LIGHT UNFLAVORED MESONS
$(S = C = B = 0)$

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

$\pi^{\pm}$

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

Mass $m = 139.57018 \pm 0.00035$ MeV $\quad (S = 1.2)$
Mean life $\tau = (2.6033 \pm 0.0005) \times 10^{-8}$ s $\quad (S = 1.2)$
$c\tau = 7.8045$ m

$\pi^{\pm} \to \ell^{\pm}\nu\gamma$ form factors [a]

$F_V = 0.017 \pm 0.008$
$F_A = 0.0115 \pm 0.0005 \quad (S = 1.2)$
$R = 0.059^{+0.009}_{-0.008}$

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

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

π^+ DECAY MODES		Fraction (Γ_i/Γ)			Confidence level	p (MeV/c)
$\mu^+ \nu_\mu$		[b]	(99.98770	±0.00004) %		30
$\mu^+ \nu_\mu \gamma$		[c]	(2.00	±0.25) $\times 10^{-4}$		30
$e^+ \nu_e$		[b]	(1.230	±0.004) $\times 10^{-4}$		70
$e^+ \nu_e \gamma$		[c]	(1.61	±0.23) $\times 10^{-7}$		70
$e^+ \nu_e \pi^0$			(1.036	±0.006) $\times 10^{-8}$		4
$e^+ \nu_e e^+ e^-$			(3.2	±0.5) $\times 10^{-9}$		70
$e^+ \nu_e \nu \overline{\nu}$			< 5	$\times 10^{-6}$	90%	70
Lepton Family number (LF) or Lepton number (L) violating modes						
$\mu^+ \overline{\nu}_e$	L	[d] <	1.5	$\times 10^{-3}$	90%	30
$\mu^+ \nu_e$	LF	[d] <	8.0	$\times 10^{-3}$	90%	30
$\mu^- e^+ e^+ \nu$	LF	<	1.6	$\times 10^{-6}$	90%	30

π^0

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

Mass $m = 134.9766 \pm 0.0006$ MeV $\quad (S = 1.1)$
$m_{\pi^\pm} - m_{\pi^0} = 4.5936 \pm 0.0005$ MeV
Mean life $\tau = (8.4 \pm 0.6) \times 10^{-17}$ s $\quad (S = 3.0)$
$c\tau = 25.1$ 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 ± 0.034) %	S=1.5	67
$e^+ e^- \gamma$		(1.174 ± 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
$\nu\overline{\nu}$		$[e] < 2.7 \times 10^{-7}$	CL=90%	67
$\nu_e \overline{\nu}_e$		$< 1.7 \times 10^{-6}$	CL=90%	67
$\nu_\mu \overline{\nu}_\mu$		$< 1.6 \times 10^{-6}$	CL=90%	67
$\nu_\tau \overline{\nu}_\tau$		$< 2.1 \times 10^{-6}$	CL=90%	67
$\gamma\nu\overline{\nu}$		$< 6 \times 10^{-4}$	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

$$\boxed{\eta} \qquad I^G(J^{PC}) = 0^+(0^{-+})$$

Mass $m = 547.853 \pm 0.024$ MeV [f]
Full width $\Gamma = 1.30 \pm 0.07$ keV [g]

C-nonconserving decay parameters

$\pi^+\pi^-\pi^0$ Left-right asymmetry $= (0.09^{+0.11}_{-0.12}) \times 10^{-2}$
$\pi^+\pi^-\pi^0$ Sextant asymmetry $= (0.12^{+0.10}_{-0.11}) \times 10^{-2}$
$\pi^+\pi^-\pi^0$ Quadrant asymmetry $= (-0.09 \pm 0.09) \times 10^{-2}$
$\pi^+\pi^-\gamma$ Left-right asymmetry $= (0.9 \pm 0.4) \times 10^{-2}$
$\pi^+\pi^-\gamma$ β (D-wave) $= -0.02 \pm 0.07$ (S = 1.3)

Dalitz plot parameter

$\pi^0\pi^0\pi^0$ $\alpha = -0.031 \pm 0.004$

η DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Neutral modes				
neutral modes		(71.89 ± 0.34) %	S=1.2	–
2γ	[g]	(39.30 ± 0.20) %	S=1.1	274
$3\pi^0$		(32.56 ± 0.23) %	S=1.1	179
$\pi^0 2\gamma$		$(2.7\pm0.5)\times10^{-4}$	S=1.1	257
$\pi^0\pi^0\gamma\gamma$		$<1.2\times10^{-3}$	CL=90%	238
4γ		$<2.8\times10^{-4}$	CL=90%	274
invisible		$<6\times10^{-4}$	CL=90%	–
Charged modes				
charged modes		(28.08 ± 0.34) %	S=1.2	–
$\pi^+\pi^-\pi^0$		(22.73 ± 0.28) %	S=1.2	174
$\pi^+\pi^-\gamma$		(4.60 ± 0.16) %	S=2.1	236
$e^+e^-\gamma$		$(7.0\pm0.7)\times10^{-3}$	S=1.5	274
$\mu^+\mu^-\gamma$		$(3.1\pm0.4)\times10^{-4}$		253
e^+e^-		$<2.7\times10^{-5}$	CL=90%	274
$\mu^+\mu^-$		$(5.8\pm0.8)\times10^{-6}$		253
$e^+e^-e^+e^-$		$<6.9\times10^{-5}$	CL=90%	274
$\pi^+\pi^-e^+e^-$		$(4.2^{+1.5}_{-1.3})\times10^{-4}$		235
$e^+e^-\mu^+\mu^-$		$<1.6\times10^{-4}$	CL=90%	253
$\mu^+\mu^-\mu^+\mu^-$		$<3.6\times10^{-4}$	CL=90%	161
$\mu^+\mu^-\pi^+\pi^-$		$<3.6\times10^{-4}$	CL=90%	113
$\pi^+\pi^-2\gamma$		$<2.0\times10^{-3}$		236
$\pi^+\pi^-\pi^0\gamma$		$<5\times10^{-4}$	CL=90%	174
$\pi^0\mu^+\mu^-\gamma$		$<3\times10^{-6}$	CL=90%	210

Charge conjugation (C), Parity (P), Charge conjugation × Parity (CP), or Lepton Family number (LF) violating modes

			Fraction		p
$\pi^0\gamma$	C		$<9\times10^{-5}$	CL=90%	257
$\pi^+\pi^-$	P,CP		$<1.3\times10^{-5}$	CL=90%	236
$\pi^0\pi^0$	P,CP		$<3.5\times10^{-4}$	CL=90%	238
$\pi^0\pi^0\gamma$	C		$<5\times10^{-4}$	CL=90%	238
$\pi^0\pi^0\pi^0\gamma$	C		$<6\times10^{-5}$	CL=90%	179
3γ	C		$<1.6\times10^{-5}$	CL=90%	274
$4\pi^0$	P,CP		$<6.9\times10^{-7}$	CL=90%	40
$\pi^0 e^+e^-$	C	[h]	$<4\times10^{-5}$	CL=90%	257
$\pi^0\mu^+\mu^-$	C	[h]	$<5\times10^{-6}$	CL=90%	210
$\mu^+e^- + \mu^-e^+$	LF		$<6\times10^{-6}$	CL=90%	264

$f_0(600)$ [i] or σ

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

Mass $m = (400\text{–}1200)$ MeV
Full width $\Gamma = (600\text{–}1000)$ MeV

$f_0(600)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	dominant	—
$\gamma\gamma$	seen	—

$\rho(770)$ [j]

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

Mass $m = 775.49 \pm 0.34$ 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%	153
$\pi^{\pm}\pi^+\pi^-\pi^0$		< 2.0	$\times 10^{-3}$	CL=84%	254
$\rho(770)^0$ decays					
$\pi^+\pi^-\gamma$		(9.9 ± 1.6	) $\times 10^{-3}$		362
$\pi^0\gamma$		(6.0 ± 0.8	) $\times 10^{-4}$		376
$\eta\gamma$		(3.00± 0.20	) $\times 10^{-4}$		194
$\pi^0\pi^0\gamma$		(4.5 ± 0.8	) $\times 10^{-5}$		363
$\mu^+\mu^-$	[k]	(4.55± 0.28	) $\times 10^{-5}$		373
e^+e^-	[k]	(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
$\pi^+\pi^-\pi^0\pi^0$		< 4	$\times 10^{-5}$	CL=90%	257
$\pi^0 e^+e^-$		< 1.2	$\times 10^{-5}$	CL=90%	376

$\omega(782)$

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

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	p (MeV/c)
$\pi^+\pi^-\pi^0$	$(89.2 \pm 0.7\ )\ \%$		327
$\pi^0\gamma$	$(8.28 \pm 0.28)\ \%$	S=2.1	380
$\pi^+\pi^-$	$(1.53 ^{+0.11}_{-0.13})\ \%$	S=1.2	366
neutrals (excluding $\pi^0\gamma$)	$(8\ ^{+8}_{-5}\ ) \times 10^{-3}$	S=1.1	−
$\eta\gamma$	$(4.6 \pm 0.4\ ) \times 10^{-4}$	S=1.1	200
$\pi^0 e^+ e^-$	$(7.7 \pm 0.6\ ) \times 10^{-4}$		380
$\pi^0 \mu^+ \mu^-$	$(9.6 \pm 2.3\ ) \times 10^{-5}$		349
$e^+ e^-$	$(7.28 \pm 0.14) \times 10^{-5}$	S=1.3	391
$\pi^+\pi^-\pi^0\pi^0$	$< 2\quad \%$	CL=90%	262
$\pi^+\pi^-\gamma$	$< 3.6\quad \times 10^{-3}$	CL=95%	366
$\pi^+\pi^-\pi^+\pi^-$	$< 1\quad \times 10^{-3}$	CL=90%	256
$\pi^0\pi^0\gamma$	$(6.6 \pm 1.1\ ) \times 10^{-5}$		367
$\eta\pi^0\gamma$	$< 3.3\quad \times 10^{-5}$	CL=90%	162
$\mu^+\mu^-$	$(9.0 \pm 3.1\ ) \times 10^{-5}$		377
3γ	$< 1.9\quad \times 10^{-4}$	CL=95%	391

Charge conjugation (C) violating modes

$\eta\pi^0$	C	$< 1\quad \times 10^{-3}$	CL=90%	162
$3\pi^0$	C	$< 3\quad \times 10^{-4}$	CL=90%	330

$\eta'(958)$ $\qquad\qquad I^G(J^{PC}) = 0^+(0^{-+})$

Mass $m = 957.78 \pm 0.06$ MeV
Full width $\Gamma = 0.204 \pm 0.015$ MeV $\quad$ (S = 1.2)
c C-violating decay parameter $= 0.015 \pm 0.018$

$\eta'(958)$ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi^+\pi^-\eta$		$(44.6 \pm 1.4)\%$	S=1.2	232
$\rho^0\gamma$ (including non-resonant $\pi^+\pi^-\gamma$)		$(29.4 \pm 0.9)\%$	S=1.1	165
$\pi^0\pi^0\eta$		$(20.7 \pm 1.2)\%$	S=1.2	239
$\omega\gamma$		$(3.02\pm0.31)\%$		159
$\gamma\gamma$		$(2.10\pm0.12)\%$	S=1.2	479
$3\pi^0$		$(1.61\pm0.23)\times 10^{-3}$	S=1.1	430
$\mu^+\mu^-\gamma$		$(1.03\pm0.26)\times 10^{-4}$		467
$\pi^+\pi^-\mu^+\mu^-$		$< 2.3 \times 10^{-4}$	CL=90%	401
$\pi^+\pi^-\pi^0$		$(3.7 {}^{+1.1}_{-1.0})\times 10^{-3}$		428
$\pi^0\rho^0$		$< 4 \%$	CL=90%	111
$2(\pi^+\pi^-)$		$< 2.5 \times 10^{-4}$	CL=90%	372
$\pi^+\pi^-2\pi^0$		$< 2.6 \times 10^{-3}$	CL=90%	376
$2(\pi^+\pi^-)$ neutrals		$< 1 \%$	CL=95%	–
$2(\pi^+\pi^-)\pi^0$		$< 1.9 \times 10^{-3}$	CL=90%	298
$2(\pi^+\pi^-)2\pi^0$		$< 1 \%$	CL=95%	197
$3(\pi^+\pi^-)$		$< 5 \times 10^{-4}$	CL=90%	189
$\pi^+\pi^-e^+e^-$		$(2.5 {}^{+1.3}_{-1.0})\times 10^{-3}$		458
γe^+e^-		$< 9 \times 10^{-4}$	CL=90%	479
$\pi^0\gamma\gamma$		$< 8 \times 10^{-4}$	CL=90%	469
$4\pi^0$		$< 5 \times 10^{-4}$	CL=90%	380
e^+e^-		$< 2.1 \times 10^{-7}$	CL=90%	479
invisible		$< 9 \times 10^{-4}$	CL=90%	–

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

			Fraction (Γ_i/Γ)		p (MeV/c)
$\pi^+\pi^-$	P,CP		$< 2.9 \times 10^{-3}$	CL=90%	458
$\pi^0\pi^0$	P,CP		$< 9 \times 10^{-4}$	CL=90%	459
$\pi^0 e^+e^-$	C	[h]	$< 1.4 \times 10^{-3}$	CL=90%	469
ηe^+e^-	C	[h]	$< 2.4 \times 10^{-3}$	CL=90%	322
3γ	C		$< 1.0 \times 10^{-4}$	CL=90%	479
$\mu^+\mu^-\pi^0$	C	[h]	$< 6.0 \times 10^{-5}$	CL=90%	445
$\mu^+\mu^-\eta$	C	[h]	$< 1.5 \times 10^{-5}$	CL=90%	273
$e\mu$	LF		$< 4.7 \times 10^{-4}$	CL=90%	473

$f_0(980)$ [I]

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

Mass $m = 980 \pm 10$ MeV
Full width $\Gamma = 40$ to 100 MeV

$f_0(980)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	dominant	471
$K\overline{K}$	seen	†
$\gamma\gamma$	seen	490

$a_0(980)$ [l] $I^G(J^{PC}) = 1^-(0^{++})$

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)
$\eta\pi$	dominant	319
$K\overline{K}$	seen	†
$\gamma\gamma$	seen	490

$\phi(1020)$ $I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 1019.455 \pm 0.020$ MeV   (S = 1.1)
Full width $\Gamma = 4.26 \pm 0.04$ MeV   (S = 1.4)

$\phi(1020)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
K^+K^-	$(48.9 \pm 0.5$) %	S=1.1	127
$K_L^0 K_S^0$	$(34.2 \pm 0.4$) %	S=1.1	110
$\rho\pi + \pi^+\pi^-\pi^0$	$(15.32 \pm 0.32$) %	S=1.1	—
$\eta\gamma$	(1.309 ± 0.024) %	S=1.2	363
$\pi^0\gamma$	$(1.27 \pm 0.06$) $\times 10^{-3}$		501
$\ell^+\ell^-$	—		510
e^+e^-	$(2.954 \pm 0.030) \times 10^{-4}$	S=1.1	510
$\mu^+\mu^-$	$(2.87 \pm 0.19$) $\times 10^{-4}$		499
ηe^+e^-	$(1.15 \pm 0.10$) $\times 10^{-4}$		363
$\pi^+\pi^-$	$(7.4 \pm 1.3$) $\times 10^{-5}$		490
$\omega\pi^0$	$(4.7 \pm 0.5$) $\times 10^{-5}$		171
$\omega\gamma$	< 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	39
$\pi^0\pi^0\gamma$	$(1.13 \pm 0.06$) $\times 10^{-4}$		492
$\pi^+\pi^-\pi^+\pi^-$	$(4.0 \begin{smallmatrix}+2.8\\-2.2\end{smallmatrix}$) $\times 10^{-6}$		410

$\pi^+\pi^+\pi^-\pi^-\pi^0$	< 4.6	$\times 10^{-6}$ CL=90%	342
$\pi^0 e^+ e^-$	(1.12 $\pm$0.28) $\times 10^{-5}$		501
$\pi^0 \eta \gamma$	(8.3 $\pm$0.5) $\times 10^{-5}$		346
$a_0(980)\gamma$	(7.6 $\pm$0.6) $\times 10^{-5}$		39
$\eta'(958)\gamma$	(6.25 $\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

$h_1(1170)$ $\qquad I^G(J^{PC}) = 0^-(1^{+-})$

Mass $m = 1170 \pm 20$ MeV
Full width $\Gamma = 360 \pm 40$ MeV

$h_1(1170)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	307

$b_1(1235)$ $\qquad I^G(J^{PC}) = 1^+(1^{+-})$

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)
$\omega\pi$	dominant			348
[D/S amplitude ratio $= 0.277 \pm 0.027$]				
$\pi^{\pm}\gamma$	(1.6$\pm$0.4) $\times 10^{-3}$			607
$\eta\rho$	seen			†
$\pi^+\pi^+\pi^-\pi^0$	< 50	%	84%	535
$(K\overline{K})^{\pm}\pi^0$	< 8	%	90%	248
$K^0_S K^0_L \pi^{\pm}$	< 6	%	90%	235
$K^0_S K^0_S \pi^{\pm}$	< 2	%	90%	235
$\phi\pi$	< 1.5	%	84%	147

$a_1(1260)$ [m] $\qquad I^G(J^{PC}) = 1^-(1^{++})$

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

$a_1(1260)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$(\rho\pi)_{S-\text{wave}}$	seen	353
$(\rho\pi)_{D-\text{wave}}$	seen	353
$(\rho(1450)\pi)_{S-\text{wave}}$	seen	†
$(\rho(1450)\pi)_{D-\text{wave}}$	seen	†
$\sigma\pi$	seen	−
$f_0(980)\pi$	not seen	189
$f_0(1370)\pi$	seen	†
$f_2(1270)\pi$	seen	†
$K\overline{K}^*(892)+$ c.c.	seen	†
$\pi\gamma$	seen	608

$f_2(1270)$ $\qquad\qquad I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 1275.1 \pm 1.2$ MeV (S = 1.1)
Full width $\Gamma = 185.1^{+2.9}_{-2.4}$ MeV (S = 1.5)

$f_2(1270)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi\pi$	$(84.8\ ^{+2.4}_{-1.2}\ )$ %	S=1.2	623
$\pi^+\pi^-2\pi^0$	$(\ 7.1\ ^{+1.4}_{-2.7}\ )$ %	S=1.3	562
$K\overline{K}$	$(\ 4.6\ \pm0.4\ )$ %	S=2.8	403
$2\pi^+2\pi^-$	$(\ 2.8\ \pm0.4\ )$ %	S=1.2	559
$\eta\eta$	$(\ 4.0\ \pm0.8\ ) \times 10^{-3}$	S=2.1	326
$4\pi^0$	$(\ 3.0\ \pm1.0\ ) \times 10^{-3}$		564
$\gamma\gamma$	$(\ 1.64\pm0.19) \times 10^{-5}$	S=1.9	638
$\eta\pi\pi$	$<\ 8\qquad \times 10^{-3}$	CL=95%	477
$K^0K^-\pi^+ +$ c.c.	$<\ 3.4\qquad \times 10^{-3}$	CL=95%	293
e^+e^-	$<\ 6\qquad \times 10^{-10}$	CL=90%	638

$f_1(1285)$ $\qquad\qquad I^G(J^{PC}) = 0^+(1^{++})$

Mass $m = 1281.8 \pm 0.6$ MeV (S = 1.6)
Full width $\Gamma = 24.3 \pm 1.1$ MeV (S = 1.4)

$f_1(1285)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
4π	$(33.1 ^{+2.1}_{-1.8})$ %	S=1.3	568
$\pi^0\pi^0\pi^+\pi^-$	$(22.0 ^{+1.4}_{-1.2})$ %	S=1.3	566
$2\pi^+2\pi^-$	$(11.0 ^{+0.7}_{-0.6})$ %	S=1.3	563
$\rho^0\pi^+\pi^-$	$(11.0 ^{+0.7}_{-0.6})$ %	S=1.3	336
$\rho^0\rho^0$	seen		†
$4\pi^0$	$< 7 \times 10^{-4}$	CL=90%	568
$\eta\pi\pi$	(52 ± 16) %		482
$a_0(980)\pi$ [ignoring $a_0(980) \to K\overline{K}$]	(36 ± 7) %		238
$\eta\pi\pi$ [excluding $a_0(980)\pi$]	(16 ± 7) %		482
$K\overline{K}\pi$	(9.0 ± 0.4) %	S=1.1	308
$K\overline{K}^*(892)$	not seen		†
$\gamma\rho^0$	(5.5 ± 1.3) %	S=2.8	406
$\phi\gamma$	$(7.4\pm 2.6)\times 10^{-4}$		236

$\eta(1295)$ $I^G(J^{PC}) = 0^+(0^{-+})$

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
$\eta(\pi\pi)_{S\text{-wave}}$	seen	–

$\pi(1300)$ $I^G(J^{PC}) = 1^-(0^{-+})$

Mass $m = 1300 \pm 100$ MeV [n]
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 $m = 1318.3 \pm 0.6$ MeV   (S = 1.2)
Full width $\Gamma = 107 \pm 5$ MeV [n]

$a_2(1320)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
3π	$(70.1 \pm 2.7)\%$	S=1.2	624
$\eta\pi$	$(14.5 \pm 1.2)\%$		535
$\omega\pi\pi$	$(10.6 \pm 3.2)\%$	S=1.3	366
$K\overline{K}$	$(4.9 \pm 0.8)\%$		437
$\eta'(958)\pi$	$(5.3 \pm 0.9) \times 10^{-3}$		288
$\pi^{\pm}\gamma$	$(2.68 \pm 0.31) \times 10^{-3}$		652
$\gamma\gamma$	$(9.4 \pm 0.7) \times 10^{-6}$		659
e^+e^-	$< 6 \quad\times 10^{-9}$	CL=90%	659

$f_0(1370)$ [l]

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

Mass $m = 1200$ to 1500 MeV
Full 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
$\quad 4\pi^0$	seen	617
$\quad 2\pi^+2\pi^-$	seen	612
$\quad \pi^+\pi^-2\pi^0$	seen	615
$\quad \rho\rho$	dominant	†
$\quad 2(\pi\pi)_{S\text{-wave}}$	seen	–
$\quad \pi(1300)\pi$	seen	†
$\quad a_1(1260)\pi$	seen	35
$\eta\eta$	seen	411
$K\overline{K}$	seen	475
$K\overline{K}n\pi$	not seen	†
6π	not seen	508

$\omega\omega$	not seen	†
$\gamma\gamma$	seen	685
e^+e^-	not seen	685

$\pi_1(1400)$ [o] $\qquad I^G(J^{PC}) = 1^-(1^{-+})$

Mass $m = 1351 \pm 30$ MeV $\quad$ (S = 2.0)
Full width $\Gamma = 313 \pm 40$ MeV

$\pi_1(1400)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi^0$	seen	555
$\eta\pi^-$	seen	554

$\eta(1405)$ [p] $\qquad I^G(J^{PC}) = 0^+(0^{-+})$

Mass $m = 1409.8 \pm 2.5$ MeV [n] $\quad$ (S = 2.2)
Full width $\Gamma = 51.1 \pm 3.4$ MeV [n] $\quad$ (S = 2.0)

$\eta(1405)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K\overline{K}\pi$	seen		425
$\eta\pi\pi$	seen		563
$\quad a_0(980)\pi$	seen		345
$\quad \eta(\pi\pi)_{S\text{-wave}}$	seen		−
$f_0(980)\eta$	seen		†
4π	seen		639
$\quad \rho\rho$	<58 %	99.85%	†
$K^*(892)K$	seen		125

$f_1(1420)$ [q] $\qquad I^G(J^{PC}) = 0^+(1^{++})$

Mass $m = 1426.4 \pm 0.9$ MeV $\quad$ (S = 1.1)
Full width $\Gamma = 54.9 \pm 2.6$ MeV

$f_1(1420)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}\pi$	dominant	438
$K\overline{K}^*(892)+$ c.c.	dominant	163
$\eta\pi\pi$	possibly seen	573
$\phi\gamma$	seen	349

$\omega(1420)$ [r]

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

Mass m (1400–1450) MeV
Full width Γ (180–250) MeV

$\omega(1420)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	dominant	486
$\omega\pi\pi$	seen	444
$b_1(1235)\pi$	seen	125
e^+e^-	seen	710

$a_0(1450)$ [l]

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

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)
$\pi\eta$	seen	627
$\pi\eta'(958)$	seen	410
$K\overline{K}$	seen	547
$\omega\pi\pi$	seen	484
$a_0(980)\pi\pi$	seen	342

$\rho(1450)$ [s]

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

Mass $m = 1465 \pm 25$ MeV [n]
Full width $\Gamma = 400 \pm 60$ MeV [n]

$\rho(1450)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	seen	720
4π	seen	669
e^+e^-	seen	732
$\eta\rho$	possibly seen	310
$a_2(1320)\pi$	not seen	55
$K\overline{K}$	not seen	541
$K\overline{K}^*(892)+$ c.c.	possibly seen	229
$\eta\gamma$	possibly seen	630

$\eta(1475)$ [p]

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

Mass $m = 1476 \pm 4$ MeV   (S = 1.3)
Full width $\Gamma = 85 \pm 9$ MeV   (S = 1.5)

$\eta(1475)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}\pi$	dominant	477
$K\overline{K}^*(892)+$ c.c.	seen	245
$a_0(980)\pi$	seen	396
$\gamma\gamma$	seen	738

$f_0(1500)$ [o]

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

Mass $m = 1505 \pm 6$ MeV   (S = 1.3)
Full width $\Gamma = 109 \pm 7$ MeV

$f_0(1500)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$\pi\pi$	(34.9 ± 2.3) %	1.2	741
$\quad \pi^+\pi^-$	seen		740
$\quad 2\pi^0$	seen		741
4π	(49.5 ± 3.3) %	1.2	691
$\quad 4\pi^0$	seen		691
$\quad 2\pi^+2\pi^-$	seen		687
$\eta\eta$	(5.1 ± 0.9) %	1.4	516
$\eta\eta'(958)$	(1.9 ± 0.8) %	1.7	†
$K\overline{K}$	(8.6 ± 1.0) %	1.1	568
$\gamma\gamma$	not seen		753

$f_2'(1525)$ $\qquad I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 1525 \pm 5$ MeV [n]
Full width $\Gamma = 73^{+6}_{-5}$ MeV [n]

$f_2'(1525)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	$(88.7\ \pm2.2\ )$ %	581
$\eta\eta$	$(10.4\ \pm2.2\ )$ %	530
$\pi\pi$	$(8.2\ \pm1.5\ )\times10^{-3}$	750
$\gamma\gamma$	$(1.11\pm0.14)\times10^{-6}$	763

$\pi_1(1600)$ [o] $\qquad I^G(J^{PC}) = 1^-(1^{-+})$

Mass $m = 1662^{+15}_{-11}$ MeV $\quad$ (S = 1.2)
Full width $\Gamma = 234 \pm 50$ MeV $\quad$ (S = 1.7)

$\pi_1(1600)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi\pi$	not seen	803
$\quad \rho^0\pi^-$	not seen	641
$\quad f_2(1270)\pi^-$	not seen	319
$b_1(1235)\pi$	seen	357
$\eta'(958)\pi^-$	seen	543
$f_1(1285)\pi$	seen	315

$\eta_2(1645)$ $\qquad I^G(J^{PC}) = 0^+(2^{-+})$

Mass $m = 1617 \pm 5$ MeV
Full width $\Gamma = 181 \pm 11$ MeV

$\eta_2(1645)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$a_2(1320)\pi$	seen	242
$K\overline{K}\pi$	seen	580
$K^*\overline{K}$	seen	404
$\eta\pi^+\pi^-$	seen	685
$a_0(980)\pi$	seen	499
$f_2(1270)\eta$	not seen	†

$\omega(1650)$ [t] $I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 1670 \pm 30$ MeV
Full width $\Gamma = 315 \pm 35$ MeV

$\omega(1650)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	646
$\omega\pi\pi$	seen	617
$\omega\eta$	seen	500
e^+e^-	seen	835

$\omega_3(1670)$ $I^G(J^{PC}) = 0^-(3^{--})$

Mass $m = 1667 \pm 4$ MeV
Full width $\Gamma = 168 \pm 10$ MeV [n]

$\omega_3(1670)$ 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

$\pi_2(1670)$ $I^G(J^{PC}) = 1^-(2^{-+})$

Mass $m = 1672.4 \pm 3.2$ MeV [n]   (S = 1.4)
Full width $\Gamma = 259 \pm 9$ MeV [n]   (S = 1.3)

