ \pi^+ \pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	1234
$\Lambda\bar{\Lambda}\eta$	< 1.9	$\times 10^{-4}$	CL=90%	1263
$\Sigma^+ \bar{\Sigma}^-$	< 1.0	$\times 10^{-4}$	CL=90%	1465
$\Sigma^0 \bar{\Sigma}^0$	< 4	$\times 10^{-5}$	CL=90%	1462
$\Xi^+ \bar{\Xi}^-$	< 1.5	$\times 10^{-4}$	CL=90%	1347
$\Xi^0 \bar{\Xi}^0$	< 1.4	$\times 10^{-4}$	CL=90%	1353

Radiative decays

$\gamma\chi_{c2}$	$< 6.4 \times 10^{-4}$	CL=90%	211
$\gamma\chi_{c1}$	$(2.49 \pm 0.23) \times 10^{-3}$		254
$\gamma\chi_{c0}$	$(6.9 \pm 0.6) \times 10^{-3}$		342
$\gamma\eta_c$	$< 7 \times 10^{-4}$	CL=90%	707
$\gamma\eta_c(2S)$	$< 9 \times 10^{-4}$	CL=90%	134
$\gamma\eta'$	$< 1.8 \times 10^{-4}$	CL=90%	1765
$\gamma\eta$	$< 1.5 \times 10^{-4}$	CL=90%	1847
$\gamma\pi^0$	$< 2 \times 10^{-4}$	CL=90%	1884

$\psi_2(3823)$

$$I^G(J^{PC}) = 0^-(2^{--})$$

I, J, P need confirmation.

was $\psi(3823), X(3823)$

Mass $m = 3822.2 \pm 1.2$ MeV

Full width $\Gamma < 16$ MeV, CL = 90%

$\psi_2(3823)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\chi_{c1}\gamma$	seen	299
$\chi_{c2}\gamma$	not seen	257

$\psi_3(3842)$

$$I^G(J^{PC}) = 0^-(3^{--})$$

J, P need confirmation.

Mass $m = 3842.71 \pm 0.20$ MeV

Full width $\Gamma = 2.8 \pm 0.6$ MeV

$\psi_3(3842)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
D^+D^-	seen	443
$D^0\bar{D}^0$	seen	463

$\chi_{c1}(3872)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

also known as $X(3872)$

Mass $m = 3871.69 \pm 0.17$ MeV

$m_{\chi_{c1}(3872)} - m_{J/\psi} = 775 \pm 4$ MeV

Full width $\Gamma < 1.2$ MeV, CL = 90%

$\chi_{c1}(3872)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi^+\pi^-J/\psi(1S)$	$> 3.2\%$	650
$\omega J/\psi(1S)$	$> 2.3\%$	†
$D^0\bar{D}^0\pi^0$	$> 40\%$	117

$\bar{D}^{*0} D^0$	>30 %	4
$\pi^0 \chi_{c1}$	> 2.8 %	319
$\gamma J/\psi$	> 7 $\times 10^{-3}$	697
$\gamma \psi(2S)$	> 4 %	181
$\pi^+ \pi^- \eta_c(1S)$	not seen	745
$\pi^+ \pi^- \chi_{c1}$	not seen	218
$p \bar{p}$	not seen	1693

Z_c(3900)

$$I^G(J^{PC}) = 1^+(1^{+-})$$

was X(3900)

$$\text{Mass } m = 3888.4 \pm 2.5 \text{ MeV} \quad (S = 1.7)$$

$$\text{Full width } \Gamma = 28.3 \pm 2.5 \text{ MeV}$$

Z_c(3900) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi \pi$	seen	700
$h_c \pi^\pm$	not seen	319
$\eta_c \pi^+ \pi^-$	not seen	760
$(D \bar{D}^*)^\pm$	seen	—
$D^0 D^{*-} + \text{c.c.}$	seen	160
$D^- D^{*0} + \text{c.c.}$	seen	152
$\omega \pi^\pm$	not seen	1863
$J/\psi \eta$	not seen	511
$D^+ D^{*-} + \text{c.c.}$	seen	—
$D^0 \bar{D}^{*0} + \text{c.c.}$	seen	—

X(3915)

$$I^G(J^{PC}) = 0^+(0 \text{ or } 2^{++})$$

was χ_{c0} (3915)

$$\text{Mass } m = 3918.4 \pm 1.9 \text{ MeV}$$

$$\text{Full width } \Gamma = 20 \pm 5 \text{ MeV} \quad (S = 1.1)$$

X(3915) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega J/\psi$	seen	222
$\pi^+ \pi^- \eta_c(1S)$	not seen	785
$\eta_c \eta$	not seen	665
$\eta_c \pi^0$	not seen	814
$K \bar{K}$	not seen	1896
$\gamma \gamma$	seen	1959

$\chi_{c2}(3930)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass $m = 3922.2 \pm 1.0$ MeV (S = 1.6)Full width $\Gamma = 35.3 \pm 2.8$ MeV (S = 1.4)

$\chi_{c2}(3930)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\gamma\gamma$	seen	1961
$D\bar{D}$	seen	607
D^+D^-	seen	592
$D^0\bar{D}^0$	seen	607
$\pi^+\pi^-\eta_c(1S)$	not seen	788
$K\bar{K}$	not seen	1898

 $X(4020)^\pm$

$$I^G(J^{PC}) = 1^+(?^{? -})$$

Mass $m = 4024.1 \pm 1.9$ MeVFull width $\Gamma = 13 \pm 5$ MeV (S = 1.7)

$X(4020)^\pm$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$h_c(1P)\pi$	seen	450
$D^*\bar{D}^*$	seen	85
$D\bar{D}^* + c.c.$	not seen	542
$\eta_c\pi^+\pi^-$	not seen	872
$J/\psi(1S)\pi^\pm$	not seen	811

 $\psi(4040)$ ^[rraa]

$$I^G(J^{PC}) = 0^-(1^{--})$$

Mass $m = 4039 \pm 1$ MeVFull width $\Gamma = 80 \pm 10$ MeV $\Gamma_{ee} = 0.86 \pm 0.07$ keV

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective \sqrt{s} near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in \sqrt{s} or absence thereof. See mode listing(s) for details and references.

$\psi(4040)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
e^+e^-	$(1.07 \pm 0.16) \times 10^{-5}$		2019
$D\bar{D}$	seen		775
$D^0\bar{D}^0$	seen		775
D^+D^-	seen		763

$D^* \bar{D}^+ + \text{c.c.}$	seen			569
$D^*(2007)^0 \bar{D}^0 + \text{c.c.}$	seen			575
$D^*(2010)^+ D^- + \text{c.c.}$	seen			561
$D^* \bar{D}^*$	seen			193
$D^*(2007)^0 \bar{D}^*(2007)^0$	seen			226
$D^*(2010)^+ D^*(2010)^-$	seen			193
$D^0 D^- \pi^+ + \text{c.c.}$ (excl. $D^*(2007)^0 \bar{D}^0 + \text{c.c.}$, $D^*(2010)^+ D^- + \text{c.c.}$)	not seen			—
$D \bar{D}^* \pi$ (excl. $D^* \bar{D}^*$)	not seen			—
$D^0 \bar{D}^{*-} \pi^+ + \text{c.c.}$ (excl. $D^*(2010)^+ D^*(2010)^-$)	seen			—
$D_s^+ D_s^-$	seen			452
$J/\psi \pi^+ \pi^-$	< 4	$\times 10^{-3}$	90%	794
$J/\psi \pi^0 \pi^0$	< 2	$\times 10^{-3}$	90%	797
$J/\psi \eta$	(5.2 ± 0.7)	$\times 10^{-3}$		675
$J/\psi \pi^0$	< 2.8	$\times 10^{-4}$	90%	823
$J/\psi \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%	746
$\chi_{c1} \gamma$	< 3.4	$\times 10^{-3}$	90%	494
$\chi_{c2} \gamma$	< 5	$\times 10^{-3}$	90%	454
$\chi_{c1} \pi^+ \pi^- \pi^0$	< 1.1	%	90%	306
$\chi_{c2} \pi^+ \pi^- \pi^0$	< 3.2	%	90%	233
$h_c(1P) \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%	403
$\phi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%	1880
$\Lambda \bar{\Lambda} \pi^+ \pi^-$	< 2.9	$\times 10^{-4}$	90%	1578
$\Lambda \bar{\Lambda} \pi^0$	< 9	$\times 10^{-5}$	90%	1636
$\Lambda \bar{\Lambda} \eta$	< 3.0	$\times 10^{-4}$	90%	1452
$\Sigma^+ \bar{\Sigma}^-$	< 1.3	$\times 10^{-4}$	90%	1632
$\Sigma^0 \bar{\Sigma}^0$	< 7	$\times 10^{-5}$	90%	1630
$\Xi^+ \bar{\Xi}^-$	< 1.6	$\times 10^{-4}$	90%	1527
$\Xi^0 \bar{\Xi}^0$	< 1.8	$\times 10^{-4}$	90%	1533

$\chi_{c1}(4140)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

was $X(4140)$

$$\text{Mass } m = 4146.8 \pm 2.4 \text{ MeV} \quad (S = 1.1)$$

$$\text{Full width } \Gamma = 22_{-7}^{+8} \text{ MeV} \quad (S = 1.3)$$

$\chi_{c1}(4140)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi \phi$	seen	217
$\gamma\gamma$	not seen	2073

$\psi(4160)$ [*rraa*]

$$J^{PC} = 0^-(1^--)$$

Mass $m = 4191 \pm 5$ MeVFull width $\Gamma = 70 \pm 10$ MeV $\Gamma_{ee} = 0.48 \pm 0.22$ keV

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective \sqrt{s} near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in \sqrt{s} or absence thereof. See mode listing(s) for details and references.