$\pi_2(1670)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
3π	$(95.8\pm1.4)\ \%$		809
$\quad f_2(1270)\pi$	$(56.3\pm3.2)\ \%$		329
$\quad \rho\pi$	$(31\ \pm4\ )\ \%$		648
$\quad \sigma\pi$	$(10.9\pm3.4)\ \%$		–
$\quad (\pi\pi)_{S\text{-wave}}$	$(\ 8.7\pm3.4)\ \%$		–
$K\overline{K}^*(892)+$ c.c.	$(\ 4.2\pm1.4)\ \%$		455
$\omega\rho$	$(\ 2.7\pm1.1)\ \%$		304
$\gamma\gamma$	$<\ 2.8\quad \times 10^{-7}$	90%	836
$\rho(1450)\pi$	$<\ 3.6\quad \times 10^{-3}$	97.7%	148
$b_1(1235)\pi$	$<\ 1.9\quad \times 10^{-3}$	97.7%	366
$\quad f_1(1285)\pi$	possibly seen		323
$\quad a_2(1320)\pi$	not seen		292

$\phi(1680)$ $\qquad\qquad I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 1680 \pm 20$ MeV [n]
Full width $\Gamma = 150 \pm 50$ MeV [n]

$\phi(1680)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}^*(892)+$ c.c.	dominant	462
$K^0_S K\pi$	seen	621
$K\overline{K}$	seen	680
e^+e^-	seen	840
$\omega\pi\pi$	not seen	623

$\rho_3(1690)$ $\qquad\qquad I^G(J^{PC}) = 1^+(3^{--})$

Mass $m = 1688.8 \pm 2.1$ MeV [n]
Full width $\Gamma = 161 \pm 10$ MeV [n]   (S = 1.5)

$\rho_3(1690)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
4π	$(71.1 \pm 1.9\ )\%$		790
$\pi^\pm\pi^+\pi^-\pi^0$	$(67\ \pm22\ )\%$		787
$\omega\pi$	$(16\ \pm 6\ )\%$		655
$\pi\pi$	$(23.6 \pm 1.3\ )\%$		834
$K\overline{K}\pi$	$(3.8 \pm 1.2\ )\%$		629
$K\overline{K}$	$(1.58\pm 0.26)\%$	1.2	685
$\eta\pi^+\pi^-$	seen		727
$\rho(770)\eta$	seen		520
$\pi\pi\rho$	seen		633
Excluding 2ρ and $a_2(1320)\pi$.			
$a_2(1320)\pi$	seen		307
$\rho\rho$	seen		334

$\rho(1700)$ [s] $\qquad I^G(J^{PC}) = 1^+(1^{--})$

Mass $m = 1720 \pm 20$ MeV [n] ($\eta\rho^0$ and $\pi^+\pi^-$ modes)
Full width $\Gamma = 250 \pm 100$ MeV [n] ($\eta\rho^0$ and $\pi^+\pi^-$ modes)

$\rho(1700)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$2(\pi^+\pi^-)$	large	803
$\rho\pi\pi$	dominant	653
$\rho^0\pi^+\pi^-$	large	650
$\rho^\pm\pi^\mp\pi^0$	large	652
$a_1(1260)\pi$	seen	404
$h_1(1170)\pi$	seen	447
$\pi(1300)\pi$	seen	349
$\rho\rho$	seen	372
$\pi^+\pi^-$	seen	849
$\pi\pi$	seen	849
$K\overline{K}^*(892)+$ c.c.	seen	496
$\eta\rho$	seen	545
$a_2(1320)\pi$	not seen	334
$K\overline{K}$	seen	704
e^+e^-	seen	860
$\pi^0\omega$	seen	674

$f_0(1710)$ [u] $\qquad I^G(J^{PC}) = 0^+(0^{++})$

Mass $m = 1720 \pm 6$ MeV (S = 1.6)
Full width $\Gamma = 135 \pm 8$ MeV (S = 1.1)

$f_0(1710)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	seen	704
$\eta\eta$	seen	663
$\pi\pi$	seen	849
$\omega\omega$	seen	357

$\pi(1800)$ $I^G(J^{PC}) = 1^-(0^{-+})$

Mass $m = 1816 \pm 14$ MeV   (S = 2.3)
Full width $\Gamma = 208 \pm 12$ MeV

$\pi(1800)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi^+\pi^-\pi^-$	seen	881
$\quad f_0(600)\pi^-$	seen	−
$\quad f_0(980)\pi^-$	seen	634
$\quad f_0(1370)\pi^-$	seen	371
$\quad f_0(1500)\pi^-$	not seen	254
$\quad \rho\pi^-$	not seen	735
$\eta\eta\pi^-$	seen	664
$\quad a_0(980)\eta$	seen	477
$\quad a_2(1320)\eta$	not seen	†
$\quad f_2(1270)\pi$	not seen	445
$\quad f_0(1370)\pi^-$	not seen	371
$\quad f_0(1500)\pi^-$	seen	254
$\eta\eta'(958)\pi^-$	seen	380
$K_0^*(1430)K^-$	seen	†
$K^*(892)K^-$	not seen	573

$\phi_3(1850)$ $I^G(J^{PC}) = 0^-(3^{--})$

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

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

$\pi_2(1880)$ $I^G(J^{PC}) = 1^-(2^{-+})$

Mass $m = 1895 \pm 16$ MeV
Full width $\Gamma = 235 \pm 34$ MeV

$f_2(1950)$ $\qquad I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 1944 \pm 12$ MeV $\quad$ (S = 1.5)
Full width $\Gamma = 472 \pm 18$ MeV

$f_2(1950)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K^*(892)\overline{K}^*(892)$	seen	387
$\pi^+\pi^-$	seen	962
4π	seen	925
$\eta\eta$	seen	803
$K\overline{K}$	seen	837
$\gamma\gamma$	seen	972

$f_2(2010)$ $\qquad I^G(J^{PC}) = 0^+(2^{++})$

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	†
$K\overline{K}$	seen	876

$a_4(2040)$ $\qquad I^G(J^{PC}) = 1^-(4^{++})$

Mass $m = 2001 \pm 10$ MeV
Full width $\Gamma = 313 \pm 31$ MeV

$a_4(2040)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	seen	870
$\pi^+\pi^-\pi^0$	seen	977
$\rho\pi$	seen	844
$f_2(1270)\pi$	seen	583
$\omega\pi^-\pi^0$	seen	822
$\omega\rho$	seen	628
$\eta\pi^0$	seen	920
$\eta'(958)\pi$	seen	764

$f_4(2050)$ $\qquad I^G(J^{PC}) = 0^+(4^{++})$

Mass $m = 2018 \pm 11$ MeV $\quad$ (S = 2.1)
Full width $\Gamma = 237 \pm 18$ MeV $\quad$ (S = 1.9)

$f_4(2050)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega\omega$	seen	637
$\pi\pi$	(17.0 ± 1.5) %	1000
$K\overline{K}$	$(6.8^{+3.4}_{-1.8})\times10^{-3}$	880
$\eta\eta$	$(2.1\pm0.8)\times10^{-3}$	848
$4\pi^0$	<1.2 %	964
$a_2(1320)\pi$	seen	567

$f_2(2300)$

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

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
$K\overline{K}$	seen	1037
$\gamma\gamma$	seen	1149

$f_2(2340)$

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

Mass $m = 2339 \pm 60$ MeV
Full width $\Gamma = 319^{+80}_{-70}$ MeV

$f_2(2340)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\phi\phi$	seen	573
$\eta\eta$	seen	1033

STRANGE MESONS
$(S = \pm1, C = B = 0)$

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

$K^\pm$

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

Mass $m = 493.677 \pm 0.016$ MeV [v] $(S = 2.8)$
Mean life $\tau = (1.2380 \pm 0.0021) \times 10^{-8}$ s $(S = 1.9)$
$c\tau = 3.712$ m

Slope parameter g [w]

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

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

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

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

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

$K^\pm$ decay form factors [a,x]

Assuming μ-e universality

$\lambda_+(K^+_{\mu 3}) = \lambda_+(K^+_{e3}) = (2.97 \pm 0.05) \times 10^{-2}$

$\lambda_0(K^+_{\mu 3}) = (1.96 \pm 0.12) \times 10^{-2}$

Not assuming μ-e universality

$\lambda_+(K^+_{e3}) = (2.96 \pm 0.06) \times 10^{-2}$

$\lambda_+(K^+_{\mu 3}) = (2.96 \pm 0.17) \times 10^{-2}$

$\lambda_0(K^+_{\mu 3}) = (1.96 \pm 0.13) \times 10^{-2}$

K_{e3} form factor quadratic fit

$\qquad \lambda'_+ (K^\pm_{e3})$ linear coeff. $= (2.48 \pm 0.17) \times 10^{-2}$

$\qquad \lambda''_+ (K^\pm_{e3})$ quadratic coeff. $= (0.19 \pm 0.09) \times 10^{-2}$

K^+_{e3} $\quad |f_S/f_+| = (-0.3^{+0.8}_{-0.7}) \times 10^{-2}$

K^+_{e3} $\quad |f_T/f_+| = (-1.2 \pm 2.3) \times 10^{-2}$

$K^+_{\mu 3}$ $\quad |f_S/f_+| = (0.2 \pm 0.6) \times 10^{-2}$

$K^+_{\mu 3}$ $\quad |f_T/f_+| = (-0.1 \pm 0.7) \times 10^{-2}$

$K^+ \rightarrow e^+ \nu_e \gamma$ $\quad |F_A + F_V| = 0.148 \pm 0.010$

$K^+ \rightarrow \mu^+ \nu_\mu \gamma$ $\quad |F_A + F_V| = 0.165 \pm 0.013$

$K^+ \rightarrow e^+ \nu_e \gamma$ $\quad |F_A - F_V| < 0.49$

$K^+ \rightarrow \mu^+ \nu_\mu \gamma$ $\quad |F_A - F_V| = -0.24$ to 0.04, CL $= 90\%$

Charge Radius

$\langle r \rangle = 0.560 \pm 0.031$ fm

CP violation parameters

$\Delta(K^\pm_{\pi \mu \mu}) = -0.02 \pm 0.12$

T violation parameters

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

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

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

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

K^+ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Leptonic and semileptonic modes			
$K^+ \to e^+ \nu_e$	$(1.55 \pm 0.07) \times 10^{-5}$		247
$K^+ \to \mu^+ \nu_\mu$	$(63.55 \pm 0.11)\ \%$	S=1.2	236
$K^+ \to \pi^0 e^+ \nu_e$	$(5.07 \pm 0.04)\ \%$	S=2.1	228
Called K^+_{e3}.			
$K^+ \to \pi^0 \mu^+ \nu_\mu$	$(3.353 \pm 0.034)\ \%$	S=1.8	215
Called $K^+_{\mu3}$.			
$K^+ \to \pi^0 \pi^0 e^+ \nu_e$	$(2.2 \pm 0.4) \times 10^{-5}$		206
$K^+ \to \pi^+ \pi^- e^+ \nu_e$	$(4.09 \pm 0.10) \times 10^{-5}$		203
$K^+ \to \pi^+ \pi^- \mu^+ \nu_\mu$	$(1.4 \pm 0.9) \times 10^{-5}$		151
$K^+ \to \pi^0 \pi^0 \pi^0 e^+ \nu_e$	$< 3.5 \times 10^{-6}$	CL=90%	135
Hadronic modes			
$K^+ \to \pi^+ \pi^0$	$(20.66 \pm 0.08)\ \%$	S=1.2	205
$K^+ \to \pi^+ \pi^0 \pi^0$	$(1.761 \pm 0.022)\ \%$	S=1.1	133
$K^+ \to \pi^+ \pi^+ \pi^-$	$(5.59 \pm 0.04)\ \%$	S=1.3	125
Leptonic and semileptonic modes with photons			
$K^+ \to \mu^+ \nu_\mu \gamma$	[y,z] $(6.2 \pm 0.8) \times 10^{-3}$		236
$K^+ \to \mu^+ \nu_\mu \gamma (SD^+)$	[a,aa] $< 3.0 \times 10^{-5}$	CL=90%	–
$K^+ \to \mu^+ \nu_\mu \gamma (SD^+INT)$	[a,aa] $< 2.7 \times 10^{-5}$	CL=90%	–
$K^+ \to \mu^+ \nu_\mu \gamma (SD^- + SD^-INT)$	[a,aa] $< 2.6 \times 10^{-4}$	CL=90%	–
$K^+ \to e^+ \nu_e \gamma (SD^+)$	[a,aa] $(1.53 \pm 0.23) \times 10^{-5}$		–
$K^+ \to e^+ \nu_e \gamma (SD^-)$	[a,aa] $< 1.6 \times 10^{-4}$	CL=90%	–
$K^+ \to \pi^0 e^+ \nu_e \gamma$	[y,z] $(2.56 \pm 0.16) \times 10^{-4}$		228
$K^+ \to \pi^0 e^+ \nu_e \gamma (SD)$	[a,aa] $< 5.3 \times 10^{-5}$	CL=90%	228
$K^+ \to \pi^0 \mu^+ \nu_\mu \gamma$	[y,z] $(1.5 \pm 0.4) \times 10^{-5}$		215
$K^+ \to \pi^0 \pi^0 e^+ \nu_e \gamma$	$< 5 \times 10^{-6}$	CL=90%	206
Hadronic modes with photons or $\ell\bar{\ell}$ pairs			
$K^+ \to \pi^+ \pi^0 \gamma$	[y,z] $(2.75 \pm 0.15) \times 10^{-4}$		205
$K^+ \to \pi^+ \pi^0 \gamma (DE)$	[z,bb] $(4.3 \pm 0.7) \times 10^{-6}$		205
$K^+ \to \pi^+ \pi^0 \pi^0 \gamma$	[y,z] $(7.6 \ {}^{+6.0}_{-3.0}) \times 10^{-6}$		133
$K^+ \to \pi^+ \pi^+ \pi^- \gamma$	[y,z] $(1.04 \pm 0.31) \times 10^{-4}$		125
$K^+ \to \pi^+ \gamma \gamma$	[z] $(1.10 \pm 0.32) \times 10^{-6}$		227
$K^+ \to \pi^+ 3\gamma$	[z] $< 1.0 \times 10^{-4}$	CL=90%	227
$K^\pm \to \pi^+ e^+ e^- \gamma$	$(1.19 \pm 0.13) \times 10^{-8}$		227

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

$K^+ \to e^+ \nu_e \nu\bar{\nu}$		$<$ 6	$\times 10^{-5}$ CL=90%	247
$K^+ \to \mu^+ \nu_\mu \nu\bar{\nu}$		$<$ 6.0	$\times 10^{-6}$ CL=90%	236
$K^+ \to e^+ \nu_e e^+ e^-$		(2.48 $\pm$0.20) $\times 10^{-8}$		247
$K^+ \to \mu^+ \nu_\mu e^+ e^-$		(7.06 $\pm$0.31) $\times 10^{-8}$		236
$K^+ \to e^+ \nu_e \mu^+ \mu^-$		(1.7 $\pm$0.5) $\times 10^{-8}$		223
$K^+ \to \mu^+ \nu_\mu \mu^+ \mu^-$		$<$ 4.1	$\times 10^{-7}$ 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

$K^+ \to \pi^+ \pi^+ e^- \bar{\nu}_e$	SQ		$<$ 1.2	$\times 10^{-8}$ CL=90%	203
$K^+ \to \pi^+ \pi^+ \mu^- \bar{\nu}_\mu$	SQ		$<$ 3.0	$\times 10^{-6}$ CL=95%	151
$K^+ \to \pi^+ e^+ e^-$	S1		(2.88 $\pm$0.13) $\times 10^{-7}$		227
$K^+ \to \pi^+ \mu^+ \mu^-$	S1		(8.1 $\pm$1.4) $\times 10^{-8}$ S=2.7		172
$K^+ \to \pi^+ \nu\bar{\nu}$	S1		(1.7 $\pm$1.1) $\times 10^{-10}$		227
$K^+ \to \pi^+ \pi^0 \nu\bar{\nu}$	S1		$<$ 4.3	$\times 10^{-5}$ CL=90%	205
$K^+ \to \mu^- \nu e^+ e^+$	LF		$<$ 2.0	$\times 10^{-8}$ CL=90%	236
$K^+ \to \mu^+ \nu_e$	LF	[d]	$<$ 4	$\times 10^{-3}$ CL=90%	236
$K^+ \to \pi^+ \mu^+ e^-$	LF		$<$ 1.3	$\times 10^{-11}$ CL=90%	214
$K^+ \to \pi^+ \mu^- e^+$	LF		$<$ 5.2	$\times 10^{-10}$ CL=90%	214
$K^+ \to \pi^- \mu^+ e^+$	L		$<$ 5.0	$\times 10^{-10}$ CL=90%	214
$K^+ \to \pi^- e^+ e^+$	L		$<$ 6.4	$\times 10^{-10}$ CL=90%	227
$K^+ \to \pi^- \mu^+ \mu^+$	L	[d]	$<$ 3.0	$\times 10^{-9}$ CL=90%	172
$K^+ \to \mu^+ \bar{\nu}_e$	L	[d]	$<$ 3.3	$\times 10^{-3}$ CL=90%	236
$K^+ \to \pi^0 e^+ \bar{\nu}_e$	L		$<$ 3	$\times 10^{-3}$ CL=90%	228
$K^+ \to \pi^+ \gamma$		[cc]	$<$ 2.3	$\times 10^{-9}$ CL=90%	227

K^0

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

50% K_S, 50% K_L

Mass $m = 497.614 \pm 0.024$ MeV (S = 1.6)

$m_{K^0} - m_{K^\pm} = 3.937 \pm 0.028$ MeV (S = 1.8)

Mean Square Charge Radius

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

T-violation parameters in K^0-$\overline{K}^0$ mixing [x]

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

CPT-violation parameters [x]

$\mathrm{Re}\ \delta = (2.3 \pm 2.7) \times 10^{-4}$

$\mathrm{Im}\ \delta = (0.4 \pm 2.1) \times 10^{-5}$

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

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

$\left| m_{K^0} - m_{\overline{K}^0} \right| / m_{\text{average}} \ < \ 8 \times 10^{-19}$, CL $= 90\%$ [dd]

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

Tests of $\Delta S = \Delta Q$

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

$$\boxed{K^0_S}$$ $$I(J^P) = \tfrac{1}{2}(0^-)$$

Mean life $\tau = (0.8953 \pm 0.0005) \times 10^{-10}$ s   (S $= 1.1$)   Assuming *CPT*

Mean life $\tau = (0.8958 \pm 0.0005) \times 10^{-10}$ s   Not assuming *CPT*

$c\tau = 2.6842$ cm   Assuming *CPT*

CP-violation parameters [ee]

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

$\mathrm{Im}(\eta_{000}) \ = (-0.1 \pm 1.6) \times 10^{-2}$

$\left| \eta_{000} \right| = \left| A(K^0_S \to 3\pi^0)/A(K^0_L \to 3\pi^0) \right| \ < \ 0.018$, CL $= 90\%$

CP asymmetry A in $\pi^+ \pi^- e^+ e^- = (-1 \pm 4)\%$

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
$\pi^+\pi^-\pi^0$		$(\,3.5\,{}^{+1.1}_{-0.9}\,)\times10^{-7}$		133
Modes with photons or $\ell\bar\ell$ pairs				
$\pi^+\pi^-\gamma$	[y,ff]	$(\,1.79\pm0.05)\times10^{-3}$		206
$\pi^+\pi^-e^+e^-$		$(\,4.69\pm0.30)\times10^{-5}$		206
$\pi^0\gamma\gamma$	[ff]	$(\,4.9\,\pm1.8\,)\times10^{-8}$		231
$\gamma\gamma$		$(\,2.63\pm0.17)\times10^{-6}$	S=3.0	249
Semileptonic modes				
$\pi^\pm e^\mp\nu_e$	[gg]	$(\,7.04\pm0.08)\times10^{-4}$		229
CP violating (CP) and $\Delta S = 1$ weak neutral current ($S1$) modes				
$3\pi^0$	CP	$<\,1.2\quad\times10^{-7}$	CL=90%	139
$\mu^+\mu^-$	$S1$	$<\,3.2\quad\times10^{-7}$	CL=90%	225
e^+e^-	$S1$	$<\,1.4\quad\times10^{-7}$	CL=90%	249
$\pi^0e^+e^-$	$S1$ [ff]	$(\,3.0\,{}^{+1.5}_{-1.2}\,)\times10^{-9}$		230
$\pi^0\mu^+\mu^-$	$S1$	$(\,2.9\,{}^{+1.5}_{-1.2}\,)\times10^{-9}$		177

$\boxed{K_L^0}$ $\qquad\qquad\qquad I(J^P) = \tfrac{1}{2}(0^-)$

$m_{K_L} - m_{K_S}$
$\quad = (0.5292 \pm 0.0009) \times 10^{10}\ \hbar\ \text{s}^{-1}\quad (S = 1.2)\quad$ Assuming CPT
$\quad = (3.483 \pm 0.006) \times 10^{-12}\ \text{MeV}\quad$ Assuming CPT
$\quad = (0.5290 \pm 0.0015) \times 10^{10}\ \hbar\ \text{s}^{-1}\quad (S = 1.1)\quad$ Not assuming
$\qquad CPT$
$\qquad$ Mean life $\tau = (5.116 \pm 0.020) \times 10^{-8}$ s
$\qquad\quad c\tau = 15.34$ m

Slope parameter g [w]

(See Particle Listings for quadratic coefficients)
$\quad K_L^0 \to\ \pi^+\pi^-\pi^0$: $g = 0.678 \pm 0.008\quad (S = 1.5)$

K_L decay form factors [x]

$\qquad$ Linear parametrization assuming μ-e universality
$\qquad\quad \lambda_+(K_{\mu3}^0) = \lambda_+(K_{e3}^0) = (2.82 \pm 0.04) \times 10^{-2}\quad (S = 1.1)$
$\qquad\quad \lambda_0(K_{\mu3}^0) = (1.38 \pm 0.18) \times 10^{-2}\quad (S = 2.2)$

Quadratic parametrization assuming μ-e universality

$$\lambda'_+(K^0_{\mu3}) = \lambda'_+(K^0_{e3}) = (2.40 \pm 0.12) \times 10^{-2} \quad (S = 1.2)$$
$$\lambda''_+(K^0_{\mu3}) = \lambda''_+(K^0_{e3}) = (0.20 \pm 0.05) \times 10^{-2} \quad (S = 1.2)$$
$$\lambda_0(K^0_{\mu3}) = (1.16 \pm 0.09) \times 10^{-2} \quad (S = 1.2)$$

Pole parametrization assuming μ-e universality

$$M^\mu_V(K^0_{\mu3}) = M^e_V(K^0_{e3}) = 878 \pm 6 \text{ MeV} \quad (S = 1.1)$$
$$M^\mu_S(K^0_{\mu3}) = 1252 \pm 90 \text{ MeV} \quad (S = 2.6)$$

K^0_{e3} $\quad |f_S/f_+| = (1.5^{+1.4}_{-1.6}) \times 10^{-2}$

K^0_{e3} $\quad |f_T/f_+| = (5^{+4}_{-5}) \times 10^{-2}$

$K^0_{\mu3}$ $\quad |f_T/f_+| = (12 \pm 12) \times 10^{-2}$

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

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

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

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

CP-violation parameters [ee]

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

$|\eta_{00}| = (2.221 \pm 0.011) \times 10^{-3} \quad (S = 1.8)$

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

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

$|\eta_{00}/\eta_{+-}| = 0.9951 \pm 0.0008$ [hh] $\quad (S = 1.6)$

$\text{Re}(\epsilon'/\epsilon) = (1.65 \pm 0.26) \times 10^{-3}$ [hh] $\quad (S = 1.6)$

Assuming *CPT*

$$\phi_{+-} = (43.51 \pm 0.05)^\circ \quad (S = 1.1)$$
$$\phi_{00} = (43.52 \pm 0.05)^\circ \quad (S = 1.1)$$
$$\phi_\epsilon = \phi_{SW} = (43.51 \pm 0.05)^\circ \quad (S = 1.1)$$

Not assuming *CPT*

$$\phi_{+-} = (43.4 \pm 0.7)° \quad (S = 1.3)$$

$$\phi_{00} = (43.7 \pm 0.8)° \quad (S = 1.2)$$

$$\phi_\epsilon = (43.5 \pm 0.7)° \quad (S = 1.3)$$

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

β_{CP} from $K_L^0 \to e^+ e^- e^+ e^- = -0.19 \pm 0.07$

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

j for $K_L^0 \to \pi^+\pi^-\pi^0 = 0.0012 \pm 0.0008$

f for $K_L^0 \to \pi^+\pi^-\pi^0 = 0.004 \pm 0.006$

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

$$\phi_{+-\gamma} = (44 \pm 4)°$$

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

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

T-violation parameters

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

CPT invariance tests

$$\phi_{00} - \phi_{+-} = (0.2 \pm 0.4)°$$

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

$\Delta S = -\Delta Q$ 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	p (MeV/c)
Semileptonic modes				
$\pi^\pm e^\mp \nu_e$	[gg]	$(40.55 \pm 0.12)\%$	S=1.8	229
Called K_{e3}^0.				
$\pi^\pm \mu^\mp \nu_\mu$	[gg]	$(27.04 \pm 0.07)\%$	S=1.1	216
Called $K_{\mu3}^0$.				
$(\pi\mu\text{atom})\nu$		$(1.05 \pm 0.11) \times 10^{-7}$		188
$\pi^0 \pi^\pm e^\mp \nu$	[gg]	$(5.20 \pm 0.11) \times 10^{-5}$		207
$\pi^\pm e^\mp \nu e^+ e^-$	[gg]	$(1.26 \pm 0.04) \times 10^{-5}$		229
Hadronic modes, including Charge conjugation×Parity Violating (*CPV*) modes				
$3\pi^0$		$(19.52 \pm 0.12)\%$	S=1.7	139
$\pi^+ \pi^- \pi^0$		$(12.54 \pm 0.05)\%$		133
$\pi^+ \pi^-$	*CPV* [ii]	$(1.966 \pm 0.010) \times 10^{-3}$	S=1.6	206
$\pi^0 \pi^0$	*CPV*	$(8.65 \pm 0.06) \times 10^{-4}$	S=1.8	209
Semileptonic modes with photons				
$\pi^\pm e^\mp \nu_e \gamma$	[y,gg,jj]	$(3.79 \pm 0.06) \times 10^{-3}$		229
$\pi^\pm \mu^\mp \nu_\mu \gamma$		$(5.65 \pm 0.23) \times 10^{-4}$		216
Hadronic modes with photons or $\ell\bar{\ell}$ pairs				
$\pi^0 \pi^0 \gamma$		$< 2.43 \times 10^{-7}$	CL=90%	209
$\pi^+ \pi^- \gamma$	[y,jj]	$(4.15 \pm 0.15) \times 10^{-5}$	S=2.8	206
$\pi^+ \pi^- \gamma$(DE)		$(2.84 \pm 0.11) \times 10^{-5}$	S=2.0	206
$\pi^0 2\gamma$	[jj]	$(1.273 \pm 0.034) \times 10^{-6}$		231
$\pi^0 \gamma e^+ e^-$		$(1.62 \pm 0.17) \times 10^{-8}$		230
Other modes with photons or $\ell\bar{\ell}$ pairs				
2γ		$(5.47 \pm 0.04) \times 10^{-4}$	S=1.2	249
3γ		$< 2.4 \times 10^{-7}$	CL=90%	249
$e^+ e^- \gamma$		$(9.4 \pm 0.4) \times 10^{-6}$	S=2.0	249
$\mu^+ \mu^- \gamma$		$(3.59 \pm 0.11) \times 10^{-7}$	S=1.3	225
$e^+ e^- \gamma\gamma$	[jj]	$(5.95 \pm 0.33) \times 10^{-7}$		249
$\mu^+ \mu^- \gamma\gamma$	[jj]	$(1.0 ^{+0.8}_{-0.6}) \times 10^{-8}$		225

Charge conjugation × Parity (*CP*) or Lepton Family number (*LF*)
violating modes, or $\Delta S = 1$ weak neutral current (*S1*) modes

$\mu^+ \mu^-$	*S1*	$(6.84 \pm 0.11) \times 10^{-9}$		225
$e^+ e^-$	*S1*	$(9 ^{+6}_{-4}) \times 10^{-12}$		249
$\pi^+ \pi^- e^+ e^-$	*S1* [jj]	$(3.11 \pm 0.19) \times 10^{-7}$		206
$\pi^0 \pi^0 e^+ e^-$	*S1*	$< 6.6 \times 10^{-9}$	CL=90%	209
$\mu^+ \mu^- e^+ e^-$	*S1*	$(2.69 \pm 0.27) \times 10^{-9}$		225
$e^+ e^- e^+ e^-$	*S1*	$(3.56 \pm 0.21) \times 10^{-8}$		249

$\pi^0 \mu^+ \mu^-$	$CP,S1[kk]$ <	3.8	$\times 10^{-10}$ CL=90%	177
$\pi^0 e^+ e^-$	$CP,S1[kk]$ <	2.8	$\times 10^{-10}$ CL=90%	230
$\pi^0 \nu\overline{\nu}$	$CP,S1\ [ll]$ <	6.7	$\times 10^{-8}$ CL=90%	231
$\pi^0 \pi^0 \nu\overline{\nu}$	$S1$ <	4.7	$\times 10^{-5}$ CL=90%	209
$e^\pm \mu^\mp$	$LF\quad [gg]$ <	4.7	$\times 10^{-12}$ CL=90%	238
$e^\pm e^\pm \mu^\mp \mu^\mp$	$LF\quad [gg]$ <	4.12	$\times 10^{-11}$ CL=90%	225
$\pi^0 \mu^\pm e^\mp$	$LF\quad [gg]$ <	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

$K^*(892)$ $\qquad\qquad I(J^P) = \frac{1}{2}(1^-)$

$K^*(892)^\pm$ mass $m = 891.66 \pm 0.26$ MeV
Mass $m = 895.5 \pm 0.8$ MeV
$K^*(892)^0$ mass $m = 896.00 \pm 0.25$ MeV $(S = 1.4)$
$K^*(892)^\pm$ full width $\Gamma = 50.8 \pm 0.9$ MeV
Full width $\Gamma = 46.2 \pm 1.3$ MeV
$K^*(892)^0$ full width $\Gamma = 50.3 \pm 0.6$ MeV $(S = 1.1)$

$K^*(892)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K\pi$	$\sim$ 100 %		289
$K^0 \gamma$	(2.31$\pm$0.20) $\times 10^{-3}$		307
$K^\pm \gamma$	(9.9 $\pm$0.9) $\times 10^{-4}$		309
$K\pi\pi$	< 7 $\times 10^{-4}$	95%	223

$K_1(1270)$ $\qquad\qquad I(J^P) = \frac{1}{2}(1^+)$

Mass $m = 1272 \pm 7$ MeV [n]
Full width $\Gamma = 90 \pm 20$ MeV [n]

$K_1(1270)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\rho$	(42 $\pm$6) %	45
$K_0^*(1430)\pi$	(28 $\pm$4) %	†
$K^*(892)\pi$	(16 $\pm$5) %	302
$K\omega$	(11.0$\pm$2.0) %	†
$K f_0(1370)$	(3.0$\pm$2.0) %	†
γK^0	seen	539

$K_1(1400)$ $\qquad\qquad I(J^P) = \frac{1}{2}(1^+)$

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
$K\rho$	$(3.0 \pm 3.0)\%$	292
$K f_0(1370)$	$(2.0 \pm 2.0)\%$	†
$K\omega$	$(1.0 \pm 1.0)\%$	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	seen		619

$K_0^*(1430)$ [mm] $I(J^P) = \frac{1}{2}(0^+)$

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

$K_2^*(1430)$ $I(J^P) = \frac{1}{2}(2^+)$

$K_2^*(1430)^\pm$ mass $m = 1425.6 \pm 1.5$ MeV (S = 1.1)
$K_2^*(1430)^0$ mass $m = 1432.4 \pm 1.3$ MeV
$K_2^*(1430)^\pm$ full width $\Gamma = 98.5 \pm 2.7$ MeV (S = 1.1)
$K_2^*(1430)^0$ 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 ± 1.2) %		619
$K^*(892)\pi$	(24.7 ± 1.5) %		419
$K^*(892)\pi\pi$	(13.4 ± 2.2) %		372
$K\rho$	(8.7 ± 0.8) %	S=1.2	318
$K\omega$	(2.9 ± 0.8) %		311
$K^+\gamma$	$(2.4\pm0.5)\times10^{-3}$	S=1.1	627
$K\eta$	$(1.5^{+3.4}_{-1.0})\times10^{-3}$	S=1.3	486
$K\omega\pi$	$< 7.2 \times 10^{-4}$	CL=95%	100
$K^0\gamma$	$< 9 \times 10^{-4}$	CL=90%	626

$K^*(1680)$ $I(J^P) = \frac{1}{2}(1^-)$

Mass $m = 1717 \pm 27$ MeV (S = 1.4)
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 ± 2.5) %	781
$K\rho$	$(31.4^{+5.0}_{-2.1})$ %	570
$K^*(892)\pi$	$(29.9^{+2.2}_{-5.0})$ %	618

$K_2(1770)$ [nn] $I(J^P) = \frac{1}{2}(2^-)$

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

$K_2(1770)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\pi\pi$		794
$\quad K_2^*(1430)\pi$	dominant	288
$\quad K^*(892)\pi$	seen	654
$\quad K f_2(1270)$	seen	55
$K\phi$	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
$K_2^*(1430)\pi$	$< 16\qquad \%$	95%	291

$K_2(1820)$ [oo] $\qquad I(J^P) = \frac{1}{2}(2^-)$

Mass $m = 1816 \pm 13$ MeV
Full width $\Gamma = 276 \pm 35$ MeV

$K_2(1820)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K_2^*(1430)\pi$	seen	327
$K^*(892)\pi$	seen	681
$K f_2(1270)$	seen	186
$K\omega$	seen	638

$K_4^*(2045)$ $\qquad I(J^P) = \frac{1}{2}(4^+)$

Mass $m = 2045 \pm 9$ MeV   (S = 1.1)
Full width $\Gamma = 198 \pm 30$ MeV

$K_4^*(2045)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\pi$	$(9.9\pm1.2)\%$	958
$K^*(892)\pi\pi$	$(9 \pm5\ )\%$	802
$K^*(892)\pi\pi\pi$	$(7 \pm5\ )\%$	768
$\rho K\pi$	$(5.7\pm3.2)\%$	741
$\omega K\pi$	$(5.0\pm3.0)\%$	738
$\phi K\pi$	$(2.8\pm1.4)\%$	594
$\phi K^*(892)$	$(1.4\pm0.7)\%$	363

CHARMED MESONS
$(C = \pm 1)$

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

$D^\pm$

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

Mass $m = 1869.62 \pm 0.20$ MeV $\quad$ (S = 1.1)
Mean life $\tau = (1040 \pm 7) \times 10^{-15}$ s
$\quad c\tau = 311.8\ \mu$m

c-quark decays

$\Gamma(c \to \ell^+ \text{anything})/\Gamma(c \to \text{anything}) = 0.096 \pm 0.004$ [pp]
$\Gamma(c \to D^*(2010)^+ \text{anything})/\Gamma(c \to \text{anything}) = 0.255 \pm 0.017$

CP-violation decay-rate asymmetries

$A_{CP}(\mu^\pm \nu) = 0.08 \pm 0.08$
$A_{CP}(K_S^0 \pi^\pm) = -0.009 \pm 0.009$
$A_{CP}(K^\mp 2\pi^\pm) = -0.005 \pm 0.010$
$A_{CP}(K^\mp \pi^\pm \pi^\pm \pi^0) = 0.010 \pm 0.013$
$A_{CP}(K_S^0 \pi^\pm \pi^0) = 0.003 \pm 0.009$
$A_{CP}(K_S^0 \pi^\pm \pi^+ \pi^-) = 0.001 \pm 0.013$
$A_{CP}(K_S^0 K^\pm) = 0.07 \pm 0.06$
$A_{CP}(K^+ K^- \pi^\pm) = (0.3 \pm 0.6)\%$
$A_{CP}(K^\pm K^{*0}) = (0.1 \pm 1.3)\%$
$A_{CP}(\phi \pi^\pm) = (-0.9 \pm 1.1)\%$
$A_{CP}(K^\pm K_0^*(1430)^0) = (8^{+7}_{-6})\%$
$A_{CP}(K^\pm K_2^*(1430)^0) = (43^{+20}_{-26})\%$
$A_{CP}(K^\pm K_0^*(800)) = (-12^{+18}_{-13})\%$
$A_{CP}(a_0(1450)^0 \pi^\pm) = (-19^{+14}_{-16})\%$
$A_{CP}(\phi(1680) \pi^\pm) = (-9 \pm 26)\%$
$A_{CP}(\pi^+ \pi^- \pi^\pm) = -0.02 \pm 0.04$
$A_{CP}(K_S^0 K^\pm \pi^+ \pi^-) = -0.04 \pm 0.07$

T-violation decay-rate asymmetry

$A_T(K_S^0 K^\pm \pi^+ \pi^-) = 0.02 \pm 0.07$

$D^+ \to \overline{K}^*(892)^0 \ell^+ \nu_\ell$ form factors

$r_v = 1.62 \pm 0.08 \quad$ (S = 1.5)
$r_2 = 0.83 \pm 0.05$
$r_3 = 0.0 \pm 0.4$
$\Gamma_L/\Gamma_T = 1.13 \pm 0.08$
$\Gamma_+/\Gamma_- = 0.22 \pm 0.06 \quad$ (S = 1.6)

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

D^+ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Inclusive modes			
e^+ anything	$(16.0 \pm 0.4\ )\ \%$		—
μ^+ anything	$(17.6 \pm 3.2\ )\ \%$		—
K^- anything	$(25.7 \pm 1.4\ )\ \%$		—
$\overline{K}^0$ anything $+\ K^0$ anything	$(61\ \ \pm 5\ \ \ )\ \%$		—
K^+ anything	$(\ 5.9 \pm 0.8\ )\ \%$		—
$K^*(892)^-$ anything	$(\ 6\ \ \pm 5\ \ \ )\ \%$		—
$\overline{K}^*(892)^0$ anything	$(23\ \ \pm 5\ \ \ )\ \%$		—
$K^*(892)^0$ anything	$<\ \ 6.6\ \ \ \ \ \ \ \%$	CL=90%	—
η anything	$(\ 6.3 \pm 0.7\ )\ \%$		—
η' anything	$(\ 1.04 \pm 0.18)\ \%$		—
ϕ anything	$(\ 1.03 \pm 0.12)\ \%$		—
Leptonic and semileptonic modes			
$e^+\nu_e$	$<\ \ 8.8\ \ \ \ \ \ \ \times 10^{-6}$	CL=90%	935
$\mu^+\nu_\mu$	$(\ 3.82 \pm 0.33) \times 10^{-4}$		932
$\tau^+\nu_\tau$	$<\ \ 1.2\ \ \ \ \ \ \ \times 10^{-3}$	CL=90%	90
$\overline{K}^0 e^+\nu_e$	$(\ 8.50 \pm 0.26)\ \%$		869
$\overline{K}^0 \mu^+\nu_\mu$	$(\ 9.4 \pm 0.8\ )\ \%$	S=1.1	865
$K^-\pi^+ e^+\nu_e$	$(\ 4.1 \pm 0.6\ )\ \%$	S=1.1	864
$\overline{K}^*(892)^0 e^+\nu_e$, $\overline{K}^*(892)^0 \to K^-\pi^+$	$(\ 3.67 \pm 0.21)\ \%$		722
$K^-\pi^+ e^+\nu_e$ nonresonant	$<\ \ 7\ \ \ \ \ \ \ \times 10^{-3}$	CL=90%	864
$K^-\pi^+\mu^+\nu_\mu$	$(\ 3.9 \pm 0.5\ )\ \%$		851
$\overline{K}^*(892)^0 \mu^+\nu_\mu$, $\overline{K}^*(892)^0 \to K^-\pi^+$	$(\ 3.6 \pm 0.3\ )\ \%$		717
$K^-\pi^+\mu^+\nu_\mu$ nonresonant	$(\ 2.1 \pm 0.5\ ) \times 10^{-3}$		851
$K^-\pi^+\pi^0\mu^+\nu_\mu$	$<\ \ 1.6\ \ \ \ \ \ \ \times 10^{-3}$	CL=90%	825
$\pi^0 e^+\nu_e$	$(\ 3.73 \pm 0.26) \times 10^{-3}$		930
$\rho^0 e^+\nu_e$	$(\ 2.2 \pm 0.4\ ) \times 10^{-3}$		774
$\rho^0 \mu^+\nu_\mu$	$(\ 2.5 \pm 0.4\ ) \times 10^{-3}$		770
$\omega e^+\nu_e$	$(\ 1.6\ ^{+0.7}_{-0.6}\ ) \times 10^{-3}$		771
$\phi e^+\nu_e$	$<\ \ 2.01\ \ \ \ \ \ \%$	CL=90%	657
$\phi \mu^+\nu_\mu$	$<\ \ 2.04\ \ \ \ \ \ \%$	CL=90%	651
$\eta \ell^+\nu_\ell$	$<\ \ 6\ \ \ \ \ \ \ \times 10^{-3}$	CL=90%	855
$\eta'(958)\mu^+\nu_\mu$	$<\ \ 1.1\ \ \ \ \ \ \%$	CL=90%	684

Fractions of some of the following modes with resonances have already
appeared above as submodes of particular charged-particle modes.

$\overline{K}^*(892)^0 e^+ \nu_e$		(5.51±0.31) %	S=1.2	722
$\overline{K}^*(892)^0 \mu^+ \nu_\mu$		(5.4 ±0.5) %	S=1.1	717
$\overline{K}_0^*(1430)^0 \mu^+ \nu_\mu$		< 2.5 $\times 10^{-4}$		380
$\overline{K}^*(1680)^0 \mu^+ \nu_\mu$		< 1.6 $\times 10^{-3}$		105

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

$K_S^0 \pi^+$		(1.46±0.04) %	S=1.3	863
$K_L^0 \pi^+$		(1.46±0.05) %		863
$K^- 2\pi^+$	[qq]	(9.29±0.25) %	S=1.4	846
$(K^- \pi^+)_{S-\text{wave}} \pi^+$		(7.62±0.25) %		846
$\overline{K}^*(892)^0 \pi^+$, $\overline{K}^*(892)^0 \to K^- \pi^+$		(9.8 ±1.0) $\times 10^{-3}$		714
$\overline{K}_2^*(1430)^0 \pi^+$, $\overline{K}_2^*(1430)^0 \to K^- \pi^+$		(2.1 ±0.4) $\times 10^{-4}$		371
$\overline{K}^*(1680)^0 \pi^+$, $\overline{K}^*(1680)^0 \to K^- \pi^+$	[rr]	(2.3 ±1.1) $\times 10^{-4}$		58
$K^- (2\pi^+)_{I=2}$		(1.44±0.26) %		–
$K_S^0 \pi^+ \pi^0$	[qq]	(6.8 ±0.4) %	S=1.6	845
$K_S^0 \rho^+$		(4.6 ±1.0) %		677
$\overline{K}^*(892)^0 \pi^+$, $\overline{K}^*(892)^0 \to K_S^0 \pi^0$		(1.3 ±0.6) %		714
$K_S^0 \pi^+ \pi^0$ nonresonant		(9 ±7) $\times 10^{-3}$		845
$K^- \pi^+ \pi^+ \pi^0$	[qq]	(6.04±0.22) %	S=1.3	816
$\overline{K}^*(892)^0 \rho^+$ total, $\overline{K}^*(892)^0 \to K^- \pi^+$		(1.3 ±0.8) %		422
$\overline{K}_1(1400)^0 \pi^+$, $\overline{K}_1(1400)^0 \to K^- \pi^+ \pi^0$		(1.8 ±0.7) %		390
$K^- \rho^+ \pi^+$ total		(2.9 ±1.0) %		613
$K^- \rho^+ \pi^+$ 3-body		(1.0 ±0.4) %		613
$\overline{K}^*(892)^0 \pi^+ \pi^0$ total, $\overline{K}^*(892)^0 \to K^- \pi^+$		(4.2 ±0.6) %		690
$\overline{K}^*(892)^0 \pi^+ \pi^0$ 3-body, $\overline{K}^*(892)^0 \to K^- \pi^+$		(2.7 ±0.8) %		690
$K^*(892)^- \pi^+ \pi^+$ 3-body, $K^*(892)^- \to K^- \pi^0$		(5 ±3) $\times 10^{-3}$		688
$K^- \pi^+ \pi^+ \pi^0$ nonresonant	[ss]	(1.1 ±0.5) %		816
$K_S^0 \pi^+ \pi^+ \pi^-$	[qq]	(3.04±0.11) %	S=1.2	814
$K_S^0 a_1(1260)^+$, $a_1(1260)^+ \to \pi^+ \pi^+ \pi^-$		(1.8 ±0.3) %		328
$\overline{K}_1(1400)^0 \pi^+$, $\overline{K}_1(1400)^0 \to K_S^0 \pi^+ \pi^-$		(1.8 ±0.7) %		390

$K^*(892)^- \pi^+ \pi^+$ 3-body, $K^*(892)^- \to K_S^0 \pi^-$		(5 $\pm$3) $\times 10^{-3}$		688
$K_S^0 \rho^0 \pi^+$ total		(1.8 $\pm$0.6) %		611
$K_S^0 \rho^0 \pi^+$ 3-body		(2.1 $\pm$2.2) $\times 10^{-3}$		611
$K_S^0 \pi^+ \pi^+ \pi^-$ nonresonant		(3.6 $\pm$1.9) $\times 10^{-3}$		814
$K^- 3\pi^+ \pi^-$	[qq]	(5.7 $\pm$0.5) $\times 10^{-3}$	S=1.1	772
$\overline{K}^*(892)^0 \pi^+ \pi^+ \pi^-$, $\overline{K}^*(892)^0 \to K^- \pi^+$		(1.2 $\pm$0.4) $\times 10^{-3}$		645
$\overline{K}^*(892)^0 \rho^0 \pi^+$, $\overline{K}^*(892)^0 \to K^- \pi^+$		(2.3 $\pm$0.4) $\times 10^{-3}$		239
$K^- \rho^0 \pi^+ \pi^+$		(1.71$\pm$0.28) $\times 10^{-3}$		524
$K^- 3\pi^+ \pi^-$ nonresonant		(4.0 $\pm$2.9) $\times 10^{-4}$		772
$K^+ 2K_S^0$		(4.5 $\pm$2.1) $\times 10^{-3}$		545
$K^+ K^- K_S^0 \pi^+$		(2.3 $\pm$0.5) $\times 10^{-4}$		436

Fractions of some of the following modes with resonances have already
appeared above as submodes of particular charged-particle modes.

$K_S^0 a_1(1260)^+$		(3.5 $\pm$0.6) %		329
$K_S^0 a_2(1320)^+$		< 1.5 $\times 10^{-3}$	CL=90%	200
$\overline{K}^*(892)^0 \rho^+$ total	[ss]	(2.0 $\pm$1.2) %		422
$\overline{K}^*(892)^0 \rho^+$ S-wave	[ss]	(1.6 $\pm$1.5) %		422
$\overline{K}^*(892)^0 \rho^+$ P-wave		< 1 $\times 10^{-3}$	CL=90%	422
$\overline{K}^*(892)^0 \rho^+$ D-wave		(9 $\pm$6) $\times 10^{-3}$		422
$\overline{K}^*(892)^0 \rho^+$ D-wave longitudinal		< 7 $\times 10^{-3}$	CL=90%	422
$\overline{K}_1(1270)^0 \pi^+$		< 7 $\times 10^{-3}$	CL=90%	487
$\overline{K}_1(1400)^0 \pi^+$		(3.8 $\pm$1.3) %		390
$\overline{K}^*(892)^0 \pi^+ \pi^0$ total		(6.3 $\pm$0.9) %		690
$\overline{K}^*(892)^0 \pi^+ \pi^0$ 3-body	[ss]	(4.0 $\pm$1.2) %		690
$K^*(892)^- \pi^+ \pi^+$ total		—		689
$K^*(892)^- \pi^+ \pi^+$ 3-body		(1.4 $\pm$0.9) %		689
$\overline{K}^*(892)^0 a_1(1260)^+$		(9.2 $\pm$1.8) $\times 10^{-3}$		†

Pionic modes

$\pi^+ \pi^0$	(1.25$\pm$0.08) $\times 10^{-3}$		925
$\pi^+ \pi^+ \pi^-$	(3.24$\pm$0.19) $\times 10^{-3}$		909
$\rho^0 \pi^+$	(8.2 $\pm$1.5) $\times 10^{-4}$		767
$\pi^+ (\pi^+ \pi^-)_{S-wave}$	(1.81$\pm$0.17) $\times 10^{-3}$		909
$\sigma \pi^+, \sigma \to \pi^+ \pi^-$	(1.37$\pm$0.12) $\times 10^{-3}$		—
$f_0(980) \pi^+$, $f_0(980) \to \pi^+ \pi^-$	(1.55$\pm$0.33) $\times 10^{-4}$		669
$f_0(1370) \pi^+$, $f_0(1370) \to \pi^+ \pi^-$	(8 $\pm$4) $\times 10^{-5}$		—
$f_2(1270) \pi^+$, $f_2(1270) \to \pi^+ \pi^-$	(5.0 $\pm$0.9) $\times 10^{-4}$		485

$\rho(1450)^0\pi^+$, $\rho(1450)^0 \to \pi^+\pi^-$	< 8	$\times 10^{-5}$	CL=95%	338
$f_0(1500)\pi^+$, $f_0(1500) \to \pi^+\pi^-$	(1.1 ±0.4) $\times 10^{-4}$			–
$f_0(1710)\pi^+$, $f_0(1710) \to \pi^+\pi^-$	< 5	$\times 10^{-5}$	CL=95%	–
$f_0(1790)\pi^+$, $f_0(1790) \to \pi^+\pi^-$	< 6	$\times 10^{-5}$	CL=95%	–
$(\pi^+\pi^+)_{S-\text{wave}}\,\pi^-$	< 1.2	$\times 10^{-4}$	CL=95%	909
$\pi^+\pi^+\pi^-$ nonresonant	< 1.1	$\times 10^{-4}$	CL=95%	909
$\pi^+2\pi^0$	(4.6 ±0.4) $\times 10^{-3}$			910
$\pi^+\pi^+\pi^-\pi^0$	(1.15$\pm$0.08) %			883
$\eta\pi^+$, $\eta \to \pi^+\pi^-\pi^0$	(7.7 ±0.7) $\times 10^{-4}$			848
$\omega\pi^+$, $\omega \to \pi^+\pi^-\pi^0$	< 3	$\times 10^{-4}$	CL=90%	763
$3\pi^+2\pi^-$	(1.64$\pm$0.16) $\times 10^{-3}$		S=1.1	845

Fractions of some of the following modes with resonances have already
appeared above as submodes of particular charged-particle modes.

$\eta\pi^+$	(3.36$\pm$0.18) $\times 10^{-3}$		S=1.1	848
$\eta\pi^+\pi^0$	(1.38$\pm$0.35) $\times 10^{-3}$			830
$\eta\rho^+$	< 6	$\times 10^{-3}$	CL=90%	655
$\omega\pi^+$	< 3.4	$\times 10^{-4}$	CL=90%	764
$\eta'(958)\pi^+$	(4.44$\pm$0.35) $\times 10^{-3}$			681
$\eta'(958)\pi^+\pi^0$	(1.6 ±0.5) $\times 10^{-3}$			654
$\eta'(958)\rho^+$	< 5	$\times 10^{-3}$	CL=90%	349

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

$K^+K^0_S$	(3.05$\pm$0.13) $\times 10^{-3}$		S=1.3	793
$K^+K^-\pi^+$	[qq] (9.72$\pm$0.33) $\times 10^{-3}$		S=1.5	744
$\phi\pi^+$, $\phi \to K^+K^-$	(2.71$\pm$0.11) $\times 10^{-3}$		S=1.4	647
$K^+\overline{K}^*(892)^0$, $\overline{K}^*(892)^0 \to K^-\pi^+$	($2.50^{+0.10}_{-0.15}$) $\times 10^{-3}$			613
$K^+\overline{K}^*_0(1430)^0$, $\overline{K}^*_0(1430)^0 \to K^-\pi^+$	(1.83$\pm$0.35) $\times 10^{-3}$			–
$K^+\overline{K}^*_2(1430)^0$, $\overline{K}^*_2 \to K^-\pi^+$	(1.7 $^{+1.2}_{-0.8}$) $\times 10^{-4}$			–
$K^+\overline{K}^*_0(800)$, $\overline{K}^*_0 \to K^-\pi^+$	(6.8 $^{+3.5}_{-2.1}$) $\times 10^{-4}$			–
$a_0(1450)^0\pi^+$, $a_0^0 \to K^+K^-$	(4.5 $^{+7.0}_{-1.8}$) $\times 10^{-4}$			–
$\phi(1680)\pi^+$, $\phi \to K^+K^-$	(5.0 $^{+4.0}_{-1.9}$) $\times 10^{-5}$			–
$K^0_S K^0_S \pi^+$	—			741

$K^*(892)^+ K^0_S$, $K^*(892)^+ \to K^0_S \pi^+$	$(5.3 \pm 2.3) \times 10^{-3}$		611
$K^+ K^- \pi^+ \pi^0$	—		682
$\phi \pi^+ \pi^0$, $\phi \to K^+ K^-$	$(1.1 \pm 0.5)\%$		619
$\phi \rho^+$, $\phi \to K^+ K^-$	$< 7 \times 10^{-3}$	CL=90%	258
$K^+ K^- \pi^+ \pi^0$ non-ϕ	$(1.5 ^{+0.7}_{-0.6})\%$		682
$K^+ K^0_S \pi^+ \pi^-$	$(1.71 \pm 0.18) \times 10^{-3}$		678
$K^0_S K^- \pi^+ \pi^+$	$(2.34 \pm 0.18) \times 10^{-3}$		678
$K^+ K^- \pi^+ \pi^+ \pi^-$	$(2.3 \pm 1.2) \times 10^{-4}$		600

Fractions of the following modes with resonances have already appeared above as submodes of particular charged-particle modes.