$\psi(4160)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$e^+ e^-$	$(6.9 \pm 3.3) \times 10^{-6}$		2096
$\mu^+ \mu^-$	seen		2093
$D \bar{D}$	seen		956
$D^0 \bar{D}^0$	seen		956
$D^+ D^-$	seen		947
$D^* \bar{D} + \text{c.c.}$	seen		798
$D^*(2007)^0 \bar{D}^0 + \text{c.c.}$	seen		802
$D^*(2010)^+ D^- + \text{c.c.}$	seen		792
$D^* \bar{D}^*$	seen		592
$D^*(2007)^0 \bar{D}^*(2007)^0$	seen		604
$D^*(2010)^+ D^*(2010)^-$	seen		592
$D^0 D^- \pi^+ + \text{c.c.}$ (excl. $D^*(2007)^0 \bar{D}^0 + \text{c.c.},$ $D^*(2010)^+ D^- + \text{c.c.}$)	not seen		—
$D \bar{D}^* \pi + \text{c.c.}$ (excl. $D^* \bar{D}^*$)	seen		—
$D^0 D^{*-} \pi^+ + \text{c.c.}$ (excl. $D^*(2010)^+ D^*(2010)^-$)	not seen		—
$D_s^+ D_s^-$	not seen		719
$D_s^{*+} D_s^- + \text{c.c.}$	seen		385
$J/\psi \pi^+ \pi^-$	$< 3 \times 10^{-3}$	90%	919
$J/\psi \pi^0 \pi^0$	$< 3 \times 10^{-3}$	90%	922
$J/\psi K^+ K^-$	$< 2 \times 10^{-3}$	90%	407
$J/\psi \eta$	$< 8 \times 10^{-3}$	90%	822
$J/\psi \pi^0$	$< 1 \times 10^{-3}$	90%	944
$J/\psi \eta'$	$< 5 \times 10^{-3}$	90%	457
$J/\psi \pi^+ \pi^- \pi^0$	$< 1 \times 10^{-3}$	90%	879
$\psi(2S) \pi^+ \pi^-$	$< 4 \times 10^{-3}$	90%	396
$\chi_{c1} \gamma$	$< 5 \times 10^{-3}$	90%	625
$\chi_{c2} \gamma$	$< 1.3 \%$	90%	587
$\chi_{c1} \pi^+ \pi^- \pi^0$	$< 2 \times 10^{-3}$	90%	496
$\chi_{c2} \pi^+ \pi^- \pi^0$	$< 8 \times 10^{-3}$	90%	445

$h_c(1P)\pi^+\pi^-$	< 5	$\times 10^{-3}$	90%	556
$h_c(1P)\pi^0\pi^0$	< 2	$\times 10^{-3}$	90%	560
$h_c(1P)\eta$	< 2	$\times 10^{-3}$	90%	348
$h_c(1P)\pi^0$	< 4	$\times 10^{-4}$	90%	600
$\phi\pi^+\pi^-$	< 2	$\times 10^{-3}$	90%	1961
$\gamma\chi_{c1}(3872) \rightarrow \gamma J/\psi\pi^+\pi^-$	< 6.8	$\times 10^{-5}$	90%	—
$\gamma X(3915) \rightarrow \gamma J/\psi\pi^+\pi^-$	< 1.36	$\times 10^{-4}$	90%	—
$\gamma X(3930) \rightarrow \gamma J/\psi\pi^+\pi^-$	< 1.18	$\times 10^{-4}$	90%	—
$\gamma X(3940) \rightarrow \gamma J/\psi\pi^+\pi^-$	< 1.47	$\times 10^{-4}$	90%	—
$\gamma\chi_{c1}(3872) \rightarrow \gamma\gamma J/\psi$	< 1.05	$\times 10^{-4}$	90%	—
$\gamma X(3915) \rightarrow \gamma\gamma J/\psi$	< 1.26	$\times 10^{-4}$	90%	—
$\gamma X(3930) \rightarrow \gamma\gamma J/\psi$	< 8.8	$\times 10^{-5}$	90%	—
$\gamma X(3940) \rightarrow \gamma\gamma J/\psi$	< 1.79	$\times 10^{-4}$	90%	—

$\psi(4230)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as $Y(4230)$; was $X(4230)$

See also $\psi(4260)$ entry in Particle Listings.

Mass $m = 4220 \pm 15$ MeV

Full width $\Gamma = 20$ to 100 MeV

$\psi(4230)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega\chi_{c0}$	seen	171
$\pi^+\pi^-h_c$	seen	583
$\pi^+\pi^-J/\psi$	seen	942
$\pi^+\pi^-\psi(2S)$	seen	426
$\pi^+D^0D^{*-} + \text{c.c.}$	seen	650
$\gamma\chi_{c1}(3872)$	seen	334

$\chi_{c1}(4274)$

$$I^G(J^{PC}) = 0^+(1^{++})$$

was $X(4274)$

Mass $m = 4274^{+8}_{-6}$ MeV

Full width $\Gamma = 49 \pm 12$ MeV

$\chi_{c1}(4274)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi\phi$	seen	503

$\psi(4360)$

$$J^{PC} = 0^-(1^{--})$$

also known as $Y(4360)$; was $X(4360)$

$$\psi(4360) \text{ MASS} = 4368 \pm 13 \text{ MeV} \quad (S = 3.7)$$

$$\psi(4360) \text{ WIDTH} = 96 \pm 7 \text{ MeV}$$

$\psi(4360)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\psi(2S)\pi^+\pi^-$	seen	573
$\psi_2(3823)\pi^+\pi^-$	possibly seen	440
$D_1(2420)\bar{D} + \text{c.c.}$	possibly seen	419

 $\psi(4415)$ [*rraa*]

$$J^{PC} = 0^-(1^{--})$$

$$\text{Mass } m = 4421 \pm 4 \text{ MeV}$$

$$\text{Full width } \Gamma = 62 \pm 20 \text{ MeV}$$

$$\Gamma_{ee} = 0.58 \pm 0.07 \text{ keV}$$

Due to the complexity of the $c\bar{c}$ threshold region, in this listing, “seen” (“not seen”) means that a cross section for the mode in question has been measured at effective \sqrt{s} near this particle’s central mass value, more (less) than 2σ above zero, without regard to any peaking behavior in \sqrt{s} or absence thereof. See mode listing(s) for details and references.

$\psi(4415)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$D\bar{D}$	seen		1187
$D^0\bar{D}^0$	seen		1187
D^+D^-	seen		1179
$D^*\bar{D} + \text{c.c.}$	seen		1063
$D^*(2007)^0\bar{D}^0 + \text{c.c.}$	seen		1067
$D^*(2010)^+D^- + \text{c.c.}$	seen		1059
$D^*\bar{D}^*$	seen		919
$D^*(2007)^0\bar{D}^*(2007)^0 + \text{c.c.}$	seen		927
$D^*(2010)^+D^*(2010)^- + \text{c.c.}$	seen		919
$D^0D^-\pi^+ (\text{excl. } D^*(2007)^0\bar{D}^0 + \text{c.c., } D^*(2010)^+D^- + \text{c.c.})$	< 2.3 %	90%	–
$D\bar{D}_2^*(2460) \rightarrow D^0D^-\pi^+ + \text{c.c.}$	(10 \pm 4) %		–
$D^0D^*\pi^+ + \text{c.c.}$	< 11 %	90%	926
$D_1(2420)\bar{D} + \text{c.c.}$	possibly seen		538
$D_s^+D_s^-$	not seen		1006
$\omega\chi_{c2}$	possibly seen		330
$D_s^{*+}D_s^- + \text{c.c.}$	seen		–

$D_s^{*+} D_s^{*-}$	not seen		652
$\psi_2(3823)\pi^+\pi^-$	possibly seen		494
$\psi(3770)\pi^+\pi^-$	possibly seen		541
$J/\psi\eta$	< 6	$\times 10^{-3}$	90% 1022
$\chi_{c1}\gamma$	< 8	$\times 10^{-4}$	90% 817
$\chi_{c2}\gamma$	< 4	$\times 10^{-3}$	90% 780
e^+e^-	$(9.4 \pm 3.2) \times 10^{-6}$		2210

Z_c(4430)

$$I^G(J^{PC}) = 1^+(1^{+-})$$

G, C need confirmation.

was $X(4430)^\pm$

Quantum numbers not established.

$$\text{Mass } m = 4478_{-18}^{+15} \text{ MeV}$$

$$\text{Full width } \Gamma = 181 \pm 31 \text{ MeV}$$

Z_c(4430) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi^+\psi(2S)$	seen	711
π^+J/ψ	seen	1162

ψ(4660)

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as $Y(4660)$; was $X(4660)$

$$\psi(4660) \text{ MASS} = 4633 \pm 7 \text{ MeV} \quad (S = 1.4)$$

$$\psi(4660) \text{ WIDTH} = 64 \pm 9 \text{ MeV}$$

ψ(4660) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
e^+e^-	not seen	2316
$\psi(2S)\pi^+\pi^-$	seen	812
$J/\psi\eta$	not seen	1194
$D^0 D^{*-} \pi^+$	not seen	1156
$\chi_{c1}\gamma$	not seen	986
$\chi_{c2}\gamma$	not seen	952
$\Lambda_c^+ \Lambda_c^-$	seen	371
$D_s^+ D_{s1}^-(2536)^-$	seen	539

$b\bar{b}$ MESONS (including possibly non- $q\bar{q}$ states)

 $\eta_b(1S)$

$$I^G(J^{PC}) = 0^+(0^{-+})$$

 Mass $m = 9398.7 \pm 2.0$ MeV (S = 1.5)

 Full width $\Gamma = 10^{+5}_{-4}$ MeV

$\eta_b(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
hadrons	seen		—
$3h^+3h^-$	not seen		4672
$2h^+2h^-$	not seen		4689
$4h^+4h^-$	not seen		4648
$\gamma\gamma$	not seen		4699
$\mu^+\mu^-$	$<9 \times 10^{-3}$	90%	4698
$\tau^+\tau^-$	$<8\%$	90%	4350

 $\Upsilon(1S)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

 Mass $m = 9460.30 \pm 0.26$ MeV (S = 3.3)

 Full width $\Gamma = 54.02 \pm 1.25$ keV

 $\Gamma_{ee} = 1.340 \pm 0.018$ keV

$\Upsilon(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\tau^+\tau^-$	(2.60 \pm 0.10) %		4384
e^+e^-	(2.38 \pm 0.11) %		4730
$\mu^+\mu^-$	(2.48 \pm 0.05) %		4729

Hadronic decays

ggg	(81.7 \pm 0.7) %		—
γgg	(2.2 \pm 0.6) %		—
$\eta'(958)$ anything	(2.94 \pm 0.24) %		—
$J/\psi(1S)$ anything	(5.4 \pm 0.4) $\times 10^{-4}$	S=1.4	4223
$J/\psi(1S)\eta_c$	< 2.2	$\times 10^{-6}$ CL=90%	3623
$J/\psi(1S)\chi_{c0}$	< 3.4	$\times 10^{-6}$ CL=90%	3429
$J/\psi(1S)\chi_{c1}$	(3.9 \pm 1.2) $\times 10^{-6}$		3382
$J/\psi(1S)\chi_{c2}$	< 1.4	$\times 10^{-6}$ CL=90%	3359
$J/\psi(1S)\eta_c(2S)$	< 2.2	$\times 10^{-6}$ CL=90%	3317
$J/\psi(1S)X(3940)$	< 5.4	$\times 10^{-6}$ CL=90%	3148