$\phi \pi^+$	$(5.53 \pm 0.24) \times 10^{-3}$	S=1.4	647
$\phi \pi^+ \pi^0$	$(2.3 \pm 1.0)\%$		619
$\phi \rho^+$	$< 1.5\%$	CL=90%	259
$K^+ \overline{K}{}^*(892)^0$	$(3.80 ^{+0.15}_{-0.23}) \times 10^{-3}$		613
$K^*(892)^+ K^0_S$	$(1.6 \pm 0.7)\%$		612

Doubly Cabibbo-suppressed modes

$K^+ \pi^0$	$(2.37 \pm 0.32) \times 10^{-4}$		864
$K^+ \pi^+ \pi^-$	$(6.3 \pm 0.7) \times 10^{-4}$		846
$K^+ \rho^0$	$(2.4 \pm 0.6) \times 10^{-4}$		679
$K^*(892)^0 \pi^+$, $K^*(892)^0 \to K^+ \pi^-$	$(2.9 \pm 0.6) \times 10^{-4}$		714
$K^+ f_0(980)$, $f_0(980) \to \pi^+ \pi^-$	$(5.6 \pm 3.4) \times 10^{-5}$		–
$K^*_2(1430)^0 \pi^+$, $K^*_2(1430)^0 \to K^+ \pi^-$	$(5.0 \pm 3.4) \times 10^{-5}$		–
$K^+ K^+ K^-$	$(8.8 \pm 2.0) \times 10^{-5}$		550

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

$\pi^+ e^+ e^-$	$C1$	$< 7.4 \times 10^{-6}$	CL=90%	930
$\pi^+ \phi$, $\phi \to e^+ e^-$		[tt] $(2.7 ^{+4.0}_{-1.8}) \times 10^{-6}$		–
$\pi^+ \mu^+ \mu^-$	$C1$	$< 3.9 \times 10^{-6}$	CL=90%	918
$\pi^+ \phi$, $\phi \to \mu^+ \mu^-$		[tt] $(1.8 \pm 0.8) \times 10^{-6}$		–
$\rho^+ \mu^+ \mu^-$	$C1$	$< 5.6 \times 10^{-4}$	CL=90%	757
$K^+ e^+ e^-$		[uu] $< 6.2 \times 10^{-6}$	CL=90%	870
$K^+ \mu^+ \mu^-$		[uu] $< 9.2 \times 10^{-6}$	CL=90%	856
$\pi^+ e^\pm \mu^\mp$	LF	[gg] $< 3.4 \times 10^{-5}$	CL=90%	927
$K^+ e^\pm \mu^\mp$	LF	[gg] $< 6.8 \times 10^{-5}$	CL=90%	866
$\pi^- e^+ e^+$	L	$< 3.6 \times 10^{-6}$	CL=90%	930

$\pi^- \mu^+ \mu^+$	L	< 4.8	$\times 10^{-6}$	CL=90%	918
$\pi^- e^+ \mu^+$	L	< 5.0	$\times 10^{-5}$	CL=90%	927
$\rho^- \mu^+ \mu^+$	L	< 5.6	$\times 10^{-4}$	CL=90%	757
$K^- e^+ e^+$	L	< 4.5	$\times 10^{-6}$	CL=90%	870
$K^- \mu^+ \mu^+$	L	< 1.3	$\times 10^{-5}$	CL=90%	856
$K^- e^+ \mu^+$	L	< 1.3	$\times 10^{-4}$	CL=90%	866
$K^*(892)^- \mu^+ \mu^+$	L	< 8.5	$\times 10^{-4}$	CL=90%	703

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

Mass $m = 1864.84 \pm 0.17$ MeV $\quad$ (S = 1.1)

$m_{D^\pm} - m_{D^0} = 4.78 \pm 0.10$ MeV $\quad$ (S = 1.1)

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

$\quad c\tau = 122.9\ \mu$m

$\left| m_{D^0_1} - m_{D^0_2} \right| = (2.37^{+0.66}_{-0.71}) \times 10^{10}\ \hbar\ \text{s}^{-1}$

$(\Gamma_{D^0_1} - \Gamma_{D^0_2})/\Gamma = 2y = (1.56^{+0.36}_{-0.38}) \times 10^{-2}$

$\left| q/p \right| = 0.86 \pm 0.31$

$A_\Gamma = (1.4 \pm 2.7) \times 10^{-3}$

$K^+ \pi^-$ relative strong phase: $\cos\delta = 1.03^{+0.32}_{-0.18}$

$\Gamma(K^+ \ell^- \bar{\nu}_\ell\ (\text{via }\overline{D}^0))/\Gamma(K^- \ell^+ \nu_\ell) < 6.1 \times 10^{-4}$, CL = 90%

$\Gamma(K^+ \pi^-\ \text{via }\overline{D}^0)/\Gamma(K^- \pi^+) < 4.0 \times 10^{-4}$, CL = 95%

$\Gamma(K^0_S \pi^+ \pi^-\ \text{in }D^0 \to \overline{D}^0)/\Gamma(K^0_S \pi^+ \pi^-) < 0.0063$, CL = 95%

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

$A_{CP}(K^+ K^-) = (-0.17 \pm 0.31) \times 10^{-2} \quad$ (S = 1.3)

$A_{CP}(2K^0_S) = -0.23 \pm 0.19$

$A_{CP}(\pi^+ \pi^-) = (0.2 \pm 0.4) \times 10^{-2}$

$A_{CP}(2\pi^0) = 0.00 \pm 0.05$

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

$A_{CP}(\rho(770)^+ \pi^- \to \pi^+ \pi^- \pi^0) = (1.6 \pm 1.2)\%$

$A_{CP}(\rho(770)^0 \pi^0 \to \pi^+ \pi^- \pi^0) = (-1.6 \pm 1.5)\%$

$A_{CP}(\rho(770)^- \pi^+ \to \pi^+ \pi^- \pi^0) = (-0.7 \pm 1.2)\%$

$A_{CP}(\rho(1450)^+ \pi^- \to \pi^+ \pi^- \pi^0) = (0.0 \pm 0.14)\%$

$A_{CP}(\rho(1450)^0 \pi^0 \to \pi^+ \pi^- \pi^0) = (-0.1 \pm 0.22)\%$

$A_{CP}(\rho(1450)^- \pi^+ \to \pi^+ \pi^- \pi^0) = (0.2 \pm 0.32)\%$

$A_{CP}(\rho(1700)^+ \pi^- \to \pi^+ \pi^- \pi^0) = (-0.4 \pm 1.1)\%$

$A_{CP}(\rho(1700)^0 \pi^0 \to \pi^+ \pi^- \pi^0) = (1.3 \pm 0.9)\%$

$A_{CP}(\rho(1700)^- \pi^+ \to \pi^+ \pi^- \pi^0) = (0.5 \pm 0.7)\%$

$A_{CP}(f_0(980)\pi^0 \to \pi^+ \pi^- \pi^0) = (0.0 \pm 0.14)\%$

$A_{CP}(f_0(1370)\pi^0 \to \pi^+ \pi^- \pi^0) = (0.2 \pm 0.14)\%$

$A_{CP}(f_0(1500)\pi^0 \to \pi^+ \pi^- \pi^0) = (0.0 \pm 0.14)\%$

$A_{CP}(f_0(1710)\pi^0 \to \pi^+\pi^-\pi^0) = (0.0 \pm 0.14)\%$
$A_{CP}(f_2(1270)\pi^0 \to \pi^+\pi^-\pi^0) = (-0.1 \pm 0.14)\%$
$A_{CP}(\sigma(400)\pi^0 \to \pi^+\pi^-\pi^0) = (0.1 \pm 0.14)\%$
$A_{CP}(\text{nonresonant } \pi^+\pi^-\pi^0) = (-0.2 \pm 0.4)\%$
$A_{CP}(K^+K^-\pi^0) = (-1.0 \pm 1.7)\%$
$A_{CP}(K^*(892)^+K^- \to K^+K^-\pi^0) = (-0.8 \pm 1.2)\%$
$A_{CP}(K^*(1410)^+K^- \to K^+K^-\pi^0) = (-1.7 \pm 1.9)\%$
$A_{CP}((K^+\pi^0)_{S-wave}K^- \to K^+K^-\pi^0) = (2 \pm 5)\%$
$A_{CP}(\phi(1020)\pi^0 \to K^+K^-\pi^0) = (0.4 \pm 0.8)\%$
$A_{CP}(f_0(980)\pi^0 \to K^+K^-\pi^0) = (-0.4 \pm 2.6)\%$
$A_{CP}(a_0(980)^0\pi^0 \to K^+K^-\pi^0) = (-0.6 \pm 1.9)\%$
$A_{CP}(f_2'(1525)\pi^0 \to K^+K^-\pi^0) = (0.0 \pm 0.32)\%$
$A_{CP}(K^*(892)^-K^+ \to K^+K^-\pi^0) = (-1.7 \pm 1.4)\%$
$A_{CP}(K^*(1410)^-K^+ \to K^+K^-\pi^0) = (-1.7 \pm 2.9)\%$
$A_{CP}((K^-\pi^0)_{S-wave}K^+ \to K^+K^-\pi^0) = (-0.4 \pm 2.5)\%$
$A_{CP}(K_S^0\phi) = -0.03 \pm 0.09$
$A_{CP}(K_S^0\pi^0) = 0.001 \pm 0.013$
$A_{CP}(K^-\pi^+) = -0.004 \pm 0.010$
$A_{CP}(K^+\pi^-) = 0.022 \pm 0.032$
$A_{CP}(K^-\pi^+\pi^0) = 0.002 \pm 0.009$
$A_{CP}(K^+\pi^-\pi^0) = 0.00 \pm 0.05$
$A_{CP}(K_S^0\pi^+\pi^-) = -0.009^{+0.026}_{-0.060}$
$A_{CP}(K^*(892)^-\pi^+ \to K_S^0\pi^+\pi^-) < 3.5 \times 10^{-4}, \text{CL} = 95\%$
$A_{CP}(K^*(892)^+\pi^- \to K_S^0\pi^+\pi^-) < 7.8 \times 10^{-4}, \text{CL} = 95\%$
$A_{CP}(\overline{K}^0\rho^0 \to K_S^0\pi^+\pi^-) < 4.8 \times 10^{-4}, \text{CL} = 95\%$
$A_{CP}(\overline{K}^0\omega \to K_S^0\pi^+\pi^-) < 9.2 \times 10^{-4}, \text{CL} = 95\%$
$A_{CP}(\overline{K}^0 f_0(980) \to K_S^0\pi^+\pi^-) < 6.8 \times 10^{-4}, \text{CL} = 95\%$
$A_{CP}(\overline{K}^0 f_2(1270) \to K_S^0\pi^+\pi^-) < 13.5 \times 10^{-4}, \text{CL} = 95\%$
$A_{CP}(\overline{K}^0 f_0(1370) \to K_S^0\pi^+\pi^-) < 25.5 \times 10^{-4}, \text{CL} = 95\%$
$A_{CP}(K_0^*(1430)^-\pi^+ \to K_S^0\pi^+\pi^-) < 9.0 \times 10^{-4}, \text{CL} = 95\%$
$A_{CP}(K_2^*(1430)^-\pi^+ \to K_S^0\pi^+\pi^-) < 6.5 \times 10^{-4}, \text{CL} = 95\%$
$A_{CP}(K^*(1680)^-\pi^+ \to K_S^0\pi^+\pi^-) < 28.4 \times 10^{-4}, \text{CL} = 95\%$
$A_{CP}(K^-\pi^+\pi^+\pi^-) = 0.007 \pm 0.010$
$A_{CP}(K^+\pi^-\pi^+\pi^-) = -0.02 \pm 0.04$
$A_{CP}(K^+K^-\pi^+\pi^-) = -0.08 \pm 0.07$

T-violation decay-rate asymmetry

$A_T(K^+K^-\pi^+\pi^-) = 0.01 \pm 0.07$

CPT-violation decay-rate asymmetry

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

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

D^0 DECAY MODES		Fraction (Γ_i/Γ)			Scale factor/ Confidence level	p (MeV/c)
Topological modes						
0-prongs	[vv]	(15	± 6	) %		−
2-prongs		(70	± 6	) %		−
4-prongs	[ww]	(14.5	± 0.5	) %		−
6-prongs		(6.5	± 1.3	) $\times 10^{-4}$		−
Inclusive modes						
e^+ anything	[xx]	(6.53	± 0.17	) %		−
μ^+ anything		(6.7	± 0.6	) %		−
K^- anything		(54.7	± 2.8	) %	S=1.3	−
$\overline{K}^0$ anything $+$ K^0 anything		(47	± 4	) %		−
K^+ anything		(3.4	± 0.4	) %		−
$K^*(892)^-$ anything		(15	± 9	) %		−
$\overline{K}^*(892)^0$ 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		(1.05	± 0.11	) %		−
Semileptonic modes						
$K^- e^+ \nu_e$		(3.61	± 0.05	) %	S=1.1	867
$K^- \mu^+ \nu_\mu$		(3.32	± 0.13	) %		864
$K^*(892)^- e^+ \nu_e$		(2.17	± 0.16	) %		719
$K^*(892)^- \mu^+ \nu_\mu$		(1.98	± 0.24	) %		714
$K^- \pi^0 e^+ \nu_e$		(1.6	$^{+1.3}_{-0.5}$	) %		861
$\overline{K}^0 \pi^- e^+ \nu_e$		(2.7	$^{+0.9}_{-0.7}$	) %		860
$K^- \pi^+ \pi^- e^+ \nu_e$		(2.8	$^{+1.4}_{-1.1}$	) $\times 10^{-4}$		843
$K_1(1270)^- e^+ \nu_e$		(7.6	$^{+4.0}_{-3.1}$	) $\times 10^{-4}$		498
$K^- \pi^+ \pi^- \mu^+ \nu_\mu$		< 1.2		$\times 10^{-3}$	CL=90%	821
$(\overline{K}^*(892)\pi)^- \mu^+ \nu_\mu$		< 1.4		$\times 10^{-3}$	CL=90%	692
$\pi^- e^+ \nu_e$		(2.98	± 0.12	) $\times 10^{-3}$		927
$\pi^- \mu^+ \nu_\mu$		(2.38	± 0.24	) $\times 10^{-3}$		924
$\rho^- e^+ \nu_e$		(1.9	± 0.4	) $\times 10^{-3}$		771

Hadronic modes with one $\overline{K}$

$K^-\pi^+$		(3.91 ± 0.05) %	S=1.1	861
$K^0_S\pi^0$		(1.22 ± 0.05) %		860
$K^0_L\pi^0$		(10.0 ± 0.7) $\times 10^{-3}$		860
$K^0_S\pi^+\pi^-$	[qq]	(2.94 ± 0.17) %	S=1.1	842
$K^0_S\rho^0$		($6.7 ^{+0.5}_{-0.6}$) $\times 10^{-3}$		674
$K^0_S\omega, \omega \to \pi^+\pi^-$		(2.1 ± 0.6) $\times 10^{-4}$		670
$K^0_S(\pi^+\pi^-)_{S-\text{wave}}$		(3.5 ± 0.8) $\times 10^{-3}$		842
$K^0_S f_0(980)$, $f_0(980) \to \pi^+\pi^-$		($1.38 ^{+0.30}_{-0.22}$) $\times 10^{-3}$		549
$K^0_S f_0(1370)$, $f_0(1370) \to \pi^+\pi^-$		(2.5 ± 0.6) $\times 10^{-3}$		†
$K^0_S f_2(1270)$, $f_2(1270) \to \pi^+\pi^-$		($1.4 ^{+1.0}_{-0.6}$) $\times 10^{-4}$		262
$K^*(892)^-\pi^+$, $K^*(892)^- \to K^0_S\pi^-$		($1.80 ^{+0.13}_{-0.14}$) %		711
$K^*_0(1430)^-\pi^+$, $K^*_0(1430)^- \to K^0_S\pi^-$		($2.95 ^{+0.40}_{-0.32}$) $\times 10^{-3}$		378
$K^*_2(1430)^-\pi^+$, $K^*_2(1430)^- \to K^0_S\pi^-$		($3.5 ^{+2.0}_{-1.1}$) $\times 10^{-4}$		367
$K^*(1680)^-\pi^+$, $K^*(1680)^- \to K^0_S\pi^-$		(5 ± 4) $\times 10^{-4}$		46
$K^*(892)^+\pi^-$, $K^*(892)^+ \to K^0_S\pi^+$	[yy]	($1.18 ^{+0.60}_{-0.35}$) $\times 10^{-4}$		711
$K^*_0(1430)^+\pi^-$, $K^*_0(1430)^+ \to K^0_S\pi^+$	[yy]	< 1.5 $\times 10^{-5}$ CL=95%		–
$K^*_2(1430)^+\pi^-$, $K^*_2(1430)^+ \to K^0_S\pi^+$	[yy]	< 3.5 $\times 10^{-5}$ CL=95%		–
$K^0_S\pi^+\pi^-$ nonresonant		($2.6 ^{+6.0}_{-1.7}$) $\times 10^{-4}$		842
$K^-\pi^+\pi^0$	[qq]	(14.0 ± 0.5) %	S=1.6	844
$K^-\rho^+$		(10.9 ± 0.7) %		675
$K^-\rho(1700)^+$, $\rho(1700)^+ \to \pi^+\pi^0$		(8.0 ± 1.7) $\times 10^{-3}$		†
$K^*(892)^-\pi^+$, $K^*(892)^- \to K^-\pi^0$		($2.23 ^{+0.40}_{-0.19}$) %		711
$\overline{K}^*(892)^0\pi^0$, $\overline{K}^*(892)^0 \to K^-\pi^+$		(1.89 ± 0.23) %		711
$K^*_0(1430)^-\pi^+$, $K^*_0(1430)^- \to K^-\pi^0$		(4.6 ± 2.1) $\times 10^{-3}$		378

$\overline{K}_0^*(1430)^0 \pi^0$,	(5.7 $^{+5.0}_{-1.5}$) $\times 10^{-3}$		379
$\quad \overline{K}_0^*(1430)^0 \to K^- \pi^+$			
$K^*(1680)^- \pi^+$,	(1.8 ± 0.7) $\times 10^{-3}$		46
$\quad K^*(1680)^- \to K^- \pi^0$			
$K^- \pi^+ \pi^0$ nonresonant	(1.12 $^{+0.50}_{-0.19}$) %		844
$K_S^0 2\pi^0$	(8.3 ± 0.6) $\times 10^{-3}$		843
$\quad \overline{K}^*(892)^0 \pi^0$,	(6.7 $^{+1.8}_{-1.5}$) $\times 10^{-3}$		711
$\quad \overline{K}^*(892)^0 \to K_S^0 \pi^0$			
$K_S^0 \pi^0 \pi^0$ nonresonant	(4.5 ± 1.1) $\times 10^{-3}$		843
$K^- \pi^+ \pi^+ \pi^-$	[qq] (8.14 $^{+0.20}_{-0.18}$) %	S=1.3	813
$\quad K^- \pi^+ \rho^0$ total	(6.79 ± 0.33) %		609
$\quad\quad K^- \pi^+ \rho^0$ 3-body	(5.1 ± 2.3) $\times 10^{-3}$		609
$\quad\quad \overline{K}^*(892)^0 \rho^0$,	(1.06 ± 0.23) %		416
$\quad\quad\quad \overline{K}^*(892)^0 \to K^- \pi^+$			
$\quad K^- a_1(1260)^+$,	(3.6 ± 0.6) %		327
$\quad\quad a_1(1260)^+ \to \pi^+ \pi^+ \pi^-$			
$\quad \overline{K}^*(892)^0 \pi^+ \pi^-$ total,	(1.6 ± 0.4) %		685
$\quad\quad \overline{K}^*(892)^0 \to K^- \pi^+$			
$\quad \overline{K}^*(892)^0 \pi^+ \pi^-$ 3-body,	(1.03 ± 0.22) %		685
$\quad\quad \overline{K}^*(892)^0 \to K^- \pi^+$			
$\quad K_1(1270)^- \pi^+$,	[ss] (2.9 ± 0.3) $\times 10^{-3}$		484
$\quad\quad K_1(1270)^- \to K^- \pi^+ \pi^-$			
$\quad K^- \pi^+ \pi^+ \pi^-$ nonresonant	(1.89 ± 0.26) %		813
$K_S^0 \pi^+ \pi^- \pi^0$	[qq] (5.4 ± 0.6) %		813
$\quad K_S^0 \eta$, $\eta \to \pi^+ \pi^- \pi^0$	(9.7 ± 0.6) $\times 10^{-4}$		772
$\quad K_S^0 \omega$, $\omega \to \pi^+ \pi^- \pi^0$	(1.00 ± 0.05) %		670
$\quad K^*(892)^- \rho^+$,	(2.1 ± 0.8) %		416
$\quad\quad K^*(892)^- \to K_S^0 \pi^-$			
$\quad K_1(1270)^- \pi^+$,	[ss] (2.2 ± 0.6) $\times 10^{-3}$		484
$\quad\quad K_1(1270)^- \to K_S^0 \pi^- \pi^0$			
$\quad \overline{K}^*(892)^0 \pi^+ \pi^-$ 3-body,	(2.6 ± 0.6) $\times 10^{-3}$		685
$\quad\quad \overline{K}^*(892)^0 \to K_S^0 \pi^0$			
$\quad K_S^0 \pi^+ \pi^- \pi^0$ nonresonant	(1.1 ± 1.1) %		813
$K^- \pi^+ \pi^+ \pi^- \pi^0$	(4.3 ± 0.4) %		771
$\quad \overline{K}^*(892)^0 \pi^+ \pi^- \pi^0$,	(1.3 ± 0.6) %		643
$\quad\quad \overline{K}^*(892)^0 \to K^- \pi^+$			
$\quad K^- \pi^+ \omega$, $\omega \to \pi^+ \pi^- \pi^0$	(2.7 ± 0.5) %		605
$\quad \overline{K}^*(892)^0 \omega$,	(6.5 ± 3.0) $\times 10^{-3}$		410
$\quad\quad \overline{K}^*(892)^0 \to K^- \pi^+$,			
$\quad\quad \omega \to \pi^+ \pi^- \pi^0$			
$K_S^0 \eta \pi^0$	(5.6 ± 1.2) $\times 10^{-3}$		721

$K_S^0\, a_0(980),\ a_0(980) \to\ \eta\pi^0$	(6.7 ± 2.1) $\times 10^{-3}$	–
$\overline{K}^*(892)^0\,\eta,$	(1.6 ± 0.5) $\times 10^{-3}$	–
$\quad \overline{K}^*(892)^0 \to\ K_S^0\,\pi^0$		
$K_S^0\, 2\pi^+2\pi^-$	(2.79 ± 0.30) $\times 10^{-3}$	768
$\quad K_S^0\,\rho^0\pi^+\pi^-,\ \mathrm{no}\,K^*(892)^-$	(1.1 ± 0.7) $\times 10^{-3}$	–
$\quad K^*(892)^-\pi^+\pi^+\pi^-,$	(5 ± 8) $\times 10^{-4}$	642
$\qquad K^*(892)^- \to\ K_S^0\,\pi^-,$		
$\qquad \mathrm{no}\,\rho^0$		
$\quad K^*(892)^-\,\rho^0\pi^+,$	(1.7 ± 0.7) $\times 10^{-3}$	230
$\qquad K^*(892)^- \to\ K_S^0\,\pi^-$		
$\quad K_S^0\, 2\pi^+2\pi^-$ nonresonant	< 1.3 $\times 10^{-3}$ CL=90%	768
$K^-\,3\pi^+2\pi^-$	(2.2 ± 0.6) $\times 10^{-4}$	713

Fractions of many of the following modes with resonances have already
appeared above as submodes of particular charged-particle modes. (Modes
for which there are only upper limits and $\overline{K}^*(892)\,\rho$ submodes only appear
below.)

$K_S^0\,\eta$	(4.29 ± 0.27) $\times 10^{-3}$		772
$K_S^0\,\omega$	(1.12 ± 0.06) %		670
$K_S^0\,\eta'(958)$	(9.3 ± 1.4) $\times 10^{-3}$		565
$K^-\,a_1(1260)^+$	(7.9 ± 1.1) %		327
$\overline{K}^0\,a_1(1260)^0$	< 1.9 %	CL=90%	323
$K^-\,a_2(1320)^+$	< 2 $\times 10^{-3}$	CL=90%	198
$\overline{K}^*(892)^0\,\pi^+\pi^-$ total	(2.4 ± 0.5) %		685
$\quad \overline{K}^*(892)^0\,\pi^+\pi^-$ 3-body	(1.54 ± 0.34) %		685
$\overline{K}^*(892)^0\,\rho^0$	(1.59 ± 0.35) %		417
$\quad \overline{K}^*(892)^0\,\rho^0$ transverse	(1.6 ± 0.6) %		417
$\quad \overline{K}^*(892)^0\,\rho^0$ S-wave	(3.1 ± 0.6) %		417
$\quad \overline{K}^*(892)^0\,\rho^0$ S-wave long.	< 3 $\times 10^{-3}$	CL=90%	417
$\quad \overline{K}^*(892)^0\,\rho^0$ P-wave	< 3 $\times 10^{-3}$	CL=90%	417
$\quad \overline{K}^*(892)^0\,\rho^0$ D-wave	(2.1 ± 0.6) %		417
$K^*(892)^-\,\rho^+$	(6.5 ± 2.5) %		417
$\quad K^*(892)^-\,\rho^+$ longitudinal	(3.1 ± 1.2) %		417
$\quad K^*(892)^-\,\rho^+$ transverse	(3.4 ± 2.0) %		417
$\quad K^*(892)^-\,\rho^+$ P-wave	< 1.5 %	CL=90%	417
$K_1(1270)^-\,\pi^+$	[ss] (1.14 ± 0.32) %		484
$K_1(1400)^-\,\pi^+$	< 1.2 %	CL=90%	386
$\overline{K}_1(1400)^0\,\pi^0$	< 3.7 %	CL=90%	387
$\overline{K}^*(892)^0\,\pi^+\pi^-\pi^0$	(1.9 ± 0.9) %		643
$K^-\,\pi^+\omega$	(3.0 ± 0.6) %		605
$\quad \overline{K}^*(892)^0\,\omega$	(1.1 ± 0.5) %		410
$K^-\,\pi^+\eta'(958)$	(7.6 ± 1.9) $\times 10^{-3}$		479
$\quad \overline{K}^*(892)^0\,\eta'(958)$	< 1.1 $\times 10^{-3}$	CL=90%	119

Hadronic modes with three K's

$K^0_S K^+ K^-$	(4.65 $\pm$0.30) $\times 10^{-3}$		544
$K^0_S a_0(980)^0$, $a_0^0 \to K^+ K^-$	(3.1 $\pm$0.4) $\times 10^{-3}$		–
$K^- a_0(980)^+$, $a_0^+ \to K^+ K^0_S$	(6.2 $\pm$1.8) $\times 10^{-4}$		–
$K^+ a_0(980)^-$, $a_0^- \to K^- K^0_S$	< 1.2 $\times 10^{-4}$	CL=95%	–
$K^0_S f_0(980)$, $f_0 \to K^+ K^-$	< 1.0 $\times 10^{-4}$	CL=95%	–
$K^0_S \phi$, $\phi \to K^+ K^-$	(2.13 $\pm$0.15) $\times 10^{-3}$		520
$K^0_S f_0(1370)$, $f_0 \to K^+ K^-$	(1.8 $\pm$1.1) $\times 10^{-4}$		–
$3K^0_S$	(9.5 $\pm$1.3) $\times 10^{-4}$		539
$K^+ K^- K^- \pi^+$	(2.23 $\pm$0.32) $\times 10^{-4}$		434
$K^+ K^- \overline{K}{}^*(892)^0$, $\overline{K}{}^*(892)^0 \to K^- \pi^+$	(4.5 $\pm$1.7) $\times 10^{-5}$		†
$K^- \pi^+ \phi$, $\phi \to K^+ K^-$	(4.0 $\pm$1.7) $\times 10^{-5}$		422
$\phi \overline{K}{}^*(892)^0$, $\phi \to K^+ K^-$, $\overline{K}{}^*(892)^0 \to K^- \pi^+$	(1.07 $\pm$0.20) $\times 10^{-4}$		†
$K^+ K^- K^- \pi^+$ nonresonant	(3.3 $\pm$1.5) $\times 10^{-5}$		434
$K^0_S K^0_S K^{\pm} \pi^{\mp}$	(6.2 $\pm$1.3) $\times 10^{-4}$		427

Pionic modes

$\pi^+ \pi^-$	(1.405$\pm$0.026) $\times 10^{-3}$		922
$\pi^0 \pi^0$	(8.1 $\pm$0.8) $\times 10^{-4}$		923
$\pi^+ \pi^- \pi^0$	(1.44 $\pm$0.06) %	S=1.8	907
$\rho^+ \pi^-$	(9.8 $\pm$0.4) $\times 10^{-3}$		764
$\rho^0 \pi^0$	(3.74 $\pm$0.22) $\times 10^{-3}$		764
$\rho^- \pi^+$	(4.99 $\pm$0.23) $\times 10^{-3}$		764
$\rho(1450)^+ \pi^-$, $\rho(1450)^+ \to \pi^+ \pi^0$	(1.6 $\pm$2.0) $\times 10^{-5}$		–
$\rho(1450)^0 \pi^0$, $\rho(1450)^0 \to \pi^+ \pi^-$	(4.3 $\pm$1.9) $\times 10^{-5}$		–
$\rho(1450)^- \pi^+$, $\rho(1450)^- \to \pi^- \pi^0$	(2.6 $\pm$0.4) $\times 10^{-4}$		–
$\rho(1700)^+ \pi^-$, $\rho(1700)^+ \to \pi^+ \pi^0$	(5.9 $\pm$1.4) $\times 10^{-4}$		–
$\rho(1700)^0 \pi^0$, $\rho(1700)^0 \to \pi^+ \pi^-$	(7.2 $\pm$1.7) $\times 10^{-4}$		–
$\rho(1700)^- \pi^+$, $\rho(1700)^- \to \pi^- \pi^0$	(4.6 $\pm$1.1) $\times 10^{-4}$		–
$f_0(980) \pi^0$, $f_0(980) \to \pi^+ \pi^-$	(3.6 $\pm$0.8) $\times 10^{-5}$		–
$f_0(600) \pi^0$, $f_0(600) \to \pi^+ \pi^-$	(1.18 $\pm$0.21) $\times 10^{-4}$		–
$f_0(1370) \pi^0$, $f_0(1370) \to \pi^+ \pi^-$	(5.3 $\pm$2.1) $\times 10^{-5}$		–
$f_0(1500) \pi^0$, $f_0(1500) \to \pi^+ \pi^-$	(5.6 $\pm$1.6) $\times 10^{-5}$		–