$J/\psi(1S)X(4160)$	< 5.4	$\times 10^{-6}$	CL=90%	3018
$X(4350)$ anything, $X \rightarrow$ $J/\psi(1S)\phi$	< 8.1	$\times 10^{-6}$	CL=90%	—
$Z_c(3900)^\pm$ anything, $Z_c \rightarrow$ $J/\psi(1S)\pi^\pm$	< 1.3	$\times 10^{-5}$	CL=90%	—
$Z_c(4200)^\pm$ anything, $Z_c \rightarrow$ $J/\psi(1S)\pi^\pm$	< 6.0	$\times 10^{-5}$	CL=90%	—
$Z_c(4430)^\pm$ anything, $Z_c \rightarrow$ $J/\psi(1S)\pi^\pm$	< 4.9	$\times 10^{-5}$	CL=90%	—
X_{cs}^\pm anything, $X \rightarrow$ $J/\psi K^\pm$	< 5.7	$\times 10^{-6}$	CL=90%	—
$\chi_{c1}(3872)$ anything, $\chi_{c1} \rightarrow$ $J/\psi(1S)\pi^+\pi^-$	< 9.5	$\times 10^{-6}$	CL=90%	—
$\psi(4260)$ anything, $\psi \rightarrow$ $J/\psi(1S)\pi^+\pi^-$	< 3.8	$\times 10^{-5}$	CL=90%	—
$\psi(4260)$ anything, $\psi \rightarrow$ $J/\psi(1S)K^+K^-$	< 7.5	$\times 10^{-6}$	CL=90%	—
$\chi_{c1}(4140)$ anything, $\chi_{c1} \rightarrow$ $J/\psi(1S)\phi$	< 5.2	$\times 10^{-6}$	CL=90%	—
χ_{c0} anything	< 4	$\times 10^{-3}$	CL=90%	—
χ_{c1} anything	(1.90 \pm 0.35)	$\times 10^{-4}$		—
$\chi_{c1}(1P)X_{tetra}$	< 3.78	$\times 10^{-5}$	CL=90%	—
χ_{c2} anything	(2.8 \pm 0.8)	$\times 10^{-4}$		—
$\psi(2S)$ anything	(1.23 \pm 0.20)	$\times 10^{-4}$		—
$\psi(2S)\eta_c$	< 3.6	$\times 10^{-6}$	CL=90%	3345
$\psi(2S)\chi_{c0}$	< 6.5	$\times 10^{-6}$	CL=90%	3124
$\psi(2S)\chi_{c1}$	< 4.5	$\times 10^{-6}$	CL=90%	3070
$\psi(2S)\chi_{c2}$	< 2.1	$\times 10^{-6}$	CL=90%	3043
$\psi(2S)\eta_c(2S)$	< 3.2	$\times 10^{-6}$	CL=90%	2994
$\psi(2S)X(3940)$	< 2.9	$\times 10^{-6}$	CL=90%	2797
$\psi(2S)X(4160)$	< 2.9	$\times 10^{-6}$	CL=90%	2642
$\psi(4260)$ anything, $\psi \rightarrow$ $\psi(2S)\pi^+\pi^-$	< 7.9	$\times 10^{-5}$	CL=90%	—
$\psi(4360)$ anything, $\psi \rightarrow$ $\psi(2S)\pi^+\pi^-$	< 5.2	$\times 10^{-5}$	CL=90%	—
$\psi(4660)$ anything, $\psi \rightarrow$ $\psi(2S)\pi^+\pi^-$	< 2.2	$\times 10^{-5}$	CL=90%	—
$X(4050)^\pm$ anything, $X \rightarrow$ $\psi(2S)\pi^\pm$	< 8.8	$\times 10^{-5}$	CL=90%	—
$Z_c(4430)^\pm$ anything, $Z_c \rightarrow$ $\psi(2S)\pi^\pm$	< 6.7	$\times 10^{-5}$	CL=90%	—
$Z_c(4200)^+Z_c(4200)^-$	< 2.23	$\times 10^{-5}$	CL=90%	—
$Z_c(3900)^\pm Z_c(4200)^\mp$	< 8.1	$\times 10^{-6}$	CL=90%	—
$Z_c(3900)^+Z_c(3900)^-$	< 1.8	$\times 10^{-6}$	CL=90%	—

$X(4050)^+ X(4050)^-$	< 1.58	$\times 10^{-5}$	CL=90%	—
$X(4250)^+ X(4250)^-$	< 2.66	$\times 10^{-5}$	CL=90%	—
$X(4050)^\pm X(4250)^\mp$	< 4.42	$\times 10^{-5}$	CL=90%	—
$Z_c(4430)^+ Z_c(4430)^-$	< 2.03	$\times 10^{-5}$	CL=90%	—
$X(4055)^\pm X(4055)^\mp$	< 2.33	$\times 10^{-5}$	CL=90%	—
$X(4055)^\pm Z_c(4430)^\mp$	< 4.55	$\times 10^{-5}$	CL=90%	—
$\rho\pi$	< 3.68	$\times 10^{-6}$	CL=90%	4697
$\omega\pi^0$	< 3.90	$\times 10^{-6}$	CL=90%	4697
$\pi^+\pi^-$	< 5	$\times 10^{-4}$	CL=90%	4728
K^+K^-	< 5	$\times 10^{-4}$	CL=90%	4704
$p\bar{p}$	< 5	$\times 10^{-4}$	CL=90%	4636
$\pi^+\pi^-\pi^0$	(2.1 ± 0.8)	$\times 10^{-6}$		4725
ϕK^+K^-	(2.4 ± 0.5)	$\times 10^{-6}$		4622
$\omega\pi^+\pi^-$	(4.5 ± 1.0)	$\times 10^{-6}$		4694
$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	(4.4 ± 0.8)	$\times 10^{-6}$		4667
$\phi f'_2(1525)$	< 1.63	$\times 10^{-6}$	CL=90%	4551
$\omega f_2(1270)$	< 1.79	$\times 10^{-6}$	CL=90%	4611
$\rho(770) a_2(1320)$	< 2.24	$\times 10^{-6}$	CL=90%	4605
$K^*(892)^0 \bar{K}_2^*(1430)^0 + \text{c.c.}$	(3.0 ± 0.8)	$\times 10^{-6}$		4578
$K_1(1270)^\pm K^\mp$	< 2.41	$\times 10^{-6}$	CL=90%	4634
$K_1(1400)^\pm K^\mp$	(1.0 ± 0.4)	$\times 10^{-6}$		4613
$b_1(1235)^\pm \pi^\mp$	< 1.25	$\times 10^{-6}$	CL=90%	4649
$\pi^+\pi^-\pi^0\pi^0$	(1.28 ± 0.30)	$\times 10^{-5}$		4720
$K_S^0 K^+ \pi^- + \text{c.c.}$	(1.6 ± 0.4)	$\times 10^{-6}$		4696
$K^*(892)^0 \bar{K}^0 + \text{c.c.}$	(2.9 ± 0.9)	$\times 10^{-6}$		4675
$K^*(892)^- K^+ + \text{c.c.}$	< 1.11	$\times 10^{-6}$	CL=90%	4675
$f_1(1285)$ anything	(4.6 ± 3.1)	$\times 10^{-3}$		—
$D^*(2010)^\pm$ anything	(2.52 ± 0.20)	%		—
$f_1(1285) X_{tetra}$	< 6.24	$\times 10^{-5}$	CL=90%	—
2H anything	(2.85 ± 0.25)	$\times 10^{-5}$		—
Sum of 100 exclusive modes	(1.200 ± 0.017)	%		—

Radiative decays

$\gamma\pi^+\pi^-$	(6.3 ± 1.8)	$\times 10^{-5}$		4728
$\gamma\pi^0\pi^0$	(1.7 ± 0.7)	$\times 10^{-5}$		4728
$\gamma\pi\pi$ (S-wave)	(4.6 ± 0.7)	$\times 10^{-5}$		4728
$\gamma\pi^0\eta$	< 2.4	$\times 10^{-6}$	CL=90%	4713
γK^+K^-	[ssaa] (1.14 ± 0.13)	$\times 10^{-5}$		4704
$\gamma p\bar{p}$	[ttaa] < 6	$\times 10^{-6}$	CL=90%	4636
$\gamma 2h^+ 2h^-$	(7.0 ± 1.5)	$\times 10^{-4}$		4720
$\gamma 3h^+ 3h^-$	(5.4 ± 2.0)	$\times 10^{-4}$		4703
$\gamma 4h^+ 4h^-$	(7.4 ± 3.5)	$\times 10^{-4}$		4679
$\gamma\pi^+\pi^- K^+ K^-$	(2.9 ± 0.9)	$\times 10^{-4}$		4686
$\gamma 2\pi^+ 2\pi^-$	(2.5 ± 0.9)	$\times 10^{-4}$		4720

$\gamma 3\pi^+ 3\pi^-$	$(2.5 \pm 1.2) \times 10^{-4}$	4703
$\gamma 2\pi^+ 2\pi^- K^+ K^-$	$(2.4 \pm 1.2) \times 10^{-4}$	4658
$\gamma \pi^+ \pi^- p \bar{p}$	$(1.5 \pm 0.6) \times 10^{-4}$	4604
$\gamma 2\pi^+ 2\pi^- p \bar{p}$	$(4 \pm 6) \times 10^{-5}$	4563
$\gamma 2K^+ 2K^-$	$(2.0 \pm 2.0) \times 10^{-5}$	4601
$\gamma \eta'(958)$	$< 1.9 \times 10^{-6}$ CL=90%	4682
$\gamma \eta$	$< 1.0 \times 10^{-6}$ CL=90%	4714
$\gamma f_0(980)$	$< 3 \times 10^{-5}$ CL=90%	4678
$\gamma f_2'(1525)$	$(2.9 \pm 0.6) \times 10^{-5}$	4608
$\gamma f_2(1270)$	$(1.01 \pm 0.06) \times 10^{-4}$	4644
$\gamma \eta(1405)$	$< 8.2 \times 10^{-5}$ CL=90%	4625
$\gamma f_0(1500)$	$< 1.5 \times 10^{-5}$ CL=90%	4610
$\gamma f_0(1500) \rightarrow \gamma K^+ K^-$	$(1.0 \pm 0.4) \times 10^{-5}$	—
$\gamma f_0(1710)$	$< 2.6 \times 10^{-4}$ CL=90%	4577
$\gamma f_0(1710) \rightarrow \gamma K^+ K^-$	$(1.01 \pm 0.32) \times 10^{-5}$	—
$\gamma f_0(1710) \rightarrow \gamma \pi^+ \pi^-$	$(5.3 \pm 2.0) \times 10^{-6}$	—
$\gamma f_0(1710) \rightarrow \gamma \pi^0 \pi^0$	$< 1.4 \times 10^{-6}$ CL=90%	—
$\gamma f_0(1710) \rightarrow \gamma \eta \eta$	$< 1.8 \times 10^{-6}$ CL=90%	—
$\gamma f_4(2050)$	$< 5.3 \times 10^{-5}$ CL=90%	4515
$\gamma f_0(2200) \rightarrow \gamma K^+ K^-$	$< 2 \times 10^{-4}$ CL=90%	4475
$\gamma f_J(2220) \rightarrow \gamma K^+ K^-$	$< 8 \times 10^{-7}$ CL=90%	4469
$\gamma f_J(2220) \rightarrow \gamma \pi^+ \pi^-$	$< 6 \times 10^{-7}$ CL=90%	—
$\gamma f_J(2220) \rightarrow \gamma p \bar{p}$	$< 1.1 \times 10^{-6}$ CL=90%	—
$\gamma \eta(2225) \rightarrow \gamma \phi \phi$	$< 3 \times 10^{-3}$ CL=90%	4469
$\gamma \eta_c(1S)$	$< 5.7 \times 10^{-5}$ CL=90%	4260
$\gamma \chi_{c0}$	$< 6.5 \times 10^{-4}$ CL=90%	4114
$\gamma \chi_{c1}$	$< 2.3 \times 10^{-5}$ CL=90%	4079
$\gamma \chi_{c2}$	$< 7.6 \times 10^{-6}$ CL=90%	4062
$\gamma \chi_{c1}(3872) \rightarrow \pi^+ \pi^- J/\psi$	$< 1.6 \times 10^{-6}$ CL=90%	—
$\gamma \chi_{c1}(3872) \rightarrow \pi^+ \pi^- \pi^0 J/\psi$	$< 2.8 \times 10^{-6}$ CL=90%	—
$\gamma X(3915) \rightarrow \omega J/\psi$	$< 3.0 \times 10^{-6}$ CL=90%	—
$\gamma \chi_{c1}(4140) \rightarrow \phi J/\psi$	$< 2.2 \times 10^{-6}$ CL=90%	—
γX	$[uu\bar{a}\bar{a}] < 4.5 \times 10^{-6}$ CL=90%	—
$\gamma X \bar{X} (m_X < 3.1 \text{ GeV})$	$[v\bar{v}a\bar{a}] < 1 \times 10^{-3}$ CL=90%	—
$\gamma X \bar{X} (m_X < 4.5 \text{ GeV})$	$[x\bar{x}a\bar{a}] < 2.4 \times 10^{-4}$ CL=90%	—
$\gamma X \rightarrow \gamma + \geq 4 \text{ prongs}$	$[yy\bar{a}\bar{a}] < 1.78 \times 10^{-4}$ CL=95%	—
$\gamma a_1^0 \rightarrow \gamma \mu^+ \mu^-$	$[zz\bar{a}\bar{a}] < 9 \times 10^{-6}$ CL=90%	—
$\gamma a_1^0 \rightarrow \gamma \tau^+ \tau^-$	$[ss\bar{a}\bar{a}] < 1.30 \times 10^{-4}$ CL=90%	—
$\gamma a_1^0 \rightarrow \gamma g g$	$[a\bar{a}b\bar{b}] < 1 \%$ CL=90%	—
$\gamma a_1^0 \rightarrow \gamma s \bar{s}$	$[a\bar{a}b\bar{b}] < 1 \times 10^{-3}$ CL=90%	—