$f_0(1710)\pi^0$, $f_0(1710) \to$ $\pi^+\pi^-$	(4.5 ±1.5) $\times 10^{-5}$		–
$f_2(1270)\pi^0$, $f_2(1270) \to$ $\pi^+\pi^-$	(1.91 ±0.20) $\times 10^{-4}$		–
$\pi^+\pi^-\pi^0$ nonresonant	(1.21 ±0.35) $\times 10^{-4}$		907
$3\pi^0$	< 3.5 $\times 10^{-4}$	CL=90%	908
$2\pi^+2\pi^-$	(7.48 ±0.21) $\times 10^{-3}$	S=1.1	880
$a_1(1260)^+\pi^-$, $a_1^+ \to$ $\pi^+\pi^-\pi^+$ total	(4.49 ±0.31) $\times 10^{-3}$		–
$a_1(1260)^+\pi^-$, $a_1^+ \to$ $\rho^0\pi^+$ S-wave	(3.24 ±0.25) $\times 10^{-3}$		–
$a_1(1260)^+\pi^-$, $a_1^+ \to$ $\rho^0\pi^+$ D-wave	(1.9 ±0.5) $\times 10^{-4}$		–
$a_1(1260)^+\pi^-$, $a_1^+ \to$ $\sigma\pi^+$	(6.2 ±0.7) $\times 10^{-4}$		–
$2\rho^0$ total	(1.83 ±0.13) $\times 10^{-3}$		518
$2\rho^0$, parallel helicities	(8.2 ±3.2) $\times 10^{-5}$		–
$2\rho^0$, perpendicular helicities	(4.8 ±0.6) $\times 10^{-4}$		–
$2\rho^0$, longitudinal helicities	(1.26 ±0.10) $\times 10^{-3}$		–
Resonant $(\pi^+\pi^-)\pi^+\pi^-$ 3-body total	(1.50 ±0.12) $\times 10^{-3}$		–
$\sigma\pi^+\pi^-$	(6.1 ±0.9) $\times 10^{-4}$		–
$f_0(980)\pi^+\pi^-$, $f_0 \to$ $\pi^+\pi^-$	(1.8 ±0.5) $\times 10^{-4}$		–
$f_2(1270)\pi^+\pi^-$, $f_2 \to$ $\pi^+\pi^-$	(3.7 ±0.6) $\times 10^{-4}$		–
$\pi^+\pi^-2\pi^0$	(1.01 ±0.09) %		882
$\eta\pi^0$	[zz] (6.4 ±1.1) $\times 10^{-4}$		846
$\omega\pi^0$	[zz] < 2.6 $\times 10^{-4}$	CL=90%	761
$2\pi^+2\pi^-\pi^0$	(4.2 ±0.5) $\times 10^{-3}$		844
$\eta\pi^+\pi^-$	[zz] (1.09 ±0.16) $\times 10^{-3}$		827
$\omega\pi^+\pi^-$	[zz] (1.6 ±0.5) $\times 10^{-3}$		738
$3\pi^+3\pi^-$	(4.3 ±1.2) $\times 10^{-4}$		795
$\eta'(958)\pi^0$	(8.1 ±1.6) $\times 10^{-4}$		678
$\eta'(958)\pi^+\pi^-$	(4.5 ±1.7) $\times 10^{-4}$		650
2η	(1.67 ±0.19) $\times 10^{-3}$		754
$\eta\eta'(958)$	(1.26 ±0.27) $\times 10^{-3}$		537

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

K^+K^-	(3.97 ±0.07) $\times 10^{-3}$	S=1.2	791
$2K^0_S$	(2.0 ±0.7) $\times 10^{-4}$	S=2.6	789
$K^0_S K^-\pi^+$	(3.5 ±0.5) $\times 10^{-3}$	S=1.1	739
$\overline{K}^*(892)^0 K^0_S$, $\overline{K}^*(892)^0 \to K^-\pi^+$	< 6 $\times 10^{-4}$	CL=90%	608

$K_S^0 K^+ \pi^-$	$(2.6 \pm 0.5) \times 10^{-3}$		739
$K^*(892)^0 K_S^0$, $K^*(892)^0 \to K^+ \pi^-$	$< 2.9 \times 10^{-4}$ CL=90%		608
$K^+ K^- \pi^0$	$(3.31 \pm 0.13) \times 10^{-3}$		743
$K^*(892)^+ K^-$, $K^*(892)^+ \to K^+ \pi^0$	$(1.47 \pm 0.07) \times 10^{-3}$		–
$K^*(892)^- K^+$, $K^*(892)^- \to K^- \pi^0$	$(5.1 \pm 0.5) \times 10^{-4}$		–
$(K^+ \pi^0)_{S-wave} K^-$	$(2.35 \pm 0.17) \times 10^{-3}$		743
$(K^- \pi^0)_{S-wave} K^+$	$(1.3 \pm 0.4) \times 10^{-4}$		743
$f_0(980) \pi^0$, $f_0 \to K^+ K^-$	$(3.5 \pm 0.6) \times 10^{-4}$		–
$\phi \pi^0$, $\phi \to K^+ K^-$	$(6.1 \pm 0.6) \times 10^{-4}$		–
$K_S^0 K_S^0 \pi^0$	$< 5.9 \times 10^{-4}$		740
$K^+ K^- \pi^+ \pi^-$	[aaa] $(2.44 \pm 0.12) \times 10^{-3}$		677
$\phi \pi^+ \pi^-$ 3-body, $\phi \to K^+ K^-$	$(2.4 \pm 2.4) \times 10^{-5}$		614
$\phi \rho^0$, $\phi \to K^+ K^-$	$(7.1 \pm 0.6) \times 10^{-4}$		250
$K^+ K^- \rho^0$ 3-body	$(5 \pm 7) \times 10^{-5}$		302
$f_0(980) \pi^+ \pi^-$, $f_0 \to K^+ K^-$	$(3.7 \pm 0.9) \times 10^{-4}$		–
$K^*(892)^0 K^\mp \pi^\pm$ 3-body, $K^{*0} \to K^\pm \pi^\mp$	[bbb] $(2.7 \pm 0.6) \times 10^{-4}$		531
$K^*(892)^0 \overline{K}^*(892)^0$, $K^{*0} \to K^\pm \pi^\mp$	$(7 \pm 5) \times 10^{-5}$		272
$K_1(1270)^\pm K^\mp$, $K_1(1270)^\pm \to K^\pm \pi^+ \pi^-$	$(8.1 \pm 1.8) \times 10^{-4}$		–
$K_1(1400)^\pm K^\mp$, $K_1(1400)^\pm \to K^\pm \pi^+ \pi^-$	$(5.4 \pm 1.2) \times 10^{-4}$		–
$K_S^0 K_S^0 \pi^+ \pi^-$	$(1.28 \pm 0.24) \times 10^{-3}$		673
$K_S^0 K^- \pi^+ \pi^+ \pi^-$	$< 1.5 \times 10^{-4}$ CL=90%		595
$K^+ K^- \pi^+ \pi^- \pi^0$	$(3.1 \pm 2.0) \times 10^{-3}$		600

Fractions of most of the following modes with resonances have already appeared above as submodes of particular charged-particle modes.

$\phi \pi^0$	$(7.7 \pm 0.4) \times 10^{-4}$		645
$\phi \eta$	$(1.4 \pm 0.5) \times 10^{-4}$		489
$\phi \omega$	$< 2.1 \times 10^{-3}$ CL=90%		238

Radiative modes

$\rho^0 \gamma$	$< 2.4 \times 10^{-4}$ CL=90%		771
$\omega \gamma$	$< 2.4 \times 10^{-4}$ CL=90%		768
$\phi \gamma$	$(2.71 \pm 0.35) \times 10^{-5}$		654
$\overline{K}^*(892)^0 \gamma$	$(3.30 \pm 0.34) \times 10^{-4}$		719

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

$K^+ \ell^- \overline{\nu}_\ell$ via $\overline{D}^0$		$<\ 1.8$	$\times 10^{-4}$ CL=90%	–
K^+ or $K^*(892)^+ e^- \overline{\nu}_e$ via $\overline{D}^0$		$<\ 6$	$\times 10^{-5}$ CL=90%	–
$K^+ \pi^-$	DC	$(\ 1.48\ \pm0.07\ ) \times 10^{-4}$		861
$K^+ \pi^-$ via DCS		$(\ 1.32\ \pm0.09\ ) \times 10^{-4}$		–
$K^+ \pi^-$ via $\overline{D}^0$		$<\ 1.6$	$\times 10^{-5}$ CL=95%	861
$K^0_S \pi^+ \pi^-$ in $D^0 \to \overline{D}^0$		$<\ 1.9$	$\times 10^{-4}$ CL=95%	–
$K^*(892)^+ \pi^-$, $\ K^*(892)^+ \to\ K^0_S \pi^+$	DC	$(\ 1.18\ ^{+0.60}_{-0.35}\ ) \times 10^{-4}$		711
$K^*_0(1430)^+ \pi^-$, $\ K^*_0(1430)^+ \to\ K^0_S \pi^+$	DC	$<\ 1.5$	$\times 10^{-5}$	–
$K^*_2(1430)^+ \pi^-$, $\ K^*_2(1430)^+ \to\ K^0_S \pi^+$	DC	$<\ 3.5$	$\times 10^{-5}$	–
$K^+ \pi^- \pi^0$	DC	$(\ 3.06\ \pm0.17\ ) \times 10^{-4}$		844
$K^+ \pi^- \pi^0$ via $\overline{D}^0$		$<\ 8$	$\times 10^{-5}$ CL=95%	–
$K^+ \pi^- \pi^+ \pi^-$	DC	$(\ 2.63\ ^{+0.21}_{-0.19}\ ) \times 10^{-4}$		813
$K^+ \pi^- \pi^+ \pi^-$ via $\overline{D}^0$		$<\ 4$	$\times 10^{-4}$ CL=90%	812
μ^- anything via $\overline{D}^0$		$<\ 4$	$\times 10^{-4}$ CL=90%	–

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

$\gamma\gamma$	C1	$<\ 2.7$	$\times 10^{-5}$ CL=90%	932
$e^+ e^-$	C1	$<\ 1.2$	$\times 10^{-6}$ CL=90%	932
$\mu^+ \mu^-$	C1	$<\ 1.3$	$\times 10^{-6}$ CL=90%	926
$\pi^0 e^+ e^-$	C1	$<\ 4.5$	$\times 10^{-5}$ CL=90%	928
$\pi^0 \mu^+ \mu^-$	C1	$<\ 1.8$	$\times 10^{-4}$ CL=90%	915
$\eta e^+ e^-$	C1	$<\ 1.1$	$\times 10^{-4}$ CL=90%	852
$\eta \mu^+ \mu^-$	C1	$<\ 5.3$	$\times 10^{-4}$ CL=90%	838
$\pi^+ \pi^- e^+ e^-$	C1	$<\ 3.73$	$\times 10^{-4}$ CL=90%	922
$\rho^0 e^+ e^-$	C1	$<\ 1.0$	$\times 10^{-4}$ CL=90%	771
$\pi^+ \pi^- \mu^+ \mu^-$	C1	$<\ 3.0$	$\times 10^{-5}$ CL=90%	894
$\rho^0 \mu^+ \mu^-$	C1	$<\ 2.2$	$\times 10^{-5}$ CL=90%	754
$\omega e^+ e^-$	C1	$<\ 1.8$	$\times 10^{-4}$ CL=90%	768
$\omega \mu^+ \mu^-$	C1	$<\ 8.3$	$\times 10^{-4}$ CL=90%	751
$K^- K^+ e^+ e^-$	C1	$<\ 3.15$	$\times 10^{-4}$ CL=90%	791
$\phi e^+ e^-$	C1	$<\ 5.2$	$\times 10^{-5}$ CL=90%	654
$K^- K^+ \mu^+ \mu^-$	C1	$<\ 3.3$	$\times 10^{-5}$ CL=90%	710
$\phi \mu^+ \mu^-$	C1	$<\ 3.1$	$\times 10^{-5}$ CL=90%	631
$\overline{K}^0 e^+ e^-$	[uu]	$<\ 1.1$	$\times 10^{-4}$ CL=90%	866
$\overline{K}^0 \mu^+ \mu^-$	[uu]	$<\ 2.6$	$\times 10^{-4}$ CL=90%	852

$K^- \pi^+ e^+ e^-$	C1	$<$ 3.85	$\times 10^{-4}$ CL=90%	861
$\overline{K}^*(892)^0 e^+ e^-$		[uu] $<$ 4.7	$\times 10^{-5}$ CL=90%	719
$K^- \pi^+ \mu^+ \mu^-$	C1	$<$ 3.59	$\times 10^{-4}$ CL=90%	829
$\overline{K}^*(892)^0 \mu^+ \mu^-$		[uu] $<$ 2.4	$\times 10^{-5}$ CL=90%	700
$\pi^+ \pi^- \pi^0 \mu^+ \mu^-$	C1	$<$ 8.1	$\times 10^{-4}$ CL=90%	863
$\mu^\pm e^\mp$	LF	[gg] $<$ 8.1	$\times 10^{-7}$ CL=90%	929
$\pi^0 e^\pm \mu^\mp$	LF	[gg] $<$ 8.6	$\times 10^{-5}$ CL=90%	924
$\eta e^\pm \mu^\mp$	LF	[gg] $<$ 1.0	$\times 10^{-4}$ CL=90%	848
$\pi^+ \pi^- e^\pm \mu^\mp$	LF	[gg] $<$ 1.5	$\times 10^{-5}$ CL=90%	911
$\rho^0 e^\pm \mu^\mp$	LF	[gg] $<$ 4.9	$\times 10^{-5}$ CL=90%	767
$\omega e^\pm \mu^\mp$	LF	[gg] $<$ 1.2	$\times 10^{-4}$ CL=90%	764
$K^- K^+ e^\pm \mu^\mp$	LF	[gg] $<$ 1.8	$\times 10^{-4}$ CL=90%	754
$\phi e^\pm \mu^\mp$	LF	[gg] $<$ 3.4	$\times 10^{-5}$ CL=90%	648
$\overline{K}^0 e^\pm \mu^\mp$	LF	[gg] $<$ 1.0	$\times 10^{-4}$ CL=90%	863
$K^- \pi^+ e^\pm \mu^\mp$	LF	[gg] $<$ 5.53	$\times 10^{-4}$ CL=90%	848
$\overline{K}^*(892)^0 e^\pm \mu^\mp$	LF	[gg] $<$ 8.3	$\times 10^{-5}$ CL=90%	714
$\pi^- \pi^- e^+ e^+ +$ c.c.	L	$<$ 1.12	$\times 10^{-4}$ CL=90%	922
$\pi^- \pi^- \mu^+ \mu^+ +$ c.c.	L	$<$ 2.9	$\times 10^{-5}$ CL=90%	894
$K^- \pi^- e^+ e^+ +$ c.c.	L	$<$ 2.06	$\times 10^{-4}$ CL=90%	861
$K^- \pi^- \mu^+ \mu^+ +$ c.c.	L	$<$ 3.9	$\times 10^{-4}$ CL=90%	829
$K^- K^- e^+ e^+ +$ c.c.	L	$<$ 1.52	$\times 10^{-4}$ CL=90%	791
$K^- K^- \mu^+ \mu^+ +$ c.c.	L	$<$ 9.4	$\times 10^{-5}$ CL=90%	710
$\pi^- \pi^- e^+ \mu^+ +$ c.c.	L	$<$ 7.9	$\times 10^{-5}$ CL=90%	911
$K^- \pi^- e^+ \mu^+ +$ c.c.	L	$<$ 2.18	$\times 10^{-4}$ CL=90%	848
$K^- K^- e^+ \mu^+ +$ c.c.	L	$<$ 5.7	$\times 10^{-5}$ CL=90%	754

$D^*(2007)^0$

$I(J^P) = \frac{1}{2}(1^-)$
I, J, P need confirmation.

Mass $m = 2006.97 \pm 0.19$ MeV $(S = 1.1)$
$m_{D^{*0}} - m_{D^0} = 142.12 \pm 0.07$ MeV
Full width $\Gamma < 2.1$ MeV, CL = 90%

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

$D^*(2007)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0 \pi^0$	(61.9 ± 2.9) %	43
$D^0 \gamma$	(38.1 ± 2.9) %	137

$D^*(2010)^\pm$

$$I(J^P) = \tfrac{1}{2}(1^-)$$
I, J, P need confirmation.

Mass $m = 2010.27 \pm 0.17$ MeV   (S = 1.1)
$m_{D^*(2010)^+} - m_{D^+} = 140.64 \pm 0.10$ MeV   (S = 1.1)
$m_{D^*(2010)^+} - m_{D^0} = 145.421 \pm 0.010$ MeV   (S = 1.1)
Full width $\Gamma = 96 \pm 22$ 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

$D_1(2420)^0$

$$I(J^P) = \tfrac{1}{2}(1^+)$$
I, J, P need confirmation.

Mass $m = 2422.3 \pm 1.3$ MeV   (S = 1.2)
$m_{D_1^0} - m_{D^{*+}} = 411.7 \pm 0.8$
Full width $\Gamma = 20.4 \pm 1.7$ MeV

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

$D_1(2420)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^*(2010)^+ \pi^-$	seen	355
$D^0 \pi^+ \pi^-$	seen	426
$D^+ \pi^-$	not seen	474
$D^{*0} \pi^+ \pi^-$	not seen	281

$D_2^*(2460)^0$

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

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

Mass $m = 2461.1 \pm 1.6$ MeV   (S = 1.3)
$m_{D_2^{*0}} - m_{D^+} = 593.9 \pm 0.8$
Full width $\Gamma = 43 \pm 4$ MeV   (S = 1.8)

$\overline{D}_2^*(2460)^0$ 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

$D_2^*(2460)^\pm$ $\qquad\qquad I(J^P) = \frac{1}{2}(2^+)$

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

Mass $m = 2460.1^{+2.6}_{-3.5}$ MeV (S = 1.5)
$m_{D_2^*(2460)^\pm} - m_{D_2^*(2460)^0} = 2.4 \pm 1.7$ MeV
Full width $\Gamma = 37 \pm 6$ MeV (S = 1.4)

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

$D_2^*(2460)^\pm$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0 \pi^+$	seen	508
$D^{*0} \pi^+$	seen	391
$D^+ \pi^+ \pi^-$	not seen	457
$D^{*+} \pi^+ \pi^-$	not seen	320

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

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

$D_s^\pm$ $\qquad\qquad I(J^P) = 0(0^-)$

Mass $m = 1968.49 \pm 0.34$ MeV (S = 1.3)
$m_{D_s^\pm} - m_{D^\pm} = 98.87 \pm 0.30$ MeV (S = 1.4)
Mean life $\tau = (500 \pm 7) \times 10^{-15}$ s (S = 1.3)
$\qquad c\tau = 149.9$ μm

CP-violating decay-rate asymmetries

$A_{CP}(K^{\pm}K^0_S) = 0.049 \pm 0.023$

$A_{CP}(K^+K^-\pi^{\pm}) = 0.003 \pm 0.014$

$A_{CP}(K^+K^-\pi^{\pm}\pi^0) = -0.06 \pm 0.04$

$A_{CP}(K^0_S K^{\mp} 2\pi^{\pm}) = -0.01 \pm 0.04$

$A_{CP}(\pi^+\pi^-\pi^{\pm}) = 0.02 \pm 0.05$

$A_{CP}(\pi^{\pm}\eta) = -0.08 \pm 0.05$

$A_{CP}(\pi^{\pm}\eta') = -0.06 \pm 0.04$

$A_{CP}(K^{\pm}\pi^0) = 0.02 \pm 0.29$

$A_{CP}(K^0_S \pi^{\pm}) = 0.27 \pm 0.11$

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

$A_{CP}(K^{\pm}\eta) = -0.20 \pm 0.18$

$A_{CP}(K^{\pm}\eta'(958)) = -0.2 \pm 0.4$

T-violating decay-rate asymmetry

$A_T(K^0_S K^{\pm}\pi^+\pi^-) = -0.04 \pm 0.07$ [ccc]

D^+_s form factors

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

$r_v = 1.80 \pm 0.08$

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

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)		Confidence level	p (MeV/c)
Inclusive modes					
K^- anything		(13 $^{+14}_{-12}$	) %		–
$\overline{K}^0$ anything + K^0 anything		(39 ± 28	) %		–
K^+ anything		(20 $^{+18}_{-14}$	) %		–
(non-$K\,\overline{K}$) anything		(64 ± 17	) %		–
η anything	[ddd]	(24 ± 4	) %		–
η' anything		(8.7 ± 2.1	) %		–
ϕ anything		(16.1 ± 1.6	) %		–
e^+ anything		(8 $^{+6}_{-5}$	) %		–

Leptonic and semileptonic modes

$e^+ \nu_e$		$<$ 1.3 $\times 10^{-4}$		90%	984
$\mu^+ \nu_\mu$		$(\ 6.3\ \pm\ 0.5\ ) \times 10^{-3}$			981
$\tau^+ \nu_\tau$		$(\ 6.6\ \pm\ 0.6\ )\ \%$			182
$\phi\, e^+ \nu_e$		$(\ 2.61 \pm\ 0.17)\ \%$			720
$\eta \ell^+ \nu_\ell\ +\ \eta'(958)\ell^+\nu_\ell$	[eee]	$(\ 4.4\ \pm\ 0.7\ )\ \%$			–
$\eta \ell^+ \nu_\ell$	[eee]	$(\ 3.2\ \pm\ 0.5\ )\ \%$			908
$\eta'(958)\ell^+ \nu_\ell$	[eee]	$(\ 1.12 \pm\ 0.35)\ \%$			751

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

$K^+ K^0_S$		$(\ 1.49 \pm\ 0.09)\ \%$			850
$K^+ K^- \pi^+$	[qq]	$(\ 5.50 \pm\ 0.28)\ \%$			805
$\phi\pi^+$	[fff,ggg]	$(\ 4.39 \pm\ 0.34)\ \%$			712
$\phi\pi^+,\ \phi \to\ K^+ K^-$	[fff]	$(\ 2.18 \pm\ 0.33)\ \%$			712
$K^+ \overline{K}{}^*(892)^0,\ \overline{K}{}^{*0} \to K^- \pi^+$		$(\ 2.6\ \pm\ 0.4\ )\ \%$			416
$f_0(980)\pi^+,\ f_0 \to\ K^+ K^-$		$(\ 6.0\ \pm\ 2.4\ ) \times 10^{-3}$			732
$K^+ \overline{K}{}^*_0(1430)^0,\ \overline{K}{}^*_0 \to K^- \pi^+$		$(\ 5.1\ \pm\ 2.5\ ) \times 10^{-3}$			218
$K^0 \overline{K}{}^0 \pi^+$		—			802
$K^*(892)^+ \overline{K}{}^0$	[ggg]	$(\ 5.3\ \pm\ 1.2\ )\ \%$			683
$K^+ K^- \pi^+ \pi^0$		$(\ 5.6\ \pm\ 0.5\ )\ \%$			748
$\phi\rho^+,\ \phi \to\ K^+ K^-$		$(\ 4.0\ {}^{+\ 1.1}_{-\ 1.2}\ )\ \%$			400
$\phi\pi^+\pi^0$ 3-body, $\phi \to K^+ K^-$		$<$ 1.5 $\%$		90%	686
$K^+ K^- \pi^+ \pi^0$ non-ϕ		$<$ 11 $\%$		90%	748
$K^0_S K^- \pi^+ \pi^+$		$(\ 1.64 \pm\ 0.12)\ \%$			744
$K^*(892)^+ \overline{K}{}^*(892)^0$	[ggg]	$(\ 7.0\ \pm\ 2.5\ )\ \%$			417
$K^0 K^- 2\pi^+ (\text{non-}K^{*+}\overline{K}{}^{*0})$		$<$ 3.5 $\%$		90%	744
$K^+ K^0_S \pi^+ \pi^-$		$(\ 9.6\ \pm\ 1.3\ ) \times 10^{-3}$			744
$K^+ K^- \pi^+ \pi^+ \pi^-$		$(\ 8.8\ \pm\ 1.6\ ) \times 10^{-3}$			673
$\phi\pi^+\pi^+\pi^-,\ \phi \to\ K^+ K^-$		$(\ 5.9\ \pm\ 1.1\ ) \times 10^{-3}$			640
$K^+ K^- \rho^0 \pi^+$ non-ϕ		$<$ 2.6 $\times 10^{-4}$		90%	249
$\phi\rho^0\pi^+,\ \phi \to\ K^+ K^-$		$(\ 6.6\ \pm\ 1.3\ ) \times 10^{-3}$			181
$\phi\, a_1(1260)^+,\ \phi \to K^+ K^-,\ a_1^+ \to\ \rho^0\pi^+$		$(\ 7.5\ \pm\ 1.3\ ) \times 10^{-3}$			†
$K^+ K^- \pi^+ \pi^+ \pi^-$ nonresonant		$(\ 9\ \ \pm\ 7\ \ ) \times 10^{-4}$			673
$K^0_S K^0_S \pi^+ \pi^+ \pi^-$		$(\ 8.4\ \pm\ 3.5\ ) \times 10^{-4}$			669

Hadronic modes without K's

$\pi^+ \pi^0$		$<$ 6 $\times 10^{-4}$		90%	975
$\pi^+ \pi^+ \pi^-$		$(\ 1.11 \pm\ 0.08)\ \%$			959
$\rho^0 \pi^+$		not seen			825
$\pi^+ (\pi^+ \pi^-)_{S-\text{wave}}$	[hhh]	$(\ 9.7\ \pm\ 1.1\ ) \times 10^{-3}$			959

$f_2(1270)\pi^+$, $f_2 \to \pi^+\pi^-$		$(1.1 \pm 0.6) \times 10^{-3}$		559
$\rho(1450)^0\pi^+$, $\rho^0 \to \pi^+\pi^-$		$(7 \pm 6) \times 10^{-4}$		421
$\pi^+\pi^+\pi^-\pi^0$		< 15 %	90%	935
$\eta\pi^+$	[ggg]	(1.58 ± 0.21) %		902
$\omega\pi^+$	[ggg]	$(2.5 \pm 0.9) \times 10^{-3}$		822
$3\pi^+2\pi^-$		$(8.0 \pm 0.9) \times 10^{-3}$		899
$\pi^+\pi^+\pi^-\pi^0\pi^0$		—		902
$\eta\rho^+$	[ggg]	(13.1 ± 2.2) %		724
$\eta\pi^+\pi^0$ 3-body	[ggg]	< 5 %	90%	886
$3\pi^+2\pi^-\pi^0$		(4.9 ± 3.2) %		856
$\eta'(958)\pi^+$	[ggg]	(3.8 ± 0.4) %		743
$3\pi^+2\pi^-2\pi^0$		—		803
$\eta'(958)\rho^+$	[ggg]	(12.2 ± 2.0) %		465
$\eta'(958)\pi^+\pi^0$ 3-body	[ggg]	< 1.8 %	90%	720

Modes with one or three K's

$K^+\pi^0$		$(8.2 \pm 2.2) \times 10^{-4}$		917
$K^0_S\pi^+$		$(1.25 \pm 0.15) \times 10^{-3}$		916
$K^+\eta$		$(1.41 \pm 0.31) \times 10^{-3}$		835
$K^+\eta'(958)$		$(1.6 \pm 0.5) \times 10^{-3}$		646
$K^+\pi^+\pi^-$		$(6.9 \pm 0.5) \times 10^{-3}$		900
$K^+\rho^0$		$(2.7 \pm 0.5) \times 10^{-3}$		745
$K^+\rho(1450)^0$, $\rho^0 \to \pi^+\pi^-$		$(7.4 \pm 2.6) \times 10^{-4}$		–
$K^*(892)^0\pi^+$, $K^{*0} \to$ $K^+\pi^-$		$(1.50 \pm 0.26) \times 10^{-3}$		775
$K^*(1410)^0\pi^+$, $K^{*0} \to$ $K^+\pi^-$		$(1.30 \pm 0.31) \times 10^{-3}$		–
$K^*(1430)^0\pi^+$, $K^{*0} \to$ $K^+\pi^-$		$(5 \pm 4) \times 10^{-4}$		–
$K^+\pi^+\pi^-$ nonresonant		$(1.1 \pm 0.4) \times 10^{-3}$		900
$K^0_S\pi^+\pi^+\pi^-$		$(3.0 \pm 1.1) \times 10^{-3}$		870
$K^+K^+K^-$		$(4.9 \pm 1.7) \times 10^{-4}$		628
ϕK^+, $\phi \to K^+K^-$		$< 2.8 \times 10^{-4}$	90%	607

Doubly Cabibbo-suppressed modes

$K^+K^+\pi^-$		$(2.9 \pm 1.1) \times 10^{-4}$		805

Baryon-antibaryon mode

$p\overline{n}$		$(1.3 \pm 0.4) \times 10^{-3}$		295

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

$\pi^+e^+e^-$	[uu]	$< 2.7 \times 10^{-4}$	90%	979
$\pi^+\mu^+\mu^-$	[uu]	$< 2.6 \times 10^{-5}$	90%	968
$K^+e^+e^-$	C1	$< 1.6 \times 10^{-3}$	90%	922
$K^+\mu^+\mu^-$	C1	$< 3.6 \times 10^{-5}$	90%	909

$K^*(892)^+ \mu^+ \mu^-$	C1	< 1.4	$\times 10^{-3}$	90%	765
$\pi^+ e^\pm \mu^\mp$	LF	[gg] < 6.1	$\times 10^{-4}$	90%	976
$K^+ e^\pm \mu^\mp$	LF	[gg] < 6.3	$\times 10^{-4}$	90%	919
$\pi^- e^+ e^+$	L	< 6.9	$\times 10^{-4}$	90%	979
$\pi^- \mu^+ \mu^+$	L	< 2.9	$\times 10^{-5}$	90%	968
$\pi^- e^+ \mu^+$	L	< 7.3	$\times 10^{-4}$	90%	976
$K^- e^+ e^+$	L	< 6.3	$\times 10^{-4}$	90%	922
$K^- \mu^+ \mu^+$	L	< 1.3	$\times 10^{-5}$	90%	909
$K^- e^+ \mu^+$	L	< 6.8	$\times 10^{-4}$	90%	919
$K^*(892)^- \mu^+ \mu^+$	L	< 1.4	$\times 10^{-3}$	90%	765

$D_s^{*\pm}$ $\qquad\qquad\qquad\qquad I(J^P) = 0(?^?)$

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

Mass $m = 2112.3 \pm 0.5$ MeV $\quad (S = 1.1)$

$m_{D_s^{*\pm}} - m_{D_s^\pm} = 143.8 \pm 0.4$ 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)
$D_s^+ \gamma$	(94.2 ± 0.7) %	139
$D_s^+ \pi^0$	(5.8 ± 0.7) %	48

$D_{s0}^*(2317)^\pm$ $\qquad\qquad\qquad I(J^P) = 0(0^+)$

$\qquad\qquad\qquad\qquad\qquad$ J, P need confirmation.

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

Mass $m = 2317.8 \pm 0.6$ MeV $\quad (S = 1.1)$

$m_{D_{s0}^*(2317)^\pm} - m_{D_s^\pm} = 349.3 \pm 0.6$ MeV $\quad (S = 1.1)$

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)	p (MeV/c)
$D^+_s \pi^0$	seen	298
$D^+_s \pi^0 \pi^0$	not seen	205

$D_{s1}(2460)^\pm$ $I(J^P) = 0(1^+)$

Mass $m = 2459.6 \pm 0.6$ MeV   (S = 1.1)

$m_{D_{s1}(2460)^\pm} - m_{D^{*\pm}_s} = 347.2 \pm 0.8$ MeV   (S = 1.2)

$m_{D_{s1}(2460)^\pm} - m_{D^\pm_s} = 491.1 \pm 0.7$ 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 $\pm$11) %		297
$D^+_s \gamma$	(18 $\pm$ 4) %		442
$D^+_s \pi^+ \pi^-$	(4.3$\pm$ 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 $m = 2535.35 \pm 0.34 \pm 0.5$ MeV

Full width $\Gamma < 2.3$ MeV, CL = 90%

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

$D_{s1}(2536)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^*(2010)^+ K^0$	seen	149
$D^*(2007)^0 K^+$	seen	168
$D^+ K^0$	not seen	382
$D^0 K^+$	not seen	391
$D_s^{*+} \gamma$	possibly seen	388
$D_s^+ \pi^+ \pi^-$	seen	437

$D_{s2}(2573)^\pm$ $I(J^P) = 0(?^?)$

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

Mass $m = 2572.6 \pm 0.9$ MeV
Full width $\Gamma = 20 \pm 5$ MeV   (S = 1.3)

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

$D_{s2}(2573)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0 K^+$	seen	435
$D^*(2007)^0 K^+$	not seen	244

BOTTOM MESONS
$(B = \pm 1)$

$B^+ = u\overline{b}$, $B^0 = d\overline{b}$, $\overline{B}^0 = \overline{d}b$, $B^- = \overline{u}b$,   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-$\overline{B}^0$ mixing data are found in the B^0 section, while B^0_s-$\overline{B}^0_s$ mixing data and B-$\overline{B}$ mixing data for a B^0/B^0_s admixture are found in the B^0_s 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-$\overline{B}^0$ mixing, *CP* violation,

  branching fractions
- $B^\pm\,B^0$ Admixtures

  CP violation, branching fractions
- $B^\pm/B^0/B^0_s/b$-baryon Admixtures

  mean life, production fractions, branching fractions
- B^*

  mass
- $B_1(5721)^0$

  mass
- $B^*_2(5747)^0$

  mass
- B^0_s

  mass, mean life, B^0_s-$\overline{B}^0_s$ mixing, *CP* violation,

  branching fractions
- B^*_s

  mass
- $B_{s1}(5830)^0$

  mass
- $B^8_{s2}(5840)^0$

  mass
- $B^\pm_c$

  mass, mean life, branching fractions

At the end of Baryon Listings:

- Λ_b

  mass, mean life, branching fractions

- Σ_b

  mass

- Σ_b^*

  mass

- Ξ_b^0, Ξ_b^-

  mass, mean life, branching fractions

- Ω_b^-

  mass, branching fractions

- b-baryon Admixture

  mean life, branching fractions

$$\boxed{B^\pm} \qquad\qquad I(J^P) = \tfrac{1}{2}(0^-)$$

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

Mass $m_{B^\pm} = 5279.17 \pm 0.29$ MeV
Mean life $\tau_{B^\pm} = (1.638 \pm 0.011) \times 10^{-12}$ s
$c\tau = 491.1\ \mu$m

CP violation

$A_{CP}(B^+ \rightarrow J/\psi(1S)K^+) = 0.009 \pm 0.008 \quad (S = 1.3)$
$A_{CP}(B^+ \rightarrow J/\psi(1S)\pi^+) = 0.01 \pm 0.07 \quad (S = 1.3)$
$A_{CP}(B^+ \rightarrow J/\psi\rho^+) = -0.11 \pm 0.14$
$A_{CP}(B^+ \rightarrow J/\psi K^*(892)^+) = -0.048 \pm 0.033$
$A_{CP}(B^+ \rightarrow \eta_c K^+) = -0.16 \pm 0.08$
$A_{CP}(B^+ \rightarrow \psi(2S)\pi^+) = 0.02 \pm 0.09$
$A_{CP}(B^+ \rightarrow \psi(2S)K^+) = -0.025 \pm 0.024$
$A_{CP}(B^+ \rightarrow \psi(2S)K^*(892)^+) = 0.08 \pm 0.21$
$A_{CP}(B^+ \rightarrow \chi_{c1}(1P)\pi^+) = 0.07 \pm 0.18$
$A_{CP}(B^+ \rightarrow \chi_{c0}K^+) = -0.11 \pm 0.12$
$A_{CP}(B^+ \rightarrow \chi_{c1}K^+) = -0.009 \pm 0.033$
$A_{CP}(B^+ \rightarrow \chi_{c1}K^*(892)^+) = 0.5 \pm 0.5$
$A_{CP}(B^+ \rightarrow \overline{D}^0\pi^+) = -0.008 \pm 0.008$
$A_{CP}(B^+ \rightarrow D_{CP(+1)}\pi^+) = 0.035 \pm 0.024$
$A_{CP}(B^+ \rightarrow D_{CP(-1)}\pi^+) = 0.017 \pm 0.026$
$A_{CP}(B^+ \rightarrow \overline{D}^0 K^+) = 0.07 \pm 0.04$

$$r_B(B^+ \to D^0 K^+) = 0.101 \pm 0.032$$
$$\delta_B(B^+ \to D^0 K^+) = 126 \pm 21 \text{ degrees}$$
$$r_B(B^+ \to D K^{*+}) = 0.27 \pm 0.17 \quad (S = 1.9)$$
$$\delta_B(B^+ \to D K^{*+}) = 157 \pm 70 \text{ degrees} \quad (S = 2.0)$$
$$A_{CP}(B^+ \to [K^- \pi^+]_D K^+) = -0.1^{+0.9}_{-1.1}$$
$$A_{CP}(B^+ \to [K^- \pi^+]_{\overline{D}} K^*(892)^+) = -0.2 \pm 0.6$$
$$A_{CP}(B^+ \to [K^- \pi^+]_D \pi^+) = -0.02 \pm 0.16$$
$$A_{CP}(B^+ \to [\pi^+ \pi^- \pi^0]_D K^+) = -0.02 \pm 0.15$$
$$A_{CP}(B^+ \to D_{CP(+1)} K^+) = 0.21 \pm 0.10 \quad (S = 1.2)$$
$$A_{CP}(B^+ \to D_{CP(-1)} K^+) = -0.10 \pm 0.08$$
$$A_{CP}(B^+ \to \overline{D}^{*0} \pi^+) = -0.014 \pm 0.015$$
$$A_{CP}(B^+ \to (D^*_{CP(+1)})^0 \pi^+) = -0.02 \pm 0.05$$
$$A_{CP}(B^+ \to (D^*_{CP(-1)})^0 \pi^+) = -0.09 \pm 0.05$$
$$A_{CP}(B^+ \to D^{*0} K^+) = -0.07 \pm 0.04$$
$$r^*_B(B^+ \to D^{*0} K^+) = 0.14 \pm 0.05$$
$$\delta^*_B(B^+ \to D^{*0} K^+) = 299 \pm 24 \text{ degrees}$$
$$A_{CP}(B^+ \to D^{*0}_{CP(+1)} K^+) = -0.12 \pm 0.08$$
$$A_{CP}(B^+ \to D^*_{CP(-1)} K^+) = 0.07 \pm 0.10$$
$$A_{CP}(B^+ \to D_{CP(+1)} K^*(892)^+) = -0.08 \pm 0.21$$
$$A_{CP}(B^+ \to D_{CP(-1)} K^*(892)^+) = -0.3 \pm 0.4$$
$$A_{CP}(B^+ \to D^{*+} \overline{D}^{*0}) = -0.15 \pm 0.11$$
$$A_{CP}(B^+ \to D^{*+} \overline{D}^0) = -0.06 \pm 0.13$$
$$A_{CP}(B^+ \to D^+ \overline{D}^{*0}) = 0.13 \pm 0.18$$
$$A_{CP}(B^+ \to D^+ \overline{D}^0) = -0.03 \pm 0.07$$
$$A_{CP}(B^+ \to K^0_S \pi^+) = 0.009 \pm 0.029 \quad (S = 1.2)$$
$$A_{CP}(B^+ \to K^+ \pi^0) = 0.051 \pm 0.025$$
$$A_{CP}(B^+ \to \eta' K^+) = 0.016 \pm 0.019$$
$$A_{CP}(B^+ \to \eta' K^*(892)^+) = -0.30^{+0.33}_{-0.40}$$
$$A_{CP}(B^+ \to \eta K^+) = -0.27 \pm 0.09$$
$$A_{CP}(B^+ \to \eta K^*(892)^+) = 0.02 \pm 0.06$$
$$A_{CP}(B^+ \to \eta K^*_0(1430)^+) = 0.05 \pm 0.13$$
$$A_{CP}(B^+ \to \eta K^*_2(1430)^+) = -0.45 \pm 0.30$$
$$A_{CP}(B^+ \to \omega K^+) = 0.02 \pm 0.05$$
$$A_{CP}(B^+ \to \omega K^{*+}) = 0.29 \pm 0.35$$
$$A_{CP}(B^+ \to \omega (K\pi)^{*+}_0) = -0.10 \pm 0.09$$
$$A_{CP}(B^+ \to \omega K^*_2(1430)^+) = 0.14 \pm 0.15$$
$$A_{CP}(B^+ \to K^*(892)^+ \pi^0) = 0.04 \pm 0.29$$
$$A_{CP}(B^+ \to K^{*0} \pi^+) = -0.04 \pm 0.09 \quad (S = 2.1)$$
$$A_{CP}(B^+ \to K^+ \pi^- \pi^+) = 0.038 \pm 0.022$$
$$A_{CP}(B^+ \to f_0(980) K^+) = -0.10^{+0.05}_{-0.04}$$

$$A_{CP}(B^+ \to f_2(1270)K^+) = -0.68^{+0.19}_{-0.17}$$
$$A_{CP}(B^+ \to f_X(1300)K^+) = 0.28 \pm 0.30$$
$$A_{CP}(B^+ \to \rho^0 K^+) = 0.37 \pm 0.10$$
$$A_{CP}(B^+ \to K_0^*(1430)^0 \pi^+) = 0.055 \pm 0.033$$
$$A_{CP}(B^+ \to K_2^*(1430)^0 \pi^+) = 0.05^{+0.29}_{-0.24}$$
$$A_{CP}(B^+ \to K^0 \rho^+) = (-0.12 \pm 0.17) \times 10^{-6}$$
$$A_{CP}(B^+ \to K^{*+} \pi^+ \pi^-) = 0.07 \pm 0.08$$
$$A_{CP}(B^+ \to p\overline{\Lambda}\gamma) = 0.17 \pm 0.17$$
$$A_{CP}(B^+ \to p\overline{\Lambda}\pi^0) = 0.01 \pm 0.17$$
$$A_{CP}(B^+ \to \rho^0 K^*(892)^+)$$
$$A_{CP}(B^+ \to K^*(892)^+ f_0(980)) = -0.34 \pm 0.21$$
$$A_{CP}(B^+ \to a_1^+ K^0) = 0.12 \pm 0.11$$
$$A_{CP}(B^+ \to b_1^+ K^0) = -0.03 \pm 0.15$$
$$A_{CP}(B^+ \to K^*(892)^0 \rho^+) = -0.01 \pm 0.16$$
$$A_{CP}(B^+ \to b_1^0 K^+) = -0.46 \pm 0.20$$
$$A_{CP}(B^+ \to K^0 K^+) = 0.12 \pm 0.18$$
$$A_{CP}(B^+ \to K^+ K_S^0 K_S^0) = -0.04 \pm 0.11$$
$$A_{CP}(B^+ \to K^+ K^- \pi^+) = 0.00 \pm 0.10$$
$$A_{CP}(B^+ \to K^+ K^- K^+) = -0.017 \pm 0.030$$
$$A_{CP}(B^+ \to \phi K^+) = -0.01 \pm 0.06$$
$$A_{CP}(B^+ \to X_0(1550)K^+) = -0.04 \pm 0.07$$
$$A_{CP}(B^+ \to K^{*+} K^+ K^-) = 0.11 \pm 0.09$$
$$A_{CP}(B^+ \to \phi K^*(892)^+) = -0.01 \pm 0.08$$
$$A_{CP}(B^+ \to \phi(K\pi)_0^{*+}) = 0.04 \pm 0.16$$
$$A_{CP}(B^+ \to \phi K_1(1270)^+) = 0.15 \pm 0.20$$
$$A_{CP}(B^+ \to \phi K_2^*(1430)^+) = -0.23 \pm 0.20$$
$$A_{CP}(B^+ \to \eta K^+ \gamma) = -0.12 \pm 0.07$$
$$A_{CP}(B^+ \to \phi K^+ \gamma) = -0.26 \pm 0.15$$
$$A_{CP}(B^+ \to \rho^+ \gamma) = -0.11 \pm 0.33$$
$$A_{CP}(B^+ \to \pi^+ \pi^0) = 0.06 \pm 0.05$$
$$A_{CP}(B^+ \to \pi^+ \pi^- \pi^+) = -0.01 \pm 0.08$$
$$A_{CP}(B^+ \to \rho^0 \pi^+) = -0.07 \pm 0.13$$
$$A_{CP}(B^+ \to f_2(1270)\pi^+) = 0.00 \pm 0.25$$
$$A_{CP}(B^+ \to \rho^+ \pi^0) = 0.02 \pm 0.11$$
$$A_{CP}(B^+ \to \rho^+ \rho^0) = -0.05 \pm 0.05$$
$$A_{CP}(B^+ \to b_1^0 \pi^+) = 0.05 \pm 0.16$$
$$A_{CP}(B^+ \to \omega \pi^+) = -0.04 \pm 0.06$$
$$A_{CP}(B^+ \to \omega \rho^+) = -0.20 \pm 0.09$$
$$A_{CP}(B^+ \to \eta \pi^+) = -0.16 \pm 0.07 \quad (S = 1.1)$$
$$A_{CP}(B^+ \to \eta' \pi^+) = 0.21 \pm 0.15$$
$$A_{CP}(B^+ \to \eta \rho^+) = 0.11 \pm 0.11$$

$$A_{CP}(B^+ \to \eta' \rho^+) = 0.04 \pm 0.28$$
$$A_{CP}(B^+ \to p\overline{p}\pi^+) = 0.00 \pm 0.04$$
$$A_{CP}(B^+ \to p\overline{p}K^+) = -0.16 \pm 0.07$$
$$A_{CP}(B^+ \to p\overline{p}K^*(892)^+) = 0.21 \pm 0.16 \quad (S = 1.4)$$
$$A_{CP}(B^+ \to K^+ \ell^+ \ell^-) = -0.07 \pm 0.22$$
$$A_{CP}(B^+ \to K^{*+} \ell^+ \ell^-) = 0.03 \pm 0.23$$
$$\gamma(B^+ \to D^{(*)} K^{(*)+}) = (62 \pm 15)^\circ$$

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% $B^0 \overline{B}^0$ 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.*, $B \to D^{\pm}$ anything, 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	p (MeV/c)
Semileptonic and leptonic modes				
$\ell^+ \nu_\ell$ anything	[iii]	(10.99 $\pm$0.28) %		–
$e^+ \nu_e X_c$		(10.8 $\pm$0.4) %		–
$D \ell^+ \nu_\ell$ anything		(9.8 $\pm$0.7) %		–
$\overline{D}^0 \ell^+ \nu_\ell$	[iii]	(2.24 $\pm$0.11) %		2310
$\overline{D}^0 \tau^+ \nu_\tau$		(7 $\pm$4) $\times 10^{-3}$		1911
$\overline{D}^*(2007)^0 \ell^+ \nu_\ell$	[iii]	(5.68 $\pm$0.19) %		2258
$\overline{D}^*(2007)^0 \tau^+ \nu_\tau$		(2.2 $\pm$0.6) %		1839
$D^- \pi^+ \ell^+ \nu_\ell$		(4.2 $\pm$0.5) $\times 10^{-3}$		2306
$\overline{D}_0^*(2420)^0 \ell^+ \nu_\ell \times$ $\mathrm{B}(\overline{D}_0^{*0} \to D^+ \pi^-)$		(2.5 $\pm$0.5) $\times 10^{-3}$		–
$\overline{D}_2^*(2460)^0 \ell^+ \nu_\ell \times$ $\mathrm{B}(\overline{D}_2^{*0} \to D^+ \pi^-)$		(1.67 $\pm$0.30) $\times 10^{-3}$	S=1.2	2066
$D^{(*)} n\pi \ell^+ \nu_\ell (n \geq 1)$		(1.86 $\pm$0.26) %		–
$D^{*-} \pi^+ \ell^+ \nu_\ell$		(6.1 $\pm$0.6) $\times 10^{-3}$		2254
$\overline{D}_1(2420)^0 \ell^+ \nu_\ell \times \mathrm{B}(\overline{D}_1^0 \to D^{*+} \pi^-)$		(3.2 $\pm$0.4) $\times 10^{-3}$		2084

$\overline{D}'_1(2430)^0 \, \ell^+ \nu_\ell \times$ $\mathrm{B}(\overline{D}'^0_1 \to D^{*+}\pi^-)$		(2.7 ± 0.6) $\times 10^{-3}$		–
$\overline{D}^*_2(2460)^0 \, \ell^+ \nu_\ell \times$ $\mathrm{B}(\overline{D}^{*0}_2 \to D^{*+}\pi^-)$		(1.8 ± 0.7) $\times 10^{-3}$		2066
$\pi^0 \ell^+ \nu_\ell$		(7.7 ± 1.2) $\times 10^{-5}$		2638
$\eta \, \ell^+ \nu_\ell$		(6 ± 4) $\times 10^{-5}$		2611
$\eta' \ell^+ \nu_\ell$		(1.7 ± 2.2) $\times 10^{-5}$		2553
$\omega \, \ell^+ \nu_\ell$	[*iii*]	(1.3 ± 0.6) $\times 10^{-4}$		2582
$\rho^0 \ell^+ \nu_\ell$	[*iii*]	(1.28 ± 0.18) $\times 10^{-4}$		2583
$p\bar{p}e^+ \nu_e$		< 5.2 $\times 10^{-3}$	CL=90%	2467
$e^+ \nu_e$		< 5.2 $\times 10^{-6}$	CL=90%	2640
$\mu^+ \nu_\mu$		< 1.7 $\times 10^{-6}$	CL=90%	2639
$\tau^+ \nu_\tau$		(1.4 ± 0.4) $\times 10^{-4}$		2341
$e^+ \nu_e \gamma$		< 2.0 $\times 10^{-4}$	CL=90%	2640
$\mu^+ \nu_\mu \gamma$		< 5.2 $\times 10^{-5}$	CL=90%	2639

Inclusive modes

$D^0 X$	(8.6 ± 0.7) %	–
$\overline{D}^0 X$	(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 $^{+0.9}_{-0.6}$) %	–
$\overline{\Lambda}^-_c X$	(2.8 $^{+1.1}_{-0.9}$) %	–
$\bar{c} X$	(97 ± 4) %	–
$c X$	(23.4 $^{+2.2}_{-1.8}$) %	–
$\bar{c} c X$	(120 ± 6) %	–

D, D^*, or D_s modes

$\overline{D}^0 \pi^+$		(4.84 ± 0.15) $\times 10^{-3}$	2308
$D_{CP(+1)} \pi^+$	[*jjj*]	(2.3 ± 0.4) $\times 10^{-3}$	–
$D_{CP(-1)} \pi^+$	[*jjj*]	(2.0 ± 0.4) $\times 10^{-3}$	–
$\overline{D}^0 \rho^+$		(1.34 ± 0.18) %	2237
$\overline{D}^0 K^+$		(3.68 ± 0.33) $\times 10^{-4}$	2280
$D_{CP(+1)} K^+$	[*jjj*]	(1.95 ± 0.27) $\times 10^{-4}$	–
$D_{CP(-1)} K^+$	[*jjj*]	(1.89 ± 0.27) $\times 10^{-4}$	–
$[K^- \pi^+]_D K^+$	[*kkk*] <	2.8 $\times 10^{-7}$ CL=90%	–
$[K^+ \pi^-]_D K^+$	[*kkk*] <	4 $\times 10^{-5}$ CL=90%	–
$[K^- \pi^+]_D \pi^+$	[*kkk*]	(6.3 ± 1.1) $\times 10^{-7}$	–
$[K^+ \pi^-]_D \pi^+$		(1.9 ± 0.4) $\times 10^{-4}$	–

$[\pi^+\pi^-\pi^0]_D\,K^-$		(	4.6	±0.9	) $\times 10^{-6}$	–
$\overline{D}^0\,K^*(892)^+$		(	5.3	±0.4	) $\times 10^{-4}$	2213
$D_{CP(-1)}\,K^*(892)^+$	[jjj]	(	1.7	±0.7	) $\times 10^{-4}$	–
$D_{CP(+1)}\,K^*(892)^+$	[jjj]	(	5.2	±1.2	) $\times 10^{-4}$	–
$\overline{D}^0\,K^+\overline{K}^0$		(	5.5	±1.6	) $\times 10^{-4}$	2189
$\overline{D}^0\,K^+\overline{K}^*(892)^0$		(	7.5	±1.7	) $\times 10^{-4}$	2071
$\overline{D}^0\,\pi^+\pi^+\pi^-$		(	1.1	±0.4	) %	2289
$\overline{D}^0\,\pi^+\pi^+\pi^-$ nonresonant		(	5	±4	) $\times 10^{-3}$	2289
$\overline{D}^0\,\pi^+\rho^0$		(	4.2	±3.0	) $\times 10^{-3}$	2207
$\overline{D}^0\,a_1(1260)^+$		(	4	±4	) $\times 10^{-3}$	2123
$\overline{D}^0\,\omega\pi^+$		(	4.1	±0.9	) $\times 10^{-3}$	2206
$D^*(2010)^-\pi^+\pi^+$		(	1.35	±0.22	) $\times 10^{-3}$	2247
$D^-\pi^+\pi^+$		(	1.02	±0.16	) $\times 10^{-3}$	2299
$D^+\,K^0$		<	5.0		$\times 10^{-6}$ CL=90%	2278
$\overline{D}^*(2007)^0\pi^+$		(	5.19	±0.26	) $\times 10^{-3}$	2256
$\overline{D}^{*0}_{CP(+1)}\pi^+$	[lll]	(	2.9	±0.6	) $\times 10^{-3}$	–
$D^{*0}_{CP(-1)}\pi^+$	[lll]	(	2.5	±1.0	) $\times 10^{-3}$	–
$\overline{D}^*(2007)^0\omega\pi^+$		(	4.5	±1.2	) $\times 10^{-3}$	2149
$\overline{D}^*(2007)^0\rho^+$		(	9.8	±1.7	) $\times 10^{-3}$	2181
$\overline{D}^*(2007)^0\,K^+$		(	4.16	±0.33	) $\times 10^{-4}$	2227
$\overline{D}^{*0}_{CP(+1)}\,K^+$	[lll]	(	2.7	±0.4	) $\times 10^{-4}$	–
$\overline{D}^{*0}_{CP(-1)}\,K^+$	[lll]	(	2.29	±0.32	) $\times 10^{-4}$	–
$\overline{D}^*(2007)^0\,K^*(892)^+$		(	8.1	±1.4	) $\times 10^{-4}$	2156
$\overline{D}^*(2007)^0\,K^+\overline{K}^0$		<	1.06		$\times 10^{-3}$ CL=90%	2132
$\overline{D}^*(2007)^0\,K^+\,K^*(892)^0$		(	1.5	±0.4	) $\times 10^{-3}$	2008
$\overline{D}^*(2007)^0\,\pi^+\pi^+\pi^-$		(	1.03	±0.12	) %	2236
$\overline{D}^*(2007)^0\,a_1(1260)^+$		(	1.9	±0.5	) %	2062
$\overline{D}^*(2007)^0\,\pi^-\pi^+\pi^+\pi^0$		(	1.8	±0.4	) %	2219
$\overline{D}^{*0}\,3\pi^+2\pi^-$		(	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
$\overline{D}^{**0}\pi^+$	[mmm]	(	5.9	±1.3	) $\times 10^{-3}$	–
$\overline{D}^*_1(2420)^0\pi^+$		(	1.5	±0.6	) $\times 10^{-3}$ S=1.3	2081
$\overline{D}_1(2420)^0\pi^+\times$ B$(\overline{D}^0_1 \rightarrow$ $\overline{D}^0\pi^+\pi^-)$		(	1.9	$^{+0.5}_{-0.6}$	) $\times 10^{-4}$	2081
$\overline{D}^*_2(2462)^0\pi^+$ $\times$ B$(\overline{D}^*_2(2462)^0 \rightarrow D^-\pi^+)$		(	3.4	±0.8	) $\times 10^{-4}$	–
$\overline{D}^*_0(2400)^0\pi^+$ $\times$ B$(\overline{D}^*_0(2400)^0 \rightarrow D^-\pi^+)$		(	6.1	±1.9	) $\times 10^{-4}$	2113