Lepton Family number (LF) violating modes

$\mu^\pm \tau^\mp$	LF	$< 6.0 \times 10^{-6}$ CL=95%	4563
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Other decays

invisible $< 3.0 \times 10^{-4}$ CL=90% —

$\chi_{b0}(1P)$ [bbbb]

$$J^G(J^{PC}) = 0^+(0^{++})$$

J needs confirmation.

Mass $m = 9859.44 \pm 0.42 \pm 0.31$ MeV

$\chi_{b0}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$\gamma \Upsilon(1S)$	(1.94 ± 0.27) %		391
$D^0 X$	< 10.4 %	90%	—
$\pi^+ \pi^- K^+ K^- \pi^0$	< 1.6 $\times 10^{-4}$	90%	4875
$2\pi^+ \pi^- K^- K_S^0$	< 5 $\times 10^{-5}$	90%	4875
$2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 5 $\times 10^{-4}$	90%	4846
$2\pi^+ 2\pi^- 2\pi^0$	< 2.1 $\times 10^{-4}$	90%	4905
$2\pi^+ 2\pi^- K^+ K^-$	(1.1 ± 0.6) $\times 10^{-4}$		4861
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.7 $\times 10^{-4}$	90%	4846
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 5 $\times 10^{-4}$	90%	4828
$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 1.6 $\times 10^{-4}$	90%	4827
$3\pi^+ 3\pi^-$	< 8 $\times 10^{-5}$	90%	4904
$3\pi^+ 3\pi^- 2\pi^0$	< 6 $\times 10^{-4}$	90%	4881
$3\pi^+ 3\pi^- K^+ K^-$	(2.4 ± 1.2) $\times 10^{-4}$		4827
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 1.0 $\times 10^{-3}$	90%	4808
$4\pi^+ 4\pi^-$	< 8 $\times 10^{-5}$	90%	4880
$4\pi^+ 4\pi^- 2\pi^0$	< 2.1 $\times 10^{-3}$	90%	4850
$J/\psi J/\psi$	< 7 $\times 10^{-5}$	90%	3836
$J/\psi \psi(2S)$	< 1.2 $\times 10^{-4}$	90%	3571
$\psi(2S) \psi(2S)$	< 3.1 $\times 10^{-5}$	90%	3273
$J/\psi(1S)$ anything	< 2.3 $\times 10^{-3}$	90%	—

$\chi_{b1}(1P)$ [bbbb]

$$J^G(J^{PC}) = 0^+(1^{++})$$

J needs confirmation.

Mass $m = 9892.78 \pm 0.26 \pm 0.31$ MeV

$\chi_{b1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$\gamma \Upsilon(1S)$	(35.2 ± 2.0) %		423
$D^0 X$	(12.6 ± 2.2) %		—
$\pi^+ \pi^- K^+ K^- \pi^0$	(2.0 ± 0.6) $\times 10^{-4}$		4892
$2\pi^+ \pi^- K^- K_S^0$	(1.3 ± 0.5) $\times 10^{-4}$		4892
$2\pi^+ \pi^- K^- K_S^0 2\pi^0$	< 6 $\times 10^{-4}$	90%	4863
$2\pi^+ 2\pi^- 2\pi^0$	(8.0 ± 2.5) $\times 10^{-4}$		4921
$2\pi^+ 2\pi^- K^+ K^-$	(1.5 ± 0.5) $\times 10^{-4}$		4878

$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(3.5 \pm 1.2) \times 10^{-4}$		4863
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(8.6 \pm 3.2) \times 10^{-4}$		4845
$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$(9.3 \pm 3.3) \times 10^{-4}$		4844
$3\pi^+ 3\pi^-$	$(1.9 \pm 0.6) \times 10^{-4}$		4921
$3\pi^+ 3\pi^- 2\pi^0$	$(1.7 \pm 0.5) \times 10^{-3}$		4898
$3\pi^+ 3\pi^- K^+ K^-$	$(2.6 \pm 0.8) \times 10^{-4}$		4844
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(7.5 \pm 2.6) \times 10^{-4}$		4825
$4\pi^+ 4\pi^-$	$(2.6 \pm 0.9) \times 10^{-4}$		4897
$4\pi^+ 4\pi^- 2\pi^0$	$(1.4 \pm 0.6) \times 10^{-3}$		4867
ω anything	$(4.9 \pm 1.4) \%$		—
ωX_{tetra}	$< 4.44 \times 10^{-4}$	90%	—
$J/\psi J/\psi$	$< 2.7 \times 10^{-5}$	90%	3857
$J/\psi \psi(2S)$	$< 1.7 \times 10^{-5}$	90%	3594
$\psi(2S) \psi(2S)$	$< 6 \times 10^{-5}$	90%	3298
$J/\psi(1S)$ anything	$< 1.1 \times 10^{-3}$	90%	—
$J/\psi(1S) X_{tetra}$	$< 2.27 \times 10^{-4}$	90%	—

$h_b(1P)$

$$I^G(J^{PC}) = 0^-(1^{+-})$$

Mass $m = 9899.3 \pm 0.8$ MeV

$h_b(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta_b(1S)\gamma$	$(52_{-5}^{+6}) \%$	488

$\chi_{b2}(1P)$ ^[bbbb]

$$I^G(J^{PC}) = 0^+(2^{++})$$

J needs confirmation.

Mass $m = 9912.21 \pm 0.26 \pm 0.31$ MeV

$\chi_{b2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma \Upsilon(1S)$	$(18.0 \pm 1.0) \%$		442
$D^0 X$	$< 7.9 \%$	90%	—
$\pi^+ \pi^- K^+ K^- \pi^0$	$(8 \pm 5) \times 10^{-5}$		4902
$2\pi^+ \pi^- K^- K_S^0$	$< 1.0 \times 10^{-4}$	90%	4901
$2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$(5.3 \pm 2.4) \times 10^{-4}$		4873
$2\pi^+ 2\pi^- 2\pi^0$	$(3.5 \pm 1.4) \times 10^{-4}$		4931
$2\pi^+ 2\pi^- K^+ K^-$	$(1.1 \pm 0.4) \times 10^{-4}$		4888
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(2.1 \pm 0.9) \times 10^{-4}$		4872
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(3.9 \pm 1.8) \times 10^{-4}$		4855
$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$< 5 \times 10^{-4}$	90%	4854

$3\pi^+ 3\pi^-$	$(7.0 \pm 3.1) \times 10^{-5}$		4931
$3\pi^+ 3\pi^- 2\pi^0$	$(1.0 \pm 0.4) \times 10^{-3}$		4908
$3\pi^+ 3\pi^- K^+ K^-$	$< 8 \times 10^{-5}$	90%	4854
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(3.6 \pm 1.5) \times 10^{-4}$		4835
$4\pi^+ 4\pi^-$	$(8 \pm 4) \times 10^{-5}$		4907
$4\pi^+ 4\pi^- 2\pi^0$	$(1.8 \pm 0.7) \times 10^{-3}$		4877
$J/\psi J/\psi$	$< 4 \times 10^{-5}$	90%	3869
$J/\psi \psi(2S)$	$< 5 \times 10^{-5}$	90%	3608
$\psi(2S) \psi(2S)$	$< 1.6 \times 10^{-5}$	90%	3313
$J/\psi(1S)$ anything	$(1.5 \pm 0.4) \times 10^{-3}$		—

$\Upsilon(2S)$

$$J^{PC} = 0^-(1^{--})$$

Mass $m = 10023.26 \pm 0.31$ MeV

$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.50 \pm 0.13$ MeV

Full width $\Gamma = 31.98 \pm 2.63$ keV

$\Gamma_{ee} = 0.612 \pm 0.011$ keV

$\Upsilon(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\Upsilon(1S) \pi^+ \pi^-$	$(17.85 \pm 0.26) \%$		475
$\Upsilon(1S) \pi^0 \pi^0$	$(8.6 \pm 0.4) \%$		480
$\tau^+ \tau^-$	$(2.00 \pm 0.21) \%$		4686
$\mu^+ \mu^-$	$(1.93 \pm 0.17) \%$	S=2.2	5011
$e^+ e^-$	$(1.91 \pm 0.16) \%$		5012
$\Upsilon(1S) \pi^0$	$< 4 \times 10^{-5}$	CL=90%	531
$\Upsilon(1S) \eta$	$(2.9 \pm 0.4) \times 10^{-4}$	S=2.0	126
$J/\psi(1S)$ anything	$< 6 \times 10^{-3}$	CL=90%	4533
$J/\psi(1S) \eta_c$	$< 5.4 \times 10^{-6}$	CL=90%	3984
$J/\psi(1S) \chi_{c0}$	$< 3.4 \times 10^{-6}$	CL=90%	3808
$J/\psi(1S) \chi_{c1}$	$< 1.2 \times 10^{-6}$	CL=90%	3765
$J/\psi(1S) \chi_{c2}$	$< 2.0 \times 10^{-6}$	CL=90%	3744
$J/\psi(1S) \eta_c(2S)$	$< 2.5 \times 10^{-6}$	CL=90%	3707
$J/\psi(1S) X(3940)$	$< 2.0 \times 10^{-6}$	CL=90%	3555
$J/\psi(1S) X(4160)$	$< 2.0 \times 10^{-6}$	CL=90%	3440
χ_{c1} anything	$(2.2 \pm 0.5) \times 10^{-4}$		—
$\chi_{c1}(1P)^0 X_{tetra}$	$< 3.67 \times 10^{-5}$	CL=90%	—
χ_{c2} anything	$(2.3 \pm 0.8) \times 10^{-4}$		—
$\psi(2S) \eta_c$	$< 5.1 \times 10^{-6}$	CL=90%	3732
$\psi(2S) \chi_{c0}$	$< 4.7 \times 10^{-6}$	CL=90%	3536
$\psi(2S) \chi_{c1}$	$< 2.5 \times 10^{-6}$	CL=90%	3488
$\psi(2S) \chi_{c2}$	$< 1.9 \times 10^{-6}$	CL=90%	3464
$\psi(2S) \eta_c(2S)$	$< 3.3 \times 10^{-6}$	CL=90%	3422
$\psi(2S) X(3940)$	$< 3.9 \times 10^{-6}$	CL=90%	3250

$\psi(2S)X(4160)$	< 3.9	$\times 10^{-6}$	CL=90%	3118
$Z_c(3900)^+ Z_c(3900)^-$	< 1.0	$\times 10^{-6}$	CL=90%	—
$Z_c(4200)^+ Z_c(4200)^-$	< 1.67	$\times 10^{-5}$	CL=90%	—
$Z_c(3900)^\pm Z_c(4200)^\mp$	< 7.3	$\times 10^{-6}$	CL=90%	—
$X(4050)^+ X(4050)^-$	< 1.35	$\times 10^{-5}$	CL=90%	—
$X(4250)^+ X(4250)^-$	< 2.67	$\times 10^{-5}$	CL=90%	—
$X(4050)^\pm X(4250)^\mp$	< 2.72	$\times 10^{-5}$	CL=90%	—
$Z_c(4430)^+ Z_c(4430)^-$	< 2.03	$\times 10^{-5}$	CL=90%	—
$X(4055)^\pm X(4055)^\mp$	< 1.11	$\times 10^{-5}$	CL=90%	—
$X(4055)^\pm Z_c(4430)^\mp$	< 2.11	$\times 10^{-5}$	CL=90%	—
$\overline{2H}$ anything	$(2.78^{+0.30}_{-0.26}) \times 10^{-5}$		S=1.2	—
hadrons	$(94 \pm 11) \%$			—
ggg	$(58.8 \pm 1.2) \%$			—
$\gamma g g$	$(1.87 \pm 0.28) \%$			—
$\phi K^+ K^-$	$(1.6 \pm 0.4) \times 10^{-6}$			4910
$\omega \pi^+ \pi^-$	< 2.58	$\times 10^{-6}$	CL=90%	4977
$K^*(892)^0 K^- \pi^+ + \text{c.c.}$	$(2.3 \pm 0.7) \times 10^{-6}$			4952
$\phi f'_2(1525)$	< 1.33	$\times 10^{-6}$	CL=90%	4842
$\omega f_2(1270)$	< 5.7	$\times 10^{-7}$	CL=90%	4899
$\rho(770) a_2(1320)$	< 8.8	$\times 10^{-7}$	CL=90%	4894
$K^*(892)^0 \overline{K}_2^*(1430)^0 + \text{c.c.}$	$(1.5 \pm 0.6) \times 10^{-6}$			4869
$K_1(1270)^\pm K^\mp$	< 3.22	$\times 10^{-6}$	CL=90%	4921
$K_1(1400)^\pm K^\mp$	< 8.3	$\times 10^{-7}$	CL=90%	4901
$b_1(1235)^\pm \pi^\mp$	< 4.0	$\times 10^{-7}$	CL=90%	4935
$\rho \pi$	< 1.16	$\times 10^{-6}$	CL=90%	4981
$\pi^+ \pi^- \pi^0$	< 8.0	$\times 10^{-7}$	CL=90%	5007
$\omega \pi^0$	< 1.63	$\times 10^{-6}$	CL=90%	4980
$\pi^+ \pi^- \pi^0 \pi^0$	$(1.30 \pm 0.28) \times 10^{-5}$			5002
$K_S^0 K^+ \pi^- + \text{c.c.}$	$(1.14 \pm 0.33) \times 10^{-6}$			4979
$K^*(892)^0 \overline{K}^0 + \text{c.c.}$	< 4.22	$\times 10^{-6}$	CL=90%	4959
$K^*(892)^- K^+ + \text{c.c.}$	< 1.45	$\times 10^{-6}$	CL=90%	4960
$f_1(1285)$ anything	$(2.2 \pm 1.6) \times 10^{-3}$			—
$f_1(1285) X_{tetra}$	< 6.47	$\times 10^{-5}$	CL=90%	—
Sum of 100 exclusive modes	$(2.90 \pm 0.30) \times 10^{-3}$			—

Radiative decays

$\gamma \chi_{b1}(1P)$	$(6.9 \pm 0.4) \%$			130
$\gamma \chi_{b2}(1P)$	$(7.15 \pm 0.35) \%$			110
$\gamma \chi_{b0}(1P)$	$(3.8 \pm 0.4) \%$			162
$\gamma f_0(1710)$	< 5.9	$\times 10^{-4}$	CL=90%	4867
$\gamma f'_2(1525)$	< 5.3	$\times 10^{-4}$	CL=90%	4897
$\gamma f_2(1270)$	< 2.41	$\times 10^{-4}$	CL=90%	4930
$\gamma \eta_c(1S)$	< 2.7	$\times 10^{-5}$	CL=90%	4567
$\gamma \chi_{c0}$	< 1.0	$\times 10^{-4}$	CL=90%	4430

$\gamma\chi_{c1}$	< 3.6	$\times 10^{-6}$	CL=90%	4397
$\gamma\chi_{c2}$	< 1.5	$\times 10^{-5}$	CL=90%	4381
$\gamma\chi_{c1}(3872) \rightarrow \pi^+\pi^- J/\psi$	< 8	$\times 10^{-7}$	CL=90%	—
$\gamma\chi_{c1}(3872) \rightarrow \pi^+\pi^-\pi^0 J/\psi$	< 2.4	$\times 10^{-6}$	CL=90%	—
$\gamma X(3915) \rightarrow \omega J/\psi$	< 2.8	$\times 10^{-6}$	CL=90%	—
$\gamma\chi_{c1}(4140) \rightarrow \phi J/\psi$	< 1.2	$\times 10^{-6}$	CL=90%	—
$\gamma X(4350) \rightarrow \phi J/\psi$	< 1.3	$\times 10^{-6}$	CL=90%	—
$\gamma\eta_b(1S)$	$(5.5 \pm_{-0.9}^{+1.1}) \times 10^{-4}$		S=1.2	605
$\gamma\eta_b(1S) \rightarrow \gamma$ Sum of 26 exclusive modes	< 3.7	$\times 10^{-6}$	CL=90%	—
$\gamma X_{b\bar{b}} \rightarrow \gamma$ Sum of 26 exclusive modes	< 4.9	$\times 10^{-6}$	CL=90%	—
$\gamma X \rightarrow \gamma + \geq 4$ prongs [ccbb]	< 1.95	$\times 10^{-4}$	CL=95%	—
$\gamma A^0 \rightarrow \gamma$ hadrons	< 8	$\times 10^{-5}$	CL=90%	—
$\gamma a_1^0 \rightarrow \gamma\mu^+\mu^-$	< 8.3	$\times 10^{-6}$	CL=90%	—

Lepton Family number (LF) violating modes

$e^\pm\tau^\mp$	LF	< 3.2	$\times 10^{-6}$	CL=90%	4854
$\mu^\pm\tau^\mp$	LF	< 3.3	$\times 10^{-6}$	CL=90%	4854

$\Upsilon_2(1D)$

$$I^G(J^{PC}) = 0^-(2^{--})$$

was $\Upsilon(1D)$

$$\text{Mass } m = 10163.7 \pm 1.4 \text{ MeV} \quad (S = 1.7)$$

$\Upsilon_2(1D)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\gamma\gamma \Upsilon(1S)$	seen	679
$\gamma\chi_{bJ}(1P)$	seen	300
$\eta \Upsilon(1S)$	not seen	426
$\pi^+\pi^- \Upsilon(1S)$	$(6.6 \pm 1.6) \times 10^{-3}$	623

$\chi_{b0}(2P)$ [bbbb]

$$I^G(J^{PC}) = 0^+(0^{++})$$

J needs confirmation.

$$\text{Mass } m = 10232.5 \pm 0.4 \pm 0.5 \text{ MeV}$$

$\chi_{b0}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma \Upsilon(2S)$	$(1.38 \pm 0.30) \%$		207
$\gamma \Upsilon(1S)$	$(3.8 \pm 1.7) \times 10^{-3}$		743
$D^0 X$	< 8.2	% 90%	—
$\pi^+\pi^- K^+ K^- \pi^0$	< 3.4	$\times 10^{-5}$ 90%	5064
$2\pi^+\pi^- K^- K_S^0$	< 5	$\times 10^{-5}$ 90%	5063

$2\pi^+\pi^-K^-K_S^02\pi^0$	< 2.2	$\times 10^{-4}$	90%	5036
$2\pi^+2\pi^-2\pi^0$	< 2.4	$\times 10^{-4}$	90%	5092
$2\pi^+2\pi^-K^+K^-$	< 1.5	$\times 10^{-4}$	90%	5050
$2\pi^+2\pi^-K^+K^-\pi^0$	< 2.2	$\times 10^{-4}$	90%	5035
$2\pi^+2\pi^-K^+K^-2\pi^0$	< 1.1	$\times 10^{-3}$	90%	5019
$3\pi^+2\pi^-K^-K_S^0\pi^0$	< 7	$\times 10^{-4}$	90%	5018
$3\pi^+3\pi^-$	< 7	$\times 10^{-5}$	90%	5091
$3\pi^+3\pi^-2\pi^0$	< 1.2	$\times 10^{-3}$	90%	5070
$3\pi^+3\pi^-K^+K^-$	< 1.5	$\times 10^{-4}$	90%	5017
$3\pi^+3\pi^-K^+K^-\pi^0$	< 7	$\times 10^{-4}$	90%	4999
$4\pi^+4\pi^-$	< 1.7	$\times 10^{-4}$	90%	5069
$4\pi^+4\pi^-2\pi^0$	< 6	$\times 10^{-4}$	90%	5039

$\chi_{b1}(2P)$ ^[bbbb]

$I^G(J^{PC}) = 0^+(1^{++})$
 J needs confirmation.

Mass $m = 10255.46 \pm 0.22 \pm 0.50$ MeV

$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)} = 23.5 \pm 1.0$ MeV

$\chi_{b1}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega \Upsilon(1S)$	(1.63 ^{+0.40} _{-0.34}) %	135
$\gamma \Upsilon(2S)$	(18.1 \pm 1.9) %	230
$\gamma \Upsilon(1S)$	(9.9 \pm 1.0) %	764
$\pi\pi\chi_{b1}(1P)$	(9.1 \pm 1.3) $\times 10^{-3}$	238
$D^0 X$	(8.8 \pm 1.7) %	—
$\pi^+\pi^-K^+K^-\pi^0$	(3.1 \pm 1.0) $\times 10^{-4}$	5075
$2\pi^+\pi^-K^-K_S^0$	(1.1 \pm 0.5) $\times 10^{-4}$	5075
$2\pi^+\pi^-K^-K_S^02\pi^0$	(7.7 \pm 3.2) $\times 10^{-4}$	5047
$2\pi^+2\pi^-2\pi^0$	(5.9 \pm 2.0) $\times 10^{-4}$	5104
$2\pi^+2\pi^-K^+K^-$	(10 \pm 4) $\times 10^{-5}$	5062
$2\pi^+2\pi^-K^+K^-\pi^0$	(5.5 \pm 1.8) $\times 10^{-4}$	5047
$2\pi^+2\pi^-K^+K^-2\pi^0$	(10 \pm 4) $\times 10^{-4}$	5030
$3\pi^+2\pi^-K^-K_S^0\pi^0$	(6.7 \pm 2.6) $\times 10^{-4}$	5029
$3\pi^+3\pi^-$	(1.2 \pm 0.4) $\times 10^{-4}$	5103
$3\pi^+3\pi^-2\pi^0$	(1.2 \pm 0.4) $\times 10^{-3}$	5081
$3\pi^+3\pi^-K^+K^-$	(2.0 \pm 0.8) $\times 10^{-4}$	5029
$3\pi^+3\pi^-K^+K^-\pi^0$	(6.1 \pm 2.2) $\times 10^{-4}$	5011
$4\pi^+4\pi^-$	(1.7 \pm 0.6) $\times 10^{-4}$	5080
$4\pi^+4\pi^-2\pi^0$	(1.9 \pm 0.7) $\times 10^{-3}$	5051

$\chi_{b2}(2P)$ [bbbb]

$$I^G(J^{PC}) = 0^+(2^{++})$$

 J needs confirmation.