$\overline{D}_1(2421)^0 \pi^+$ $\times \ \mathrm{B}(\overline{D}_1(2421)^0 \to D^{*-}\pi^+)$	(6.8	± 1.5) $\times 10^{-4}$			−
$\overline{D}_2^*(2462)^0 \pi^+$ $\times \ \mathrm{B}(\overline{D}_2^*(2462)^0 \to D^{*-}\pi^+)$	(1.8	± 0.5) $\times 10^{-4}$			−
$\overline{D}_1'(2427)^0 \pi^+$ $\times \ \mathrm{B}(\overline{D}_1'(2427)^0 \to D^{*-}\pi^+)$	(5.0	± 1.2) $\times 10^{-4}$			−
$\overline{D}_1(2420)^0 \pi^+ \times \mathrm{B}(\overline{D}_1^0 \to$ $\overline{D}^{*0}\pi^+\pi^-)$	< 6	$\times 10^{-6}$	CL=90%	2081
$\overline{D}_1^*(2420)^0 \rho^+$	< 1.4	$\times 10^{-3}$	CL=90%	1995
$\overline{D}_2^*(2460)^0 \pi^+$	< 1.3	$\times 10^{-3}$	CL=90%	2063
$\overline{D}_2^*(2460)^0 \pi^+ \times \mathrm{B}(\overline{D}_2^{*0} \to$ $\overline{D}^{*0}\pi^+\pi^-)$	< 2.2	$\times 10^{-5}$	CL=90%	2063
$\overline{D}_2^*(2460)^0 \rho^+$	< 4.7	$\times 10^{-3}$	CL=90%	1976
$\overline{D}^0 D_s^+$	(1.02	± 0.17) %		1815
$D_{s0}(2317)^+ \overline{D}^0 \times$ $\mathrm{B}(D_{s0}(2317)^+ \to D_s^+\pi^0)$	(7.4	$^{+2.2}_{-1.7}$) $\times 10^{-4}$		1605
$D_{s0}(2317)^+ \overline{D}^0 \times$ $\mathrm{B}(D_{s0}(2317)^+ \to D_s^{*+}\gamma)$	< 7.6	$\times 10^{-4}$	CL=90%	1605
$D_{s0}(2317)^+ \overline{D}^*(2007)^0 \times$ $\mathrm{B}(D_{s0}(2317)^+ \to D_s^+\pi^0)$	(9	± 7) $\times 10^{-4}$		1511
$D_{sJ}(2457)^+ \overline{D}^0$	(3.1	$^{+1.0}_{-0.9}$) $\times 10^{-3}$		−
$D_{sJ}(2457)^+ \overline{D}^0 \times$ $\mathrm{B}(D_{sJ}(2457)^+ \to D_s^+\gamma)$	(4.7	$^{+1.3}_{-1.1}$) $\times 10^{-4}$		−
$D_{sJ}(2457)^+ \overline{D}^0 \times$ $\mathrm{B}(D_{sJ}(2457)^+ \to$ $D_s^+\pi^+\pi^-)$	< 2.2	$\times 10^{-4}$	CL=90%	−
$D_{sJ}(2457)^+ \overline{D}^0 \times$ $\mathrm{B}(D_{sJ}(2457)^+ \to D_s^+\pi^0)$	< 2.7	$\times 10^{-4}$	CL=90%	−
$D_{sJ}(2457)^+ \overline{D}^0 \times$ $\mathrm{B}(D_{sJ}(2457)^+ \to D_s^{*+}\gamma)$	< 9.8	$\times 10^{-4}$	CL=90%	−
$D_{sJ}(2457)^+ \overline{D}^*(2007)^0$	(1.20	± 0.30) %		−
$D_{sJ}(2457)^+ \overline{D}^*(2007)^0 \times$ $\mathrm{B}(D_{sJ}(2457)^+ \to D_s^+\gamma)$	(1.4	$^{+0.7}_{-0.6}$) $\times 10^{-3}$		−
$\overline{D}^0 D_{s1}(2536)^+ \times$ $\mathrm{B}(D_{s1}(2536)^+ \to$ $D^*(2007)^0 K^+)$	(2.2	± 0.7) $\times 10^{-4}$		1447
$\overline{D}^*(2007)^0 D_{s1}(2536)^+ \times$ $\mathrm{B}(D_{s1}(2536)^+ \to$ $D^*(2007)^0 K^+)$	(5.5	± 1.6) $\times 10^{-4}$		1338

$\overline{D}^0 D_{s1}(2536)^+ \times$ $B(D_{s1}(2536)^+ \to D^{*+} K^0)$	(	2.3	± 1.1	) $\times 10^{-4}$		1447
$\overline{D}^0 D_{sJ}(2700)^+ \times$ $B(D_{sJ}(2700)^+ \to D^0 K^+)$	(	1.13	$^{+0.26}_{-0.40}$	) $\times 10^{-3}$		–
$\overline{D}^{*0} D_{s1}(2536)^+ \times$ $B(D_{s1}(2536)^+ \to D^{*+} K^0)$	(	3.9	± 2.6	) $\times 10^{-4}$		1338
$\overline{D}^{*0} D_{sJ}(2573)^+ \times$ $B(D_{sJ}(2573)^+ \to D^0 K^+)$	<	2		$\times 10^{-4}$	CL=90%	1306
$\overline{D}^*(2007)^0 D_{sJ}(2573)^+ \times$ $B(D_{sJ}(2573)^+ \to D^0 K^+)$	<	5		$\times 10^{-4}$	CL=90%	1306
$\overline{D}^0 D_s^{*+}$	(	7.8	± 1.6	) $\times 10^{-3}$		1734
$\overline{D}^*(2007)^0 D_s^+$	(	8.4	± 1.7	) $\times 10^{-3}$		1737
$\overline{D}^*(2007)^0 D_s^{*+}$	(	1.74	± 0.23	) %		1651
$D_s^{(*)+} \overline{D}^{**0}$	(	2.7	± 1.2	) %		–
$\overline{D}^*(2007)^0 D^*(2010)^+$	(	8.1	± 1.7	) $\times 10^{-4}$		1713
$\overline{D}^0 D^*(2010)^+ +$ $\overline{D}^*(2007)^0 D^+$	<	1.30		%	CL=90%	1792
$\overline{D}^0 D^*(2010)^+$	(	3.9	± 0.5	) $\times 10^{-4}$		1792
$\overline{D}^0 D^+$	(	3.8	± 0.4	) $\times 10^{-4}$		1866
$\overline{D}^0 D^+ K^0$	<	2.8		$\times 10^{-3}$	CL=90%	1571
$D^+ \overline{D}^*(2007)^0$	(	6.3	± 1.7	) $\times 10^{-4}$		1791
$\overline{D}^*(2007)^0 D^+ K^0$	<	6.1		$\times 10^{-3}$	CL=90%	1474
$\overline{D}^0 \overline{D}^*(2010)^+ K^0$	(	5.2	± 1.2	) $\times 10^{-3}$		1476
$\overline{D}^*(2007)^0 D^*(2010)^+ K^0$	(	7.8	± 2.6	) $\times 10^{-3}$		1362
$\overline{D}^0 D^0 K^+$	(	2.10	± 0.26	) $\times 10^{-3}$		1577
$\overline{D}^*(2007)^0 D^0 K^+$	<	3.8		$\times 10^{-3}$	CL=90%	1481
$\overline{D}^0 D^*(2007)^0 K^+$	(	4.7	± 1.0	) $\times 10^{-3}$		1481
$\overline{D}^*(2007)^0 D^*(2007)^0 K^+$	(	5.3	± 1.6	) $\times 10^{-3}$		1368
$D^- D^+ K^+$	<	4		$\times 10^{-4}$	CL=90%	1570
$D^- D^*(2010)^+ K^+$	<	7		$\times 10^{-4}$	CL=90%	1475
$D^*(2010)^- D^+ K^+$	(	1.5	± 0.4	) $\times 10^{-3}$		1475
$D^*(2010)^- D^*(2010)^+ K^+$	<	1.8		$\times 10^{-3}$	CL=90%	1363
$(\overline{D} + \overline{D}^*)(D + D^*) K$	(	3.5	± 0.6	) %		–
$D_s^+ \pi^0$	(	1.6	± 0.6	) $\times 10^{-5}$		2270
$D_s^{*+} \pi^0$	<	2.7		$\times 10^{-4}$	CL=90%	2215
$D_s^+ \eta$	<	4		$\times 10^{-4}$	CL=90%	2235
$D_s^{*+} \eta$	<	6		$\times 10^{-4}$	CL=90%	2178
$D_s^+ \rho^0$	<	3.1		$\times 10^{-4}$	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

$D_s^{*+} a_1(1260)^0$	<	1.4	$\times 10^{-3}$	CL=90%	2014
$D_s^+ \phi$	<	1.9	$\times 10^{-6}$	CL=90%	2141
$D_s^{*+} \phi$	<	1.2	$\times 10^{-5}$	CL=90%	2079
$D_s^+ \overline{K}^0$	<	9	$\times 10^{-4}$	CL=90%	2241
$D_s^{*+} \overline{K}^0$	<	9	$\times 10^{-4}$	CL=90%	2184
$D_s^+ \overline{K}^*(892)^0$	<	4	$\times 10^{-4}$	CL=90%	2172
$D_s^{*+} \overline{K}^*(892)^0$	<	4	$\times 10^{-4}$	CL=90%	2112
$D_s^- \pi^+ K^+$	(	2.0 ± 0.4	$) \times 10^{-4}$		2222
$D_s^{*-} \pi^+ K^+$	(	1.7 ± 0.4	$) \times 10^{-4}$		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
$D_s^- K^+ K^+$	(	1.1 ± 0.4	$) \times 10^{-5}$		2149
$D_s^{*-} K^+ K^+$	<	1.5	$\times 10^{-5}$	CL=90%	2088

Charmonium modes

$\eta_c K^+$	(	9.1 ± 1.3	$) \times 10^{-4}$		1753
$\eta_c K^*(892)^+$	(	1.2 $^{+0.7}_{-0.6}$	$) \times 10^{-3}$		1648
$\eta_c(2S) K^+$	(	3.4 ± 1.8	$) \times 10^{-4}$		1320
$J/\psi(1S) K^+$	(	1.007 ± 0.035	$) \times 10^{-3}$		1683
$J/\psi(1S) K^+ \pi^+ \pi^-$	(	1.07 ± 0.19	$) \times 10^{-3}$	S=1.9	1612
$h_c(1P) K^+ \times$ B$(h_c(1P) \to$ $J/\psi \pi^+ \pi^-)$	<	3.4	$\times 10^{-6}$	CL=90%	1401
$X(3872) K^+$	<	3.2	$\times 10^{-4}$	CL=90%	1140
$X(3872) K^+ \times$ B$(X \to$ $J/\psi \pi^+ \pi^-)$	(	9.5 ± 1.9	$) \times 10^{-6}$	S=1.3	1140
$X(3872) K^+ \times$ B$(X \to J/\psi \gamma)$	(	3.3 ± 1.0	$) \times 10^{-6}$		1140
$X(3872) K^+ \times$ B$(X \to D^0 \overline{D}^0)$	<	6.0	$\times 10^{-5}$	CL=90%	1140
$X(3872) K^+ \times$ B$(X \to D^+ D^-)$	<	4.0	$\times 10^{-5}$	CL=90%	1140
$X(3872) K^+ \times$ B$(X \to D^0 \overline{D}^0 \pi^0)$	(	1.0 ± 0.4	$) \times 10^{-4}$		1140
$X(3872) K^+ \times$ B$(X \to \overline{D}^{*0} D^0)$	(	1.7 ± 0.6	$) \times 10^{-4}$		1140
$X(3872) K^+$ $\times$ B$(X(3872) \to J/\psi(1S) \eta)$	<	7.7	$\times 10^{-6}$	CL=90%	1140
$X(3872)^+ K^0 \times$ B$(X(3872)^+ \to [nnn]$ $J/\psi(1S) \pi^+ \pi^0)$	<	2.2	$\times 10^{-5}$	CL=90%	–
$X(4260)^0 K^+ \times$ B$(X^0 \to$ $J/\psi \pi^+ \pi^-)$	<	2.9	$\times 10^{-5}$	CL=95%	–
$X(3945)^0 K^+ \times$ B$(X^0 \to$ $J/\psi \gamma)$	<	1.4	$\times 10^{-5}$	CL=90%	–
$Z(3930)^0 K^+ \times$ B$(Z^0 \to$ $J/\psi \gamma)$	<	2.5	$\times 10^{-6}$	CL=90%	–

$J/\psi(1S)K^*(892)^+$	(	1.43 ± 0.08) $\times 10^{-3}$		1571
$J/\psi(1S)K(1270)^+$	(	1.8 ± 0.5) $\times 10^{-3}$		1390
$J/\psi(1S)K(1400)^+$	<	5 $\times 10^{-4}$	CL=90%	1308
$J/\psi(1S)\eta K^+$	(	1.08 ± 0.33) $\times 10^{-4}$		1510
$J/\psi(1S)\eta' K^+$	<	8.8 $\times 10^{-5}$	CL=90%	1273
$J/\psi(1S)\phi K^+$	(	5.2 ± 1.7) $\times 10^{-5}$	S=1.2	1227
$J/\psi(1S)\omega K^+$ nonresonant	(	3.5 ± 0.4) $\times 10^{-4}$		1388
$J/\psi(1S)\pi^+$	(	4.9 ± 0.6) $\times 10^{-5}$	S=1.5	1727
$J/\psi(1S)\rho^+$	(	5.0 ± 0.8) $\times 10^{-5}$		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
$J/\psi(1S)p\overline{\Lambda}$	(	1.18 ± 0.31) $\times 10^{-5}$		567
$J/\psi(1S)\overline{\Sigma}^0 p$	<	1.1 $\times 10^{-5}$	CL=90%	–
$J/\psi(1S)D^+$	<	1.2 $\times 10^{-4}$	CL=90%	870
$J/\psi(1S)\overline{D}^0\pi^+$	<	2.5 $\times 10^{-5}$	CL=90%	665
$\psi(2S)\pi^+$	(	2.44 ± 0.30) $\times 10^{-5}$		1347
$\psi(2S)K^+$	(	6.48 ± 0.35) $\times 10^{-4}$		1284
$\psi(2S)K^*(892)^+$	(	6.7 ± 1.4) $\times 10^{-4}$	S=1.3	1115
$\psi(2S)K^+\pi^+\pi^-$	(	1.9 ± 1.2) $\times 10^{-3}$		1178
$\psi(3770)K^+$	(	4.9 ± 1.3) $\times 10^{-4}$		1218
$\psi(3770)K^+ \times$ B$(\psi \to D^0\overline{D}^0)$	(	1.6 ± 0.4) $\times 10^{-4}$	S=1.1	1218
$\psi(3770)K^+ \times$ B$(\psi \to D^+D^-)$	(	9.4 ± 3.5) $\times 10^{-5}$		1218
$\chi_{c0}\pi^+ \times$B$(\chi_{c0} \to \pi^+\pi^-)$	<	3 $\times 10^{-7}$	CL=90%	–
$\chi_{c0}(1P)K^+$	(	$1.43 {}^{+0.21}_{-0.17}$) $\times 10^{-4}$		1478
$\chi_{c0}K^*(892)^+$	<	2.1 $\times 10^{-4}$	CL=90%	–
$\chi_{c2}K^+$	<	2.9 $\times 10^{-5}$	CL=90%	–
$\chi_{c2}K^*(892)^+$	<	1.2 $\times 10^{-5}$	CL=90%	–
$\chi_{c1}(1P)\pi^+$	(	2.2 ± 0.5) $\times 10^{-5}$		1468
$\chi_{c1}(1P)K^+$	(	5.1 ± 0.5) $\times 10^{-4}$	S=1.6	1412
$\chi_{c1}(1P)K^*(892)^+$	(	3.6 ± 0.9) $\times 10^{-4}$		1265
$h_c(1P)K^+$	<	3.8 $\times 10^{-5}$		1401

K or K* modes

$K^0\pi^+$	(	2.31 ± 0.10) $\times 10^{-5}$		2614
$K^+\pi^0$	(	1.29 ± 0.06) $\times 10^{-5}$		2615
$\eta' K^+$	(	7.00 ± 0.24) $\times 10^{-5}$		2528
$\eta' K^*(892)^+$	(	4.9 ± 2.0) $\times 10^{-6}$		2472
ηK^+	(	2.6 ± 0.5) $\times 10^{-6}$	S=2.4	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$(\eta(1295) \to$ $\eta\pi\pi)$	(	$2.9 {}^{+0.8}_{-0.7}$) $\times 10^{-6}$		2455

$\eta(1405)K^+ \times$ B$(\eta(1405) \to \eta\pi\pi)$	<	1.3	$\times 10^{-6}$	CL=90%	2425
$\eta(1405)K^+ \times$ B$(\eta(1405) \to K^*K)$	<	1.2	$\times 10^{-6}$	CL=90%	2425
$\eta(1475)K^+ \times$ B$(\eta(1475) \to K^*K)$	(	1.38 $^{+0.21}_{-0.18}$	$) \times 10^{-5}$		2406
$f_1(1285)K^+$	<	2.0	$\times 10^{-6}$	CL=90%	2458
$f_1(1420)K^+ \times$ B$(f_1(1420) \to \eta\pi\pi)$	<	2.9	$\times 10^{-6}$	CL=90%	2420
$f_1(1420)K^+ \times$ B$(f_1(1420) \to K^*K)$	<	4.1	$\times 10^{-6}$	CL=90%	2420
$\phi(1680)K^+ \times$ B$(\phi(1680) \to K^*K)$	<	3.4	$\times 10^{-6}$	CL=90%	2344
ωK^+	(	6.7 ± 0.8	$) \times 10^{-6}$	S=1.8	2557
$\omega K^*(892)^+$	<	7.4	$\times 10^{-6}$	CL=90%	2503
$\omega (K\pi)_0^{*+}$	(	2.7 ± 0.4	$) \times 10^{-5}$		–
$\omega K_0^*(1430)^+$	(	2.4 ± 0.5	$) \times 10^{-5}$		–
$\omega K_2^*(1430)^+$	(	2.1 ± 0.4	$) \times 10^{-5}$		2380
$a_0(980)^+ K^0 \times$ B$(a_0(980)^+ \to \eta\pi^+)$	<	3.9	$\times 10^{-6}$	CL=90%	–
$a_0(980)^0 K^+ \times$ B$(a_0(980)^0 \to \eta\pi^0)$	<	2.5	$\times 10^{-6}$	CL=90%	–
$K^*(892)^0 \pi^+$	(	1.01 ± 0.09	$) \times 10^{-5}$		2562
$K^*(892)^+ \pi^0$	(	6.9 ± 2.4	$) \times 10^{-6}$		2562
$K^+ \pi^- \pi^+$	(	5.10 ± 0.29	$) \times 10^{-5}$		2609
$\quad K^+ \pi^- \pi^+$ nonresonant	(	1.63 $^{+0.21}_{-0.15}$	$) \times 10^{-5}$		2609
$\quad \omega(782)K^+$	(	6 ± 9	$) \times 10^{-6}$		2557
$\quad K^+ f_0(980) \times$ B$(f_0(980) \to \pi^+\pi^-)$	(	9.4 $^{+1.0}_{-1.2}$	$) \times 10^{-6}$		2524
$\quad f_2(1270)^0 K^+$	(	1.07 ± 0.27	$) \times 10^{-6}$		–
$\quad f_0(1370)^0 K^+ \times$ B$(f_0(1370)^0 \to \pi^+\pi^-)$	<	1.07	$\times 10^{-5}$	CL=90%	–
$\quad \rho^0(1450)K^+ \times$ B$(\rho^0(1450) \to \pi^+\pi^-)$	<	1.17	$\times 10^{-5}$	CL=90%	–
$\quad K^+ f_X(1300) \times$ B$(f_X \to \pi^+\pi^-)$	(	7 ± 5	$) \times 10^{-7}$		–
$\quad f_0(1500)K^+ \times$ B$(f_0(1500) \to \pi^+\pi^-)$	<	4.4	$\times 10^{-6}$	CL=90%	2398
$\quad f_2'(1525)K^+ \times$ B$(f_2'(1525) \to \pi^+\pi^-)$	<	3.4	$\times 10^{-6}$	CL=90%	2392
$\quad K^+ \rho^0$	(	3.7 ± 0.5	$) \times 10^{-6}$		2559
$\quad K_0^*(1430)^0 \pi^+$	(	4.5 $^{+0.9}_{-0.7}$	$) \times 10^{-5}$	S=1.5	2445

$K_2^*(1430)^0\pi^+$	(5.6 $^{+2.2}_{-1.5}$) $\times 10^{-6}$			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
$K^-\pi^+\pi^+$	< 9.5 $\times 10^{-7}$	CL=90%		2609
$K^-\pi^+\pi^+$ nonresonant	< 5.6 $\times 10^{-5}$	CL=90%		2609
$K_1(1400)^0\pi^+$	< 2.6 $\times 10^{-3}$	CL=90%		2451
$K^0\pi^+\pi^0$	< 6.6 $\times 10^{-5}$	CL=90%		2609
$K^0\rho^+$	(8.0 ±1.5) $\times 10^{-6}$			2558
$K^*(892)^+\pi^+\pi^-$	(7.5 ±1.0) $\times 10^{-5}$			2556
$K^*(892)^+\rho^0$	< 6.1 $\times 10^{-6}$	CL=90%		2504
$K^*(892)^+f_0(980)$	(5.2 ±1.3) $\times 10^{-6}$			2468
$a_1^+K^0$	(3.5 ±0.7) $\times 10^{-5}$			–
$b_1^+K^0\times$ B$(b_1^+\to\ \omega\pi^+)$	(9.6 ±1.9) $\times 10^{-6}$			–
$K^*(892)^0\rho^+$	(9.2 ±1.5) $\times 10^{-6}$			2504
$K_1(1400)^+\rho^0$	< 7.8 $\times 10^{-4}$	CL=90%		2387
$K_2^*(1430)^+\rho^0$	< 1.5 $\times 10^{-3}$	CL=90%		2381
$b_1^0K^+\times$ B$(b_1^0\to\ \omega\pi^0)$	(9.1 ±2.0) $\times 10^{-6}$			–
$K^+\overline{K}^0$	(1.36 ±0.27) $\times 10^{-6}$			2593
$\overline{K}^0K^+\pi^0$	< 2.4 $\times 10^{-5}$	CL=90%		2578
$K^+K_S^0K_S^0$	(1.15 ±0.13) $\times 10^{-5}$			2521
$K_S^0K_S^0\pi^+$	< 5.1 $\times 10^{-7}$	CL=90%		2577
$K^+K^-\pi^+$	(5.0 ±0.7) $\times 10^{-6}$			2578
$K^+K^-\pi^+$ nonresonant	< 7.5 $\times 10^{-5}$	CL=90%		2578
$K^+\overline{K}^*(892)^0$	< 1.1 $\times 10^{-6}$	CL=90%		2540
$K^+\overline{K}_0^*(1430)^0$	< 2.2 $\times 10^{-6}$	CL=90%		2421
$K^+K^+\pi^-$	< 1.6 $\times 10^{-7}$	CL=90%		2578
$K^+K^+\pi^-$ nonresonant	< 8.79 $\times 10^{-5}$	CL=90%		2578
$K^{*+}\pi^+K^-$	< 1.18 $\times 10^{-5}$	CL=90%		2524
$K^*(892)^+K^*(892)^0$	(1.2 ±0.5) $\times 10^{-6}$			2484
$K^{*+}K^+\pi^-$	< 6.1 $\times 10^{-6}$	CL=90%		2524
$K^+K^-K^+$	(3.37 ±0.22) $\times 10^{-5}$	S=1.4		2522
$K^+\phi$	(8.3 ±0.7) $\times 10^{-6}$			2516
$f_0(980)K^+\times$ B$(f_0(980)\to K^+K^-)$	< 2.9 $\times 10^{-6}$	CL=90%		2524
$a_2(1320)K^+\times$ B$(a_2(1320)\to\ K^+K^-)$	< 1.1 $\times 10^{-6}$	CL=90%		2449
$f_2'(1525)K^+\times$ B$(f_2'(1525)\to\ K^+K^-)$	< 4.9 $\times 10^{-6}$	CL=90%		2392
$X_0(1550)K^+\times$ B$(X_0(1550)\to\ K^+K^-)$	(4.3 ±0.7) $\times 10^{-6}$			–
$\phi(1680)K^+\times$ B$(\phi(1680)\to K^+K^-)$	< 8 $\times 10^{-7}$	CL=90%		2344

$f_0(1710) K^+ \times \mathrm{B}(f_0(1710) \to K^+ K^-)$	(1.7 ± 1.0) $\times 10^{-6}$			2331
$K^+ K^- K^+$ nonresonant	(2.8 $^{+0.9}_{-1.6}$) $\times 10^{-5}$	S=3.3	2522
$K^*(892)^+ K^+ K^-$	(3.6 ± 0.5) $\times 10^{-5}$		2466
$K^*(892)^+ \phi$	(1.05 ± 0.15) $\times 10^{-5}$	S=1.4	2460
$\phi (K\pi)_0^{*+}$	(8.3 ± 1.6) $\times 10^{-6}$		–
$\phi K_1(1270)^+$	(6.1 ± 1.9) $\times 10^{-6}$		2375
$\phi K_1(1400)^+$	< 3.2 $\times 10^{-6}$	CL=90%	2339
$\phi K^*(1410)^+$	< 4.3 $\times 10^{-6}$	CL=90%	–
$\phi K_0^*(1430)^+$	(7.0 ± 1.6) $\times 10^{-6}$		–
$\phi K_2^*(1430)^+$	(8.4 ± 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%	–
$K^+ \phi \phi$	(4.9 $^{+2.4}_{-2.2}$) $\times 10^{-6}$	S=2.9	2306
$\eta' \eta' K^+$	< 2.5 $\times 10^{-5}$	CL=90%	2338
$K^*(892)^+ \gamma$	(4.03 ± 0.26) $\times 10^{-5}$		2564
$K_1(1270)^+ \gamma$	(4.3 ± 1.3) $\times 10^{-5}$		2486
$\eta K^+ \gamma$	(7.9 ± 0.9) $\times 10^{-6}$		2588
$\eta' K^+ \gamma$	< 4.2 $\times 10^{-6}$	CL=90%	2528
$\phi K^+ \gamma$	(3.5 ± 0.6) $\times 10^{-6}$		2516
$K^+ \pi^- \pi^+ \gamma$	(2.76 ± 0.22) $\times 10^{-5}$	S=1.2	2609
$K^*(892)^0 \pi^+ \gamma$	(2.0 $^{+0.7}_{-0.6}$) $\times 10^{-5}$		2562
$K^+ \rho^0 \gamma$	< 2.0 $\times 10^{-5}$	CL=90%	2559
$K^+ \pi^- \pi^+ \gamma$ nonresonant	< 9.2 $\times 10^{-6}$	CL=90%	2609
$K^0 \pi^+ \pi^0 \gamma$	(4.6 ± 0.5) $\times 10^{-5}$		2609
$K_1(1400)^+ \gamma$	< 1.5 $\times 10^{-5}$	CL=90%	2453
$K_2^*(1430)^+ \gamma$	(1.4 ± 0.4) $\times 10^{-5}$		2447
$K^*(1680)^+ \gamma$	< 1.9 $\times 10^{-3}$	CL=90%	2360
$K_3^*(1780)^+ \gamma$	< 3.9 $\times 10^{-5}$	CL=90%	2341
$K_4^*(2045)^+ \gamma$	< 9.9 $\times 10^{-3}$	CL=90%	2244

Light unflavored meson modes

$\rho^+ \gamma$	(9.8 ± 2.5) $\times 10^{-7}$		2583
$\pi^+ \pi^0$	(5.7 ± 0.5) $\times 10^{-6}$	S=1.4	2636
$\pi^+ \pi^+ \pi^-$	(1.62 ± 0.15) $\times 10^{-5}$		2630
$\rho^0 \pi^+$	(8.7 ± 1.1) $\times 10^{-6}$		2581
$\pi^+ f_0(980) \times \mathrm{B}(f_0(980) \to \pi^+ \pi^-)$	< 3.0 $\times 10^{-6}$	CL=90%	2547
$\pi^+ f_2(1270)$	(8.2 ± 2.5) $\times 10^{-6}$		2484
$\rho(1450)^0 \pi^+$	< 2.3 $\times 10^{-6}$	CL=90%	2434
$f_0(1370) \pi^+ \times \mathrm{B}(f_0(1370) \to \pi^+ \pi^-)$	< 3.0 $\times 10^{-6}$	CL=90%	2460

$f_0(600)\pi^+ \times B(f_0(600) \to$ $\pi^+\pi^-)$	<	4.1	$\times 10^{-6}$	CL=90%	–
$\pi^+\pi^-\pi^+$ nonresonant	<	4.6	$\times 10^{-6}$	CL=90%	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%	2621
$\rho^+\rho^0$	(	2.40 ±0.19)	$\times 10^{-5}$		2523
$\rho^+ f_0(980) \times B(f_0(980) \to$ $\pi^+\pi^-)$	<	2.0	$\times 10^{-6}$	CL=90%	2488
$a_1(1260)^+\pi^0$	(	2.6 ±0.7)	$\times 10^{-5}$		2494
$a_1(1260)^0\pi^+$	(	2.0 ±0.6)	$\times 10^{-5}$		2494
$\omega\pi^+$	(	6.9 ±0.5)	$\times 10^{-6}$		2580
$\omega\rho^+$	(	1.59 ±0.21)	$\times 10^{-5}$		2522
$\eta\pi^+$	(	4.4 ±0.4)	$\times 10^{-6}$	S=1.1	2609
$\eta\rho^+$	(	7.0 ±2.9)	$\times 10^{-6}$	S=2.8	2553
$\eta'\pi^+$	(	2.7 ±1.0)	$\times 10^{-6}$	S=2.1	2551
$\eta'\rho^+$	(	8.7 $^{+4.0}_{-3.1}$)	$\times 10^{-6}$		2492
$\phi\pi^+$	<	2.4	$\times 10^{-7}$	CL=90%	2539
$\phi\rho^+$	<	3.0	$\times 10^{-6}$	CL=90%	2480
$a_0(980)^0\pi^+ \times B(a_0(980)^0 \to$ $\eta\pi^0)$	<	5.8	$\times 10^{-6}$	CL=90%	–
$a_0(980)^+\pi^0 \times B(a_0^+ \to \eta\pi^+)$	<	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%	2410
$b_1^0\pi^+ \times B(b_1^0 \to \omega\pi^0)$	(	6.7 ±2.0)	$\times 10^{-6}$		–
$b_1^+\pi^0 \times B(b_1^+ \to \omega\pi^+)$	<	3.3	$\times 10^{-6}$	CL=90%	–
$\pi^+\pi^+\pi^+\pi^-\pi^-\pi^0$	<	6.3	$\times 10^{-3}$	CL=90%	2592
$a_1(1260)^+ a_1(1260)^0$	<	1.3	%	CL=90%	2335