Mass $m = 10268.65 \pm 0.22 \pm 0.50$ MeV

$m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)} = 13.10 \pm 0.24$ MeV

$\chi_{b2}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\omega \Upsilon(1S)$	$(1.10^{+0.34}_{-0.30})\%$		194
$\gamma \Upsilon(2S)$	$(8.9 \pm 1.2)\%$		242
$\gamma \Upsilon(1S)$	$(6.6 \pm 0.8)\%$		777
$\pi\pi\chi_{b2}(1P)$	$(5.1 \pm 0.9) \times 10^{-3}$		229
$D^0 X$	$< 2.4\%$	90%	—
$\pi^+\pi^-K^+K^-\pi^0$	$< 1.1 \times 10^{-4}$	90%	5082
$2\pi^+\pi^-K^-K_S^0$	$< 9 \times 10^{-5}$	90%	5082
$2\pi^+\pi^-K^-K_S^0 2\pi^0$	$< 7 \times 10^{-4}$	90%	5054
$2\pi^+2\pi^-2\pi^0$	$(3.9 \pm 1.6) \times 10^{-4}$		5110
$2\pi^+2\pi^-K^+K^-$	$(9 \pm 4) \times 10^{-5}$		5068
$2\pi^+2\pi^-K^+K^-\pi^0$	$(2.4 \pm 1.1) \times 10^{-4}$		5054
$2\pi^+2\pi^-K^+K^-2\pi^0$	$(4.7 \pm 2.3) \times 10^{-4}$		5037
$3\pi^+2\pi^-K^-K_S^0\pi^0$	$< 4 \times 10^{-4}$	90%	5036
$3\pi^+3\pi^-$	$(9 \pm 4) \times 10^{-5}$		5110
$3\pi^+3\pi^-2\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$		5088
$3\pi^+3\pi^-K^+K^-$	$(1.4 \pm 0.7) \times 10^{-4}$		5036
$3\pi^+3\pi^-K^+K^-\pi^0$	$(4.2 \pm 1.7) \times 10^{-4}$		5017
$4\pi^+4\pi^-$	$(9 \pm 5) \times 10^{-5}$		5087
$4\pi^+4\pi^-2\pi^0$	$(1.3 \pm 0.5) \times 10^{-3}$		5058

 $\Upsilon(3S)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

Mass $m = 10355.2 \pm 0.5$ MeV

$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.50 \pm 0.13$ MeV

Full width $\Gamma = 20.32 \pm 1.85$ keV

$\Gamma_{ee} = 0.443 \pm 0.008$ keV

$\Upsilon(3S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\Upsilon(2S)$ anything	$(10.6 \pm 0.8)\%$		296
$\Upsilon(2S)\pi^+\pi^-$	$(2.82 \pm 0.18)\%$	S=1.6	177
$\Upsilon(2S)\pi^0\pi^0$	$(1.85 \pm 0.14)\%$		190
$\Upsilon(2S)\gamma\gamma$	$(5.0 \pm 0.7)\%$		327
$\Upsilon(2S)\pi^0$	$< 5.1 \times 10^{-4}$	CL=90%	298
$\Upsilon(1S)\pi^+\pi^-$	$(4.37 \pm 0.08)\%$		813
$\Upsilon(1S)\pi^0\pi^0$	$(2.20 \pm 0.13)\%$		816

$\Upsilon(1S)\eta$	< 1	$\times 10^{-4}$	CL=90%	677
$\Upsilon(1S)\pi^0$	< 7	$\times 10^{-5}$	CL=90%	846
$h_b(1P)\pi^0$	< 1.2	$\times 10^{-3}$	CL=90%	426
$h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0$	(4.3 ± 1.4)	$\times 10^{-4}$		—
$h_b(1P)\pi^+\pi^-$	< 1.2	$\times 10^{-4}$	CL=90%	353
$\tau^+\tau^-$	(2.29 ± 0.30)	%		4863
$\mu^+\mu^-$	(2.18 ± 0.21)	%	S=2.1	5177
e^+e^-	(2.18 ± 0.20)	%		5178
hadrons	(93 ± 12)	%		—
ggg	(35.7 ± 2.6)	%		—
γgg	(9.7 ± 1.8)	$\times 10^{-3}$		—
2H anything	(2.33 ± 0.33)	$\times 10^{-5}$		—

Radiative decays

$\gamma\chi_{b2}(2P)$	(13.1 ± 1.6)	%	S=3.4	86
$\gamma\chi_{b1}(2P)$	(12.6 ± 1.2)	%	S=2.4	99
$\gamma\chi_{b0}(2P)$	(5.9 ± 0.6)	%	S=1.4	122
$\gamma\chi_{b2}(1P)$	(10.0 ± 1.0)	$\times 10^{-3}$	S=1.7	434
$\gamma\chi_{b1}(1P)$	(9 ± 5)	$\times 10^{-4}$	S=1.8	452
$\gamma\chi_{b0}(1P)$	(2.7 ± 0.4)	$\times 10^{-3}$		484
$\gamma\eta_b(2S)$	< 6.2	$\times 10^{-4}$	CL=90%	350
$\gamma\eta_b(1S)$	(5.1 ± 0.7)	$\times 10^{-4}$		912
$\gamma A^0 \rightarrow \gamma$ hadrons	< 8	$\times 10^{-5}$	CL=90%	—
$\gamma X \rightarrow \gamma + \geq 4$ prongs	[<i>ddb</i>] < 2.2	$\times 10^{-4}$	CL=95%	—
$\gamma a_1^0 \rightarrow \gamma\mu^+\mu^-$	< 5.5	$\times 10^{-6}$	CL=90%	—
$\gamma a_1^0 \rightarrow \gamma\tau^+\tau^-$	[<i>eebb</i>] < 1.6	$\times 10^{-4}$	CL=90%	—

Lepton Family number (*LF*) violating modes

$e^\pm\tau^\mp$	<i>LF</i>	< 4.2	$\times 10^{-6}$	CL=90%	5025
$\mu^\pm\tau^\mp$	<i>LF</i>	< 3.1	$\times 10^{-6}$	CL=90%	5025

$\chi_{b1}(3P)$

$$J^{PC} = 0^+(1^{++})$$

Mass $m = 10513.4 \pm 0.7$ MeV

$\chi_{b1}(3P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Upsilon(1S)\gamma$	seen	1000
$\Upsilon(2S)\gamma$	seen	479
$\Upsilon(3S)\gamma$	seen	157

$\chi_{b2}(3P)$

$$I^G(J^{PC}) = 0^+(2^{++})$$

Mass $m = 10524.0 \pm 0.8$ MeV

$\chi_{b2}(3P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Upsilon(3S)\gamma$	seen	167

 $\Upsilon(4S)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

also known as $\Upsilon(10580)$ Mass $m = 10579.4 \pm 1.2$ MeVFull width $\Gamma = 20.5 \pm 2.5$ MeV $\Gamma_{ee} = 0.272 \pm 0.029$ keV ($S = 1.5$)

$\Upsilon(4S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$B\bar{B}$	> 96 %	95%	326
B^+B^-	(51.4 \pm 0.6) %		331
D_s^+ anything + c.c.	(17.8 \pm 2.6) %		–
$B^0\bar{B}^0$	(48.6 \pm 0.6) %		326
$J/\psi K_S^0 + (J/\psi, \eta_c) K_S^0$	< 4 $\times 10^{-7}$	90%	–
non- $B\bar{B}$	< 4 %	95%	–
e^+e^-	(1.57 \pm 0.08) $\times 10^{-5}$		5290
$\rho^+\rho^-$	< 5.7 $\times 10^{-6}$	90%	5233
$K^*(892)^0\bar{K}^0$	< 2.0 $\times 10^{-6}$	90%	5240
$J/\psi(1S)$ anything	< 1.9 $\times 10^{-4}$	95%	–
D^{*+} anything + c.c.	< 7.4 %	90%	5099
ϕ anything	(7.1 \pm 0.6) %		5240
$\phi\eta$	< 1.8 $\times 10^{-6}$	90%	5226
$\phi\eta'$	< 4.3 $\times 10^{-6}$	90%	5196
$\rho\eta$	< 1.3 $\times 10^{-6}$	90%	5247
$\rho\eta'$	< 2.5 $\times 10^{-6}$	90%	5217
$\Upsilon(1S)$ anything	< 4 $\times 10^{-3}$	90%	1053
$\Upsilon(1S)\pi^+\pi^-$	(8.2 \pm 0.4) $\times 10^{-5}$		1026
$\Upsilon(1S)\eta$	(1.81 \pm 0.18) $\times 10^{-4}$		924
$\Upsilon(1S)\eta'$	(3.4 \pm 0.9) $\times 10^{-5}$		–
$\Upsilon(2S)\pi^+\pi^-$	(8.2 \pm 0.8) $\times 10^{-5}$		468
$h_b(1P)\pi^+\pi^-$	not seen		600
$h_b(1P)\eta$	(2.18 \pm 0.21) $\times 10^{-3}$		390
2H anything	< 1.3 $\times 10^{-5}$	90%	–

Double Radiative Decays

$\gamma\gamma \Upsilon(D) \rightarrow \gamma\gamma\eta \Upsilon(1S)$	< 2.3 $\times 10^{-5}$	90%	–
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Z_b(10610)

$$I^G(J^{PC}) = 1^+(1^{+-})$$

was X(10610)

Mass $m = 10607.2 \pm 2.0$ MeV

Full width $\Gamma = 18.4 \pm 2.4$ MeV

Z_b(10610) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Upsilon(1S)\pi^+$	$(5.4^{+1.9}_{-1.5}) \times 10^{-3}$	1077
$\Upsilon(1S)\pi^0$	not seen	1077
$\Upsilon(2S)\pi^+$	$(3.6^{+1.1}_{-0.8})\%$	551
$\Upsilon(2S)\pi^0$	seen	552
$\Upsilon(3S)\pi^+$	$(2.1^{+0.8}_{-0.6})\%$	207
$\Upsilon(3S)\pi^0$	seen	210
$h_b(1P)\pi^+$	$(3.5^{+1.2}_{-0.9})\%$	671
$h_b(2P)\pi^+$	$(4.7^{+1.7}_{-1.3})\%$	313
$B^+\bar{B}^0$	not seen	505
$B^+\bar{B}^{*0} + B^{*+}\bar{B}^0$	$(85.6^{+2.1}_{-2.9})\%$	—

Z_b(10650)

$$I^G(J^{PC}) = 1^+(1^{+-})$$

 I, G, C need confirmation.was X(10650)[±]

Mass $m = 10652.2 \pm 1.5$ MeV

Full width $\Gamma = 11.5 \pm 2.2$ MeV

 $Z_b(10650)^-$ decay modes are charge conjugates of the modes below.

Z_b(10650)⁺ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Upsilon(1S)\pi^+$	$(1.7^{+0.8}_{-0.6}) \times 10^{-3}$	1117
$\Upsilon(2S)\pi^+$	$(1.4^{+0.6}_{-0.4})\%$	595
$\Upsilon(3S)\pi^+$	$(1.6^{+0.7}_{-0.5})\%$	259
$h_b(1P)\pi^+$	$(8.4^{+2.9}_{-2.4})\%$	714
$h_b(2P)\pi^+$	$(15 \pm 4)\%$	360

$B^+ \bar{B}^0$	not seen	703
$B^+ \bar{B}^{*0} + B^{*+} \bar{B}^0$	not seen	—
$B^{*+} \bar{B}^{*0}$	$(74 \begin{smallmatrix} +4 \\ -6 \end{smallmatrix}) \%$	122

 $\Upsilon(10860)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

 Mass $m = 10885.2^{+2.6}_{-1.6}$ MeV

 Full width $\Gamma = 37 \pm 4$ MeV

 $\Gamma_{ee} = 0.31 \pm 0.07$ keV ($S = 1.3$)

$\Upsilon(10860)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$B \bar{B} X$	$(76.2 \begin{smallmatrix} +2.7 \\ -4.0 \end{smallmatrix}) \%$		—
$B \bar{B}$	$(5.5 \pm 1.0) \%$		1322
$B \bar{B}^* + \text{c.c.}$	$(13.7 \pm 1.6) \%$		—
$B^* \bar{B}^*$	$(38.1 \pm 3.4) \%$		1127
$B \bar{B}^{(*)} \pi$	$< 19.7 \%$	90%	1015
$B \bar{B} \pi$	$(0.0 \pm 1.2) \%$		1015
$B^* \bar{B} \pi + B \bar{B}^* \pi$	$(7.3 \pm 2.3) \%$		—
$B^* \bar{B}^* \pi$	$(1.0 \pm 1.4) \%$		739
$B \bar{B} \pi \pi$	$< 8.9 \%$	90%	551
$B_s^{(*)} \bar{B}_s^{(*)}$	$(20.1 \pm 3.1) \%$		905
$B_s \bar{B}_s$	$(5 \pm 5) \times 10^{-3}$		905
$B_s \bar{B}_s^* + \text{c.c.}$	$(1.35 \pm 0.32) \%$		—
$B_s^* \bar{B}_s^*$	$(17.6 \pm 2.7) \%$		543
no open-bottom	$(3.8 \begin{smallmatrix} +5.0 \\ -0.5 \end{smallmatrix}) \%$		—
$e^+ e^-$	$(8.3 \pm 2.1) \times 10^{-6}$		5443
$K^*(892)^0 \bar{K}^0$	$< 1.0 \times 10^{-5}$	90%	5395
$\Upsilon(1S) \pi^+ \pi^-$	$(5.3 \pm 0.6) \times 10^{-3}$		1306
$\Upsilon(2S) \pi^+ \pi^-$	$(7.8 \pm 1.3) \times 10^{-3}$		783
$\Upsilon(3S) \pi^+ \pi^-$	$(4.8 \begin{smallmatrix} +1.9 \\ -1.7 \end{smallmatrix}) \times 10^{-3}$		440
$\Upsilon(1S) K^+ K^-$	$(6.1 \pm 1.8) \times 10^{-4}$		959
$\eta \Upsilon_J(1D)$	$(4.8 \pm 1.1) \times 10^{-3}$		—
$h_b(1P) \pi^+ \pi^-$	$(3.5 \begin{smallmatrix} +1.0 \\ -1.3 \end{smallmatrix}) \times 10^{-3}$		903
$h_b(2P) \pi^+ \pi^-$	$(5.7 \begin{smallmatrix} +1.7 \\ -2.1 \end{smallmatrix}) \times 10^{-3}$		544
$\chi_{bJ}(1P) \pi^+ \pi^- \pi^0$	$(2.5 \pm 2.3) \times 10^{-3}$		894
$\chi_{b0}(1P) \pi^+ \pi^- \pi^0$	$< 6.3 \times 10^{-3}$	90%	894
$\chi_{b0}(1P) \omega$	$< 3.9 \times 10^{-3}$	90%	631
$\chi_{b0}(1P) (\pi^+ \pi^- \pi^0)_{\text{non-}\omega}$	$< 4.8 \times 10^{-3}$	90%	—

$\chi_{b1}(1P)\pi^+\pi^-\pi^0$	$(1.85 \pm 0.33) \times 10^{-3}$	861
$\chi_{b1}(1P)\omega$	$(1.57 \pm 0.30) \times 10^{-3}$	582
$\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	$(5.2 \pm 1.9) \times 10^{-4}$	—
$\chi_{b2}(1P)\pi^+\pi^-\pi^0$	$(1.17 \pm 0.30) \times 10^{-3}$	841
$\chi_{b2}(1P)\omega$	$(6.0 \pm 2.7) \times 10^{-4}$	552
$\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$	$(6 \pm 4) \times 10^{-4}$	—
$\gamma X_b \rightarrow \gamma \Upsilon(1S)\omega$	$< 3.8 \times 10^{-5}$	90% —

Inclusive Decays.

These decay modes are submodes of one or more of the decay modes above.

ϕ anything	$(13.8^{+2.4}_{-1.7})\%$	—
D^0 anything + c.c.	$(108 \pm 8)\%$	—
D_s anything + c.c.	$(46 \pm 6)\%$	—
J/ψ anything	$(2.06 \pm 0.21)\%$	—
B^0 anything + c.c.	$(77 \pm 8)\%$	—
B^+ anything + c.c.	$(72 \pm 6)\%$	—

$\Upsilon(11020)$

$$J^G(J^{PC}) = 0^-(1^{--})$$

$$\text{Mass } m = 11000 \pm 4 \text{ MeV}$$

$$\text{Full width } \Gamma = 24^{+8}_{-6} \text{ MeV}$$

$$\Gamma_{ee} = 0.130 \pm 0.030 \text{ keV}$$

$\Upsilon(11020)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
e^+e^-	$(5.4^{+1.9}_{-2.1}) \times 10^{-6}$	5500
$\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	$(9^{+9}_{-8}) \times 10^{-3}$	1007
$\chi_{b1}(1P)\pi^+\pi^-\pi^0$	seen	975
$\chi_{b2}(1P)\pi^+\pi^-\pi^0$	seen	956

NOTES

- [a] See the review on “Form Factors for Radiative Pion and Kaon Decays” for definitions and details.
- [b] Measurements of $\Gamma(e^+ \nu_e)/\Gamma(\mu^+ \nu_\mu)$ always include decays with γ 's, and measurements of $\Gamma(e^+ \nu_e \gamma)$ and $\Gamma(\mu^+ \nu_\mu \gamma)$ never include low-energy γ 's. Therefore, since no clean separation is possible, we consider the modes with γ 's to be subreactions of the modes without them, and let $[\Gamma(e^+ \nu_e) + \Gamma(\mu^+ \nu_\mu)]/\Gamma_{\text{total}} = 100\%$.
- [c] See the π^\pm Particle Listings for the energy limits used in this measurement; low-energy γ 's are not included.
- [d] Derived from an analysis of neutrino-oscillation experiments.
- [e] Astrophysical and cosmological arguments give limits of order 10^{-13} .
- [f] Forbidden by angular momentum conservation.
- [g] C parity forbids this to occur as a single-photon process.
- [h] The $\omega \rho$ interference is then due to $\omega \rho$ mixing only, and is expected to be small. If $e\mu$ universality holds, $\Gamma(\rho^0 \rightarrow \mu^+ \mu^-) = \Gamma(\rho^0 \rightarrow e^+ e^-) \times 0.99785$.
- [i] See the “Note on $a_1(1260)$ ” in the $a_1(1260)$ Particle Listings in PDG 06, Journal of Physics **G33** 1 (2006).
- [j] Our estimate. See the Particle Listings for details.
- [k] See the note on “Non- $q\bar{q}$ mesons” in the Particle Listings in PDG 06, Journal of Physics **G33** 1 (2006).
- [l] See also the $\omega(1650)$.
- [n] See also the $\omega(1420)$.
- [o] See the note in the K^\pm Particle Listings.
- [p] Neglecting photon channels. See, e.g., A. Pais and S.B. Treiman, Phys. Rev. **D12**, 2744 (1975).
- [q] The definition of the slope parameters of the $K \rightarrow 3\pi$ Dalitz plot is as follows (see also “Note on Dalitz Plot Parameters for $K \rightarrow 3\pi$ Decays” in the K^\pm Particle Listings):
- $$|M|^2 = 1 + g(s_3 - s_0)/m_{\pi^+}^2 + \dots$$
- [r] For more details and definitions of parameters see the Particle Listings.
- [s] See the K^\pm Particle Listings for the energy limits used in this measurement.
- [t] Most of this radiative mode, the low-momentum γ part, is also included in the parent mode listed without γ 's.
- [u] Structure-dependent part.

- [v] Direct-emission branching fraction.
- [x] Violates angular-momentum conservation.
- [y] Derived from measured values of ϕ_{+-} , ϕ_{00} , $|\eta|$, $|m_{K_L^0} - m_{K_S^0}|$, and $\tau_{K_S^0}$, as described in the introduction to “Tests of Conservation Laws.”
- [z] The CP -violation parameters are defined as follows (see also “Note on CP Violation in $K_S \rightarrow 3\pi$ ” and “Note on CP Violation in K_L^0 Decay” in the Particle Listings):

$$\eta_{+-} = |\eta_{+-}|e^{i\phi_{+-}} = \frac{A(K_L^0 \rightarrow \pi^+\pi^-)}{A(K_S^0 \rightarrow \pi^+\pi^-)} = \epsilon + \epsilon'$$

$$\eta_{00} = |\eta_{00}|e^{i\phi_{00}} = \frac{A(K_L^0 \rightarrow \pi^0\pi^0)}{A(K_S^0 \rightarrow \pi^0\pi^0)} = \epsilon - 2\epsilon'$$

$$\delta = \frac{\Gamma(K_L^0 \rightarrow \pi^-\ell^+\nu) - \Gamma(K_L^0 \rightarrow \pi^+\ell^-\nu)}{\Gamma(K_L^0 \rightarrow \pi^-\ell^+\nu) + \Gamma(K_L^0 \rightarrow \pi^+\ell^-\nu)},$$

$$\text{Im}(\eta_{+-0})^2 = \frac{\Gamma(K_S^0 \rightarrow \pi^+\pi^-\pi^0)^{CP \text{ viol.}}}{\Gamma(K_L^0 \rightarrow \pi^+\pi^-\pi^0)},$$

$$\text{Im}(\eta_{000})^2 = \frac{\Gamma(K_S^0 \rightarrow \pi^0\pi^0\pi^0)}{\Gamma(K_L^0 \rightarrow \pi^0\pi^0\pi^0)}.$$

where for the last two relations CPT is assumed valid, *i.e.*, $\text{Re}(\eta_{+-0}) \simeq 0$ and $\text{Re}(\eta_{000}) \simeq 0$.

- [aa] See the K_S^0 Particle Listings for the energy limits used in this measurement.
- [bb] The value is for the sum of the charge states or particle/antiparticle states indicated.
- [cc] $\text{Re}(\epsilon'/\epsilon) = \epsilon'/\epsilon$ to a very good approximation provided the phases satisfy CPT invariance.
- [dd] This mode includes gammas from inner bremsstrahlung but not the direct emission mode $K_L^0 \rightarrow \pi^+\pi^-\gamma(\text{DE})$.
- [ee] See the K_L^0 Particle Listings for the energy limits used in this measurement.
- [ff] Allowed by higher-order electroweak interactions.
- [gg] Violates CP in leading order. Test of direct CP violation since the indirect CP -violating and CP -conserving contributions are expected to be suppressed.
- [hh] See the “Note on $f_0(1370)$ ” in the $f_0(1370)$ Particle Listings and in the 1994 edition.

- [ii] See the note in the $L(1770)$ Particle Listings in Reviews of Modern Physics **56** S1 (1984), p. S200. See also the “Note on $K_2(1770)$ and the $K_2(1820)$ ” in the $K_2(1770)$ Particle Listings .
- [jj] See the “Note on $K_2(1770)$ and the $K_2(1820)$ ” in the $K_2(1770)$ Particle Listings .
- [kk] This result applies to $Z^0 \rightarrow c\bar{c}$ decays only. Here ℓ^+ is an average (not a sum) of e^+ and μ^+ decays.
- [ll] See the Particle Listings for the (complicated) definition of this quantity.
- [nn] The branching fraction for this mode may differ from the sum of the submodes that contribute to it, due to interference effects. See the relevant papers in the Particle Listings.
- [oo] These subfractions of the $K^- 2\pi^+$ mode are uncertain: see the Particle Listings.
- [pp] Submodes of the $D^+ \rightarrow K^- 2\pi^+ \pi^0$ and $K_S^0 2\pi^+ \pi^-$ modes were studied by ANJOS 92C and COFFMAN 92B, but with at most 142 events for the first mode and 229 for the second – not enough for precise results. With nothing new for 18 years, we refer to our 2008 edition, Physics Letters **B667** 1 (2008), for those results.
- [qq] The unseen decay modes of the resonances are included.
- [rr] This is *not* a test for the $\Delta C=1$ weak neutral current, but leads to the $\pi^+ \ell^+ \ell^-$ final state.
- [ss] This mode is not a useful test for a $\Delta C=1$ weak neutral current because both quarks must change flavor in this decay.
- [tt] In the 2010 *Review*, the values for these quantities were given using a measure of the asymmetry that was inconsistent with the usual definition.
- [uu] This value is obtained by subtracting the branching fractions for 2-, 4- and 6-prongs from unity.
- [vv] This is the sum of our $K^- 2\pi^+ \pi^-$, $K^- 2\pi^+ \pi^- \pi^0$, $\bar{K}^0 2\pi^+ 2\pi^-$, $K^+ 2K^- \pi^+$, $2\pi^+ 2\pi^-$, $2\pi^+ 2\pi^- \pi^0$, $K^+ K^- \pi^+ \pi^-$, and $K^+ K^- \pi^+ \pi^- \pi^0$, branching fractions.
- [xx] This is the sum of our $K^- 3\pi^+ 2\pi^-$ and $3\pi^+ 3\pi^-$ branching fractions.
- [yy] The branching fractions for the $K^- e^+ \nu_e$, $K^*(892)^- e^+ \nu_e$, $\pi^- e^+ \nu_e$, and $\rho^- e^+ \nu_e$ modes add up to 6.17 ± 0.17 %.
- [zz] This is a doubly Cabibbo-suppressed mode.
- [aaa] Submodes of the $D^0 \rightarrow K_S^0 \pi^+ \pi^- \pi^0$ mode with a K^* and/or ρ were studied by COFFMAN 92B, but with only 140 events. With nothing new for 18 years, we refer to our 2008 edition, Physics Letters **B667** 1 (2008), for those results.

- [*bbb*] This branching fraction includes all the decay modes of the resonance in the final state.
- [*ccc*] This limit is for either D^0 or \bar{D}^0 to $p e^-$.
- [*ddd*] This limit is for either D^0 or \bar{D}^0 to $\bar{p} e^+$.
- [*eee*] This is the purely e^+ semileptonic branching fraction: the e^+ fraction from τ^+ decays has been subtracted off. The sum of our (non- τ) e^+ exclusive fractions — an $e^+ \nu_e$ with an η , η' , ϕ , K^0 , or K^{*0} — is 5.99 ± 0.31 %.
- [*fff*] This fraction includes η from η' decays.
- [*ggg*] The sum of our exclusive η' fractions — $\eta' e^+ \nu_e$, $\eta' \mu^+ \nu_\mu$, $\eta' \pi^+$, $\eta' \rho^+$, and $\eta' K^+$ — is 11.8 ± 1.6 %.
- [*hhh*] This branching fraction includes all the decay modes of the final-state resonance.
- [*iii*] A test for $u\bar{u}$ or $d\bar{d}$ content in the D_s^+ . Neither Cabibbo-favored nor Cabibbo-suppressed decays can contribute, and $\omega - \phi$ mixing is an unlikely explanation for any fraction above about 2×10^{-4} .
- [*jjj*] We decouple the $D_s^+ \rightarrow \phi \pi^+$ branching fraction obtained from mass projections (and used to get some of the other branching fractions) from the $D_s^+ \rightarrow \phi \pi^+$, $\phi \rightarrow K^+ K^-$ branching fraction obtained from the Dalitz-plot analysis of $D_s^+ \rightarrow K^+ K^- \pi^+$. That is, the ratio of these two branching fractions is not exactly the $\phi \rightarrow K^+ K^-$ branching fraction 0.491.
- [*kkk*] This is the average of a model-independent and a K -matrix parametrization of the $\pi^+ \pi^-$ S -wave and is a sum over several f_0 mesons.
- [*lll*] An ℓ indicates an e or a μ mode, not a sum over these modes.
- [*nnn*] An $CP(\pm 1)$ indicates the $CP=+1$ and $CP=-1$ eigenstates of the D^0 - \bar{D}^0 system.
- [*ooo*] D denotes D^0 or \bar{D}^0 .
- [*ppp*] D_{CP+}^{*0} decays into $D^0 \pi^0$ with the D^0 reconstructed in CP -even eigenstates $K^+ K^-$ and $\pi^+ \pi^-$.
- [*qqq*] \bar{D}^{**} represents an excited state with mass $2.2 < M < 2.8$ GeV/ c^2 .
- [*rrr*] $\chi_{c1}(3872)^+$ is a hypothetical charged partner of the $\chi_{c1}(3872)$.
- [*sss*] $\Theta(1710)^{++}$ is a possible narrow pentaquark state and $G(2220)$ is a possible glueball resonance.
- [*ttt*] $(\bar{A}_c^- p)_s$ denotes a low-mass enhancement near 3.35 GeV/ c^2 .
- [*uuu*] Stands for the possible candidates of $K^*(1410)$, $K_0^*(1430)$ and $K_2^*(1430)$.
- [*vvv*] B^0 and B_s^0 contributions not separated. Limit is on weighted average of the two decay rates.

- [xxx] This decay refers to the coherent sum of resonant and nonresonant $J^P = 0^+ K\pi$ components with $1.60 < m_{K\pi} < 2.15$ GeV/c².
- [yyy] X(214) is a hypothetical particle of mass 214 MeV/c² reported by the HyperCP experiment, Physical Review Letters **94** 021801 (2005)
- [zzz] $\Theta(1540)^+$ denotes a possible narrow pentaquark state.
- [aaaa] Here S and P are the hypothetical scalar and pseudoscalar particles with masses of 2.5 GeV/c² and 214.3 MeV/c², respectively.
- [bbaa] These values are model dependent.
- [ccaa] Here “anything” means at least one particle observed.
- [ddaa] This is a $B(B^0 \rightarrow D^{*-} \ell^+ \nu_\ell)$ value.
- [eeaa] D^{**} stands for the sum of the $D(1^1P_1)$, $D(1^3P_0)$, $D(1^3P_1)$, $D(1^3P_2)$, $D(2^1S_0)$, and $D(2^1S_1)$ resonances.
- [ffaa] $D^{(*)}\bar{D}^{(*)}$ stands for the sum of $D^*\bar{D}^*$, $D^*\bar{D}$, $D\bar{D}^*$, and $D\bar{D}$.
- [ggaa] X(3915) denotes a near-threshold enhancement in the $\omega J/\psi$ mass spectrum.
- [hhaa] Inclusive branching fractions have a multiplicity definition and can be greater than 100%.
- [iiaa] D_j represents an unresolved mixture of pseudoscalar and tensor D^{**} (P -wave) states.
- [jja] Not a pure measurement. See note at head of B_s^0 Decay Modes.
- [kkaa] For $E_\gamma > 100$ MeV.
- [llaa] Includes $p\bar{p}\pi^+\pi^-\gamma$ and excludes $p\bar{p}\eta$, $p\bar{p}\omega$, $p\bar{p}\eta'$.
- [nnaa] See the “Note on the $\eta(1405)$ ” in the $\eta(1405)$ Particle Listings.
- [oaaa] For a narrow state A with mass less than 960 MeV.
- [ppaa] For a narrow scalar or pseudoscalar A^0 with mass 0.21–3.0 GeV.
- [qqaa] For a narrow resonance in the range $2.2 < M(X) < 2.8$ GeV.
- [rraa] J^{PC} known by production in e^+e^- via single photon annihilation. I^G is not known; interpretation of this state as a single resonance is unclear because of the expectation of substantial threshold effects in this energy region.
- [ssaa] $2m_\tau < M(\tau^+\tau^-) < 9.2$ GeV
- [ttaa] $2 \text{ GeV} < m_{K^+K^-} < 3$ GeV
- [uuaa] $X = \text{scalar}$ with $m < 8.0$ GeV
- [vva] $X\bar{X} = \text{vectors}$ with $m < 3.1$ GeV
- [xxaa] X and $\bar{X} = \text{zero spin}$ with $m < 4.5$ GeV
- [yyaa] $1.5 \text{ GeV} < m_X < 5.0$ GeV
- [zzaa] $201 \text{ MeV} < M(\mu^+\mu^-) < 3565$ MeV

- [*aabb*] $0.5 \text{ GeV} < m_X < 9.0 \text{ GeV}$, where m_X is the invariant mass of the hadronic final state.
- [*bbbb*] Spectroscopic labeling for these states is theoretical, pending experimental information.
- [*ccbb*] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$
- [*ddbb*] $1.5 \text{ GeV} < m_X < 5.0 \text{ GeV}$
- [*eebb*] For $m_{\tau^+\tau^-}$ in the ranges 4.03–9.52 and 9.61–10.10 GeV.