Charged particle ($h^\pm$) modes

$h^\pm = K^\pm$ or $\pi^\pm$

$h^+\pi^0$	(	1.6 $^{+0.7}_{-0.6}$)	$\times 10^{-5}$		2636
ωh^+	(	1.38 $^{+0.27}_{-0.24}$)	$\times 10^{-5}$		2580
$h^+ X^0$ (Familon)	<	4.9	$\times 10^{-5}$	CL=90%	–

Baryon modes

$p\overline{p}\pi^+$	(	1.62 ±0.20)	$\times 10^{-6}$		2439
$p\overline{p}\pi^+$ nonresonant	<	5.3	$\times 10^{-5}$	CL=90%	2439
$p\overline{p}K^+$	(	5.9 ±0.5)	$\times 10^{-6}$	S=1.5	2348
$\Theta(1710)^{++}\overline{p} \times$ $B(\Theta(1710)^{++} \to pK^+)$	[ooo] <	9.1	$\times 10^{-8}$	CL=90%	–

$f_J(2220)K^+ \times$ B($f_J(2220) \to$ [ooo] $p\overline{p}$)	<	4.1	$\times 10^{-7}$	CL=90%	2135
$p\overline{\Lambda}(1520)$	<	1.5	$\times 10^{-6}$	CL=90%	2322
$p\overline{p}K^+$ nonresonant	<	8.9	$\times 10^{-5}$	CL=90%	2348
$p\overline{p}K^*(892)^+$	(	3.6 $^{+0.8}_{-0.7}$	) $\times 10^{-6}$		2215
$f_J(2220)K^{*+} \times$ B($f_J(2220) \to p\overline{p}$)	<	7.7	$\times 10^{-7}$	CL=90%	2059
$p\overline{\Lambda}$	<	3.2	$\times 10^{-7}$	CL=90%	2430
$p\overline{\Lambda}\gamma$	(	2.5 $^{+0.5}_{-0.4}$	) $\times 10^{-6}$		2430
$p\overline{\Lambda}\pi^0$	(	3.0 $^{+0.7}_{-0.6}$	) $\times 10^{-6}$		2402
$p\overline{\Sigma}(1385)^0$	<	4.7	$\times 10^{-7}$	CL=90%	2362
$\Delta^+\overline{\Lambda}$	<	8.2	$\times 10^{-7}$	CL=90%	–
$p\overline{\Sigma}\gamma$	<	4.6	$\times 10^{-6}$	CL=90%	2413
$p\overline{\Lambda}\pi^+\pi^-$	<	2.0	$\times 10^{-4}$	CL=90%	2367
$\Lambda\overline{\Lambda}\pi^+$	<	2.8	$\times 10^{-6}$	CL=90%	2358
$\Lambda\overline{\Lambda}K^+$	(	2.9 $^{+1.0}_{-0.8}$	) $\times 10^{-6}$		2251
$\overline{\Delta}^0 p$	<	1.38	$\times 10^{-6}$	CL=90%	2402
$\Delta^{++}\overline{p}$	<	1.4	$\times 10^{-7}$	CL=90%	2402
$D^+ p\overline{p}$	<	1.5	$\times 10^{-5}$	CL=90%	1860
$D^*(2010)^+ p\overline{p}$	<	1.5	$\times 10^{-5}$	CL=90%	1786
$\overline{\Lambda}_c^- p\pi^+$	(	2.8 ± 0.8	) $\times 10^{-4}$		1980
$\overline{\Lambda}_c^- \Delta(1232)^{++}$	<	1.9	$\times 10^{-5}$	CL=90%	1928
$\overline{\Lambda}_c^- \Delta_X(1600)^{++}$	(	5.9 ± 1.9	) $\times 10^{-5}$		–
$\overline{\Lambda}_c^- \Delta_X(2420)^{++}$	(	4.7 ± 1.6	) $\times 10^{-5}$		–
$(\overline{\Lambda}_c^- p)_s \pi^+$	[ppp] (	3.9 ± 1.3	) $\times 10^{-5}$		–
$\overline{\Sigma}_c(2520)^0 p$	<	3	$\times 10^{-6}$	CL=90%	1904
$\overline{\Sigma}_c(2800)^0 p$	(	3.3 ± 1.3	) $\times 10^{-5}$		–
$\overline{\Lambda}_c^- p\pi^+\pi^0$	(	1.8 ± 0.6	) $\times 10^{-3}$		1935
$\overline{\Lambda}_c^- p\pi^+\pi^+\pi^-$	(	2.3 ± 0.7	) $\times 10^{-3}$		1880
$\overline{\Lambda}_c^- p\pi^+\pi^+\pi^-\pi^0$	<	1.34	%	CL=90%	1822
$\Lambda_c^+ \Lambda_c^- K^+$	(	8.7 ± 3.5	) $\times 10^{-4}$		–
$\overline{\Sigma}_c(2455)^0 p$	(	3.7 ± 1.3	) $\times 10^{-5}$		1938
$\overline{\Sigma}_c(2455)^0 p\pi^0$	(	4.4 ± 1.8	) $\times 10^{-4}$		1896
$\overline{\Sigma}_c(2455)^0 p\pi^-\pi^+$	(	4.4 ± 1.7	) $\times 10^{-4}$		1845
$\overline{\Sigma}_c(2455)^{--} p\pi^+\pi^+$	(	2.8 ± 1.2	) $\times 10^{-4}$		1845
$\overline{\Lambda}_c(2593)^- / \overline{\Lambda}_c(2625)^- p\pi^+$	<	1.9	$\times 10^{-4}$	CL=90%	–
$\overline{\Xi}_c^0 \Lambda_c^+ \times$ B($\overline{\Xi}_c^0 \to \overline{\Xi}^+\pi^-$)	(	3.0 ± 1.1	) $\times 10^{-5}$		1144
$\overline{\Xi}_c^0 \Lambda_c^+ \times$ B($\overline{\Xi}_c^0 \to \Lambda K^+\pi^-$)	(	2.6 ± 1.1	) $\times 10^{-5}$	S=1.1	1144

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

Mode	Type		Value				
$\pi^+ \ell^+ \ell^-$	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		<	6.9		$\times 10^{-8}$	CL=90%	2634
$\pi^+ \nu \overline{\nu}$	B1		<	1.0		$\times 10^{-4}$	CL=90%	2638
$K^+ \ell^+ \ell^-$	B1	[*iii*]	(	4.4	$^{+0.8}_{-0.7}$	$) \times 10^{-7}$	S=1.1	2617
$K^+ e^+ e^-$	B1		(	4.9	± 1.0	$) \times 10^{-7}$		2617
$K^+ \mu^+ \mu^-$	B1		(	4.5	$^{+0.9}_{-0.8}$	$) \times 10^{-7}$		2612
$K^+ \overline{\nu} \nu$	B1		<	1.4		$\times 10^{-5}$	CL=90%	2617
$\rho^+ \nu \overline{\nu}$	B1		<	1.5		$\times 10^{-4}$	CL=90%	2583
$K^*(892)^+ \ell^+ \ell^-$	B1	[*iii*]	(	7	± 5	$) \times 10^{-7}$		2564
$K^*(892)^+ \nu \overline{\nu}$	B1		<	8		$\times 10^{-5}$	CL=90%	2564
$K^*(892)^+ e^+ e^-$	B1		(	8	± 8	$) \times 10^{-7}$		2564
$K^*(892)^+ \mu^+ \mu^-$	B1		(	8	$^{+6}_{-4}$	$) \times 10^{-7}$		2560
$\pi^+ e^+ \mu^-$	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
$K^+ e^+ \mu^-$	LF		<	9.1		$\times 10^{-8}$	CL=90%	2615
$K^+ e^- \mu^+$	LF		<	1.3		$\times 10^{-7}$	CL=90%	2615
$K^+ e^\pm \mu^\mp$	LF		<	9.1		$\times 10^{-8}$	CL=90%	2615
$K^+ \mu^\pm \tau^\mp$	LF		<	7.7		$\times 10^{-5}$	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		$\times 10^{-7}$	CL=90%	2563
$\pi^- e^+ e^+$	L		<	1.6		$\times 10^{-6}$	CL=90%	2638
$\pi^- \mu^+ \mu^+$	L		<	1.4		$\times 10^{-6}$	CL=90%	2634
$\pi^- e^+ \mu^+$	L		<	1.3		$\times 10^{-6}$	CL=90%	2637
$\rho^- e^+ e^+$	L		<	2.6		$\times 10^{-6}$	CL=90%	2583
$\rho^- \mu^+ \mu^+$	L		<	5.0		$\times 10^{-6}$	CL=90%	2578
$\rho^- e^+ \mu^+$	L		<	3.3		$\times 10^{-6}$	CL=90%	2582
$K^- e^+ e^+$	L		<	1.0		$\times 10^{-6}$	CL=90%	2617
$K^- \mu^+ \mu^+$	L		<	1.8		$\times 10^{-6}$	CL=90%	2612
$K^- e^+ \mu^+$	L		<	2.0		$\times 10^{-6}$	CL=90%	2615
$K^*(892)^- e^+ e^+$	L		<	2.8		$\times 10^{-6}$	CL=90%	2564
$K^*(892)^- \mu^+ \mu^+$	L		<	8.3		$\times 10^{-6}$	CL=90%	2560
$K^*(892)^- e^+ \mu^+$	L		<	4.4		$\times 10^{-6}$	CL=90%	2563

B^0

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

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

Mass $m_{B^0} = 5279.50 \pm 0.30$ MeV

$m_{B^0} - m_{B^{\pm}} = 0.33 \pm 0.06$ MeV

Mean life $\tau_{B^0} = (1.525 \pm 0.009) \times 10^{-12}$ s

$\quad c\tau = 457.2$ μm

$\tau_{B^+}/\tau_{B^0} = 1.071 \pm 0.009$ (direct measurements)

B^0-$\overline{B}^0$ mixing parameters

$\chi_d = 0.1873 \pm 0.0024$

$\Delta m_{B^0} = m_{B^0_H} - m_{B^0_L} = (0.507 \pm 0.005) \times 10^{12}$ $\hbar$ s^{-1}

$\qquad\qquad\qquad = (3.337 \pm 0.033) \times 10^{-10}$ MeV

$x_d = \Delta m_{B^0}/\Gamma_{B^0} = 0.774 \pm 0.008$

$\mathrm{Re}(\lambda_{CP}\,/\,|\lambda_{CP}|)\,\mathrm{Re}(z) = 0.01 \pm 0.05$

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

$\mathrm{Re}(z) = 0.00 \pm 0.12$

$\mathrm{Im}(z) = -0.015 \pm 0.008$

CP violation parameters

$\mathrm{Re}(\epsilon_{B^0})/(1+|\epsilon_{B^0}|^2) = (-0.1 \pm 1.4) \times 10^{-3}$

$A_{T/CP} = 0.005 \pm 0.018$

$A_{CP}(B^0 \to D^*(2010)^+ D^-) = 0.02 \pm 0.04$

$\mathbf{A_{CP}\,(B^0 \to K^+\pi^-) = -0.098 \pm 0.013}$

$A_{CP}(B^0 \to \eta' K^*(892)^0) = 0.08 \pm 0.25$

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

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

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

$A_{CP}(B^0 \to \omega K^*_2(1430)^0) = -0.37 \pm 0.17$

$A_{CP}(B^0 \to K^0 \overline{K}^0) = (-0.6 \pm 0.7) \times 10^{-6}$

$A_{CP}(B^0 \to \eta K^*_0(1430)^0) = 0.06 \pm 0.13$

$A_{CP}(B^0 \to \eta K^*_2(1430)^0) = -0.07 \pm 0.19$

$A_{CP}(B^0 \to K^+\pi^-\pi^0) = (0 \pm 6) \times 10^{-2}$

$A_{CP}(B^0 \to \rho^- K^+) = 0.15 \pm 0.13$

$A_{CP}(B^0 \to K^+\pi^-\pi^0 \text{nonresonant}) = 0.23^{+0.22}_{-0.29}$

$A_{CP}(B^0 \to (K\pi)^{*+}_0 \pi^-) = 0.17^{+0.25}_{-0.27}$

$A_{CP}(B^0 \to (K\pi)^{*0}_0 \pi^0) = -0.22 \pm 0.32$

$A_{CP}(B^0 \to K^*(892)^+ \pi^-) = -0.10^{+0.11}_{-0.10}$

$A_{CP}(B^0 \to K^{*0}\pi^0) = -0.09^{+0.23}_{-0.26}$

$A_{CP}(B^0 \to K^*(892)^0 \pi^+\pi^-) = 0.07 \pm 0.05$

$A_{CP}(B^0 \to K^*(892)^0 \rho^0) = 0.09 \pm 0.19$

$A_{CP}(B^0 \to a^-_1 K^+) = -0.16 \pm 0.12$

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

$A_{CP}(B^0 \to K^*(892)^0 K^+ K^-) = 0.01 \pm 0.05$

$A_{CP}(B^0 \to K^*(892)^0 \phi) = 0.01 \pm 0.05$

$A_{CP}(B^0 \to K^*(892)^0 K^- \pi^+) = 0.2 \pm 0.4$

$A_{CP}(B^0 \to \phi(K\pi)_0^{*0}) = 0.20 \pm 0.15$

$A_{CP}(B^0 \to \phi K_2^*(1430)^0) = -0.08 \pm 0.13$

$A_{CP}(B^0 \to \rho^+ \pi^-) = 0.08 \pm 0.12 \quad (S = 2.0)$

$A_{CP}(B^0 \to \rho^- \pi^+) = -0.16 \pm 0.23 \quad (S = 1.7)$

$A_{CP}(B^0 \to a_1(1260)^\pm \pi^\mp) = -0.07 \pm 0.07$

$A_{CP}(B^0 \to b_1 \pi^+) = -0.05 \pm 0.10$

$A_{CP}(B^0 \to K^*(1430)\gamma) = -0.08 \pm 0.15$

$A_{CP}(B^0 \to p\overline{p} K^*(892)^0) = 0.05 \pm 0.12$

$A_{CP}(B^0 \to p\overline{\Lambda}\pi^-) = -0.02 \pm 0.10$

$C_{D^{*-} D^+}(B^0 \to D^*(2010)^- D^+) = 0.07 \pm 0.14$

$\boldsymbol{S_{D^{*-} D^+}(B^0 \to D^*(2010)^- D^+) = -0.78 \pm 0.21}$

$C_{D^{*+} D^-}(B^0 \to D^*(2010)^+ D^-) = -0.09 \pm 0.22 \quad (S = 1.6)$

$\boldsymbol{S_{D^{*+} D^-}(B^0 \to D^*(2010)^+ D^-) = -0.61 \pm 0.19}$

$C_{D^{*+} D^{*-}}(B^0 \to D^{*+} D^{*-}) = 0.07 \pm 0.09$

$\boldsymbol{S_{D^{*+} D^{*-}}(B^0 \to D^{*+} D^{*-}) = -0.70 \pm 0.16}$

$C_+(B^0 \to D^{*+} D^{*-}) = 0.00 \pm 0.12$

$\boldsymbol{S_+(B^0 \to D^{*+} D^{*-}) = -0.76 \pm 0.16}$

$C_-(B^0 \to D^{*+} D^{*-}) = 0.4 \pm 0.5$

$S_-(B^0 \to D^{*+} D^{*-}) = -1.8 \pm 0.7$

$C(B^0 \to D^*(2010)^+ D^*(2010)^- K_S^0) = 0.01 \pm 0.29$

$S(B^0 \to D^*(2010)^+ D^*(2010)^- K_S^0) = 0.1 \pm 0.4$

$C_{D^+ D^-}(B^0 \to D^+ D^-) = -0.5 \pm 0.4 \quad (S = 2.5)$

$\boldsymbol{S_{D^+ D^-}(B^0 \to D^+ D^-) = -0.87 \pm 0.26}$

$C_{J/\psi(1S)\pi^0}(B^0 \to J/\psi(1S)\pi^0) = -0.13 \pm 0.13$

$\boldsymbol{S_{J/\psi(1S)\pi^0}(B^0 \to J/\psi(1S)\pi^0) = -0.94 \pm 0.29 \quad (S = 1.9)}$

$C_{D_{CP}^{(*)} h^0}(B^0 \to D_{CP}^{(*)} h^0) = -0.23 \pm 0.16$

$S_{D_{CP}^{(*)} h^0}(B^0 \to D_{CP}^{(*)} h^0) = -0.56 \pm 0.24$

$C_{K_S^0 \pi^0}(B^0 \to K_S^0 \pi^0) = 0.09 \pm 0.10$

$S_{K_S^0 \pi^0}(B^0 \to K_S^0 \pi^0) = 0.50 \pm 0.18$

$C_{\eta'(958) K}(B^0 \to \eta'(958) K_S^0) = -0.04 \pm 0.20 \quad (S = 2.5)$

$S_{\eta'(958) K}(B^0 \to \eta'(958) K_S^0) = 0.43 \pm 0.17 \quad (S = 1.5)$

$C_{\eta' K^0}(B^0 \to \eta' K^0) = -0.05 \pm 0.05$

$\boldsymbol{S_{\eta' K^0}(B^0 \to \eta' K^0) = 0.60 \pm 0.07}$

$C_{\omega K_S^0}(B^0 \to \omega K_S^0) = -0.30 \pm 0.28 \quad (S = 1.6)$

$S_{\omega K_S^0}(B^0 \to \omega K_S^0) = 0.43 \pm 0.24$

$$C\left(B^0 \rightarrow K_S^0 \pi^0 \pi^0\right) = 0.2 \pm 0.5$$

$$S\left(B^0 \rightarrow K_S^0 \pi^0 \pi^0\right) = 0.7 \pm 0.7$$

$$C_{f_0 K_S^0}\left(B^0 \rightarrow f_0(980) K_S^0\right) = -0.03 \pm 0.26 \quad (S = 1.9)$$

$$S_{f_0 K_S^0}\left(B^0 \rightarrow f_0(980) K_S^0\right) = -0.02 \pm 0.21 \quad (S = 1.1)$$

$$C_{K_S^0 K_S^0}\left(B^0 \rightarrow K_S^0 K_S^0\right) = 0.0 \pm 0.4 \quad (S = 1.4)$$

$$S_{K_S^0 K_S^0}\left(B^0 \rightarrow K_S^0 K_S^0\right) = -0.8 \pm 0.5$$

$$C_{K^+ K^- K_S^0}\left(B^0 \rightarrow K^+ K^- K_S^0\right) = 0.07 \pm 0.08$$

$$\boldsymbol{S_{K^+ K^- K_S^0}\left(B^0 \rightarrow K^+ K^- K_S^0\right) = -0.74^{+0.12}_{-0.10}}$$

$$C_{K^+ K^- K_S^0}\left(B^0 \rightarrow K^+ K^- K_S^0 \text{ inclusive}\right) = 0.01 \pm 0.09$$

$$\boldsymbol{S_{K^+ K^- K_S^0}\left(B^0 \rightarrow K^+ K^- K_S^0 \text{ inclusive}\right) = -0.65 \pm 0.12}$$

$$C_{\phi K_S^0}\left(B^0 \rightarrow \phi K_S^0\right) = -0.01 \pm 0.12$$

$$S_{\phi K_S^0}\left(B^0 \rightarrow \phi K_S^0\right) = 0.39 \pm 0.17$$

$$C_{K_S K_S K_S}\left(B^0 \rightarrow K_S K_S K_S\right) = -0.15 \pm 0.16 \quad (S = 1.1)$$

$$S_{K_S K_S K_S}\left(B^0 \rightarrow K_S K_S K_S\right) = -0.4 \pm 0.5 \quad (S = 2.5)$$

$$C_{K_S^0 \pi^0 \gamma}\left(B^0 \rightarrow K_S^0 \pi^0 \gamma\right) = 0.36 \pm 0.33$$

$$S_{K_S^0 \pi^0 \gamma}\left(B^0 \rightarrow K_S^0 \pi^0 \gamma\right) = -0.8 \pm 0.6$$

$$C_{K^{*0}\gamma}\left(B^0 \rightarrow K^*(892)^0 \gamma\right) = -0.04 \pm 0.16 \quad (S = 1.2)$$

$$S_{K^{*0}\gamma}\left(B^0 \rightarrow K^*(892)^0 \gamma\right) = -0.15 \pm 0.22$$

$$C_{\eta K^0 \gamma}\left(B^0 \rightarrow \eta K^0 \gamma\right) = -0.3 \pm 0.4$$

$$S_{\eta K^0 \gamma}\left(B^0 \rightarrow \eta K^0 \gamma\right) = -0.2 \pm 0.5$$

$$C\left(B^0 \rightarrow K_S^0 \rho^0 \gamma\right) = -0.05 \pm 0.19$$

$$S\left(B^0 \rightarrow K_S^0 \rho^0 \gamma\right) = 0.11 \pm 0.34$$

$$C\left(B^0 \rightarrow \rho^0 \gamma\right) = 0.4 \pm 0.5$$

$$S\left(B^0 \rightarrow \rho^0 \gamma\right) = -0.8 \pm 0.7$$

$$C_{\pi\pi}\left(B^0 \rightarrow \pi^+ \pi^-\right) = -0.38 \pm 0.17 \quad (S = 2.6)$$

$$\boldsymbol{S_{\pi\pi}\left(B^0 \rightarrow \pi^+ \pi^-\right) = -0.61 \pm 0.08}$$

$$C_{\pi^0 \pi^0}\left(B^0 \rightarrow \pi^0 \pi^0\right) = -0.48 \pm 0.30$$

$$C_{\rho\pi}\left(B^0 \rightarrow \rho^+ \pi^-\right) = 0.01 \pm 0.14 \quad (S = 1.9)$$

$$S_{\rho\pi}\left(B^0 \rightarrow \rho^+ \pi^-\right) = 0.01 \pm 0.09$$

$$\boldsymbol{\Delta C_{\rho\pi}\left(B^0 \rightarrow \rho^+ \pi^-\right) = 0.37 \pm 0.08}$$

$$\Delta S_{\rho\pi}\left(B^0 \rightarrow \rho^+ \pi^-\right) = -0.05 \pm 0.10$$

$$C_{\rho^0 \pi^0}\left(B^0 \rightarrow \rho^0 \pi^0\right) = 0.3 \pm 0.4$$

$$S_{\rho^0 \pi^0}\left(B^0 \rightarrow \rho^0 \pi^0\right) = 0.1 \pm 0.4$$

$$C_{a_1 \pi}\left(B^0 \rightarrow a_1(1260)^+ \pi^-\right) = -0.10 \pm 0.17$$

$$S_{a_1 \pi}\left(B^0 \rightarrow a_1(1260)^+ \pi^-\right) = 0.37 \pm 0.22$$

$$\Delta C_{a_1 \pi}\left(B^0 \rightarrow a_1(1260)^+ \pi^-\right) = 0.26 \pm 0.17$$

$\Delta S_{a_1 \pi} (B^0 \to a_1(1260)^+ \pi^-) = -0.14 \pm 0.22$

$C (B^0 \to b_1^- K^+) = -0.22 \pm 0.24$

$\Delta C (B^0 \to b_1^- \pi^+) = -1.04 \pm 0.24$

$C_{\rho^0 K_S^0} (B^0 \to \rho^0 K_S^0) = 0.6 \pm 0.5$

$S_{\rho^0 K_S^0} (B^0 \to \rho^0 K_S^0) = 0.2 \pm 0.6$

$C_{\rho^0 \rho^0} (B^0 \to \rho^0 \rho^0) = 0.2 \pm 0.9$

$S_{\rho^0 \rho^0} (B^0 \to \rho^0 \rho^0) = 0.3 \pm 0.7$

$C_{\rho \rho} (B^0 \to \rho^+ \rho^-) = -0.05 \pm 0.13$

$S_{\rho \rho} (B^0 \to \rho^+ \rho^-) = -0.06 \pm 0.17$

$\left| \lambda \right| (B^0 \to J/\psi K^*(892)^0) < 0.25,\ \mathrm{CL} = 95\%$

$\cos 2\beta (B^0 \to J/\psi K^*(892)^0) = 1.7^{+0.7}_{-0.9} \quad (S = 1.6)$

$\cos 2\beta (B^0 \to [K_S^0 \pi^+ \pi^-]_{D(*)} h^0) = 1.0^{+0.6}_{-0.7} \quad (S = 1.8)$

$(S_+ + S_-)/2 (B^0 \to D^{*-} \pi^+) = -0.037 \pm 0.012$

$(S_- - S_+)/2 (B^0 \to D^{*-} \pi^+) = -0.006 \pm 0.016$

$(S_+ + S_-)/2 (B^0 \to D^- \pi^+) = -0.046 \pm 0.023$

$(S_- - S_+)/2 (B^0 \to D^- \pi^+) = -0.022 \pm 0.021$

$(S_+ + S_-)/2 (B^0 \to D^- \rho^+) = -0.024 \pm 0.032$

$(S_- - S_+)/2 (B^0 \to D^- \rho^+) = -0.10 \pm 0.06$

$C_{\eta_c K_S^0} (B^0 \to \eta_c K_S^0) = 0.08 \pm 0.13$

$\boldsymbol{S_{\eta_c K_S^0} (B^0 \to \eta_c K_S^0) = 0.93 \pm 0.17}$

$C_{c\bar{c} K^{(*)0}} (B^0 \to c\bar{c} K^{(*)0}) = 0.004 \pm 0.019$

$\boldsymbol{\sin(2\beta) = 0.671 \pm 0.023}$

$C_{J/\psi(\mathrm{nS}) K^0} (B^0 \to J/\psi(\mathrm{nS}) K^0) = (-0.2 \pm 2.0) \times 10^{-2}$

$\boldsymbol{S_{J/\psi(\mathrm{nS}) K^0} (B^0 \to J/\psi(\mathrm{nS}) K^0) = 0.658 \pm 0.024}$

$C_{J/\psi K^{*0}} (B^0 \to J/\psi K^{*0}) = 0.03 \pm 0.10$

$S_{J/\psi K^{*0}} (B^0 \to J/\psi K^{*0}) = 0.60 \pm 0.25$

$C_{\chi_{c1} K_S^0} (B^0 \to \chi_{c1} K_S^0) = 0.13 \pm 0.11$

$\boldsymbol{S_{\chi_{c1} K_S^0} (B^0 \to \chi_{c1} K_S^0) = 0.61 \pm 0.16}$

$\sin(2\beta_{\mathrm{eff}})(B^0 \to \phi K^0) = 0.22 \pm 0.30$

$\boldsymbol{\sin(2\beta_{\mathrm{eff}})(B^0 \to K^+ K^- K_S^0) = 0.77^{+0.13}_{-0.12}}$

$\sin(2\beta_{\mathrm{eff}})(B^0 \to [K_S^0 \pi^+ \pi^-]_{D(*)} h^0) = 0.45 \pm 0.28$

$\left| \lambda \right| (B^0 \to [K_S^0 \pi^+ \pi^-]_{D(*)} h^0) = 1.01 \pm 0.08$

$\left| \sin(2\beta + \gamma) \right| > 0.40,\ \mathrm{CL} = 90\%$

$2\beta + \gamma = (83 \pm 60)°$

$\alpha = (92 \pm 6)°$

$\overline{B}^0$ 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% $B^0 \overline{B}^0$ 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.*, $B \rightarrow D^{\pm}$ anything, 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)
$B^0 \rightarrow \ell^+ \nu_\ell$ anything	[iii]	(10.33$\pm$ 0.28) %		−
$B^0 \rightarrow e^+ \nu_e X_c$		(10.1 $\pm$ 0.4) %		−
$B^0 \rightarrow D \ell^+ \nu_\ell$ anything		(9.6 $\pm$ 0.9) %		−
$B^0 \rightarrow D^- \ell^+ \nu_\ell$	[iii]	(2.17$\pm$ 0.12) %		2309
$B^0 \rightarrow D^- \tau^+ \nu_\tau$		(1.0 $\pm$ 0.4) %		1909
$B^0 \rightarrow D^*(2010)^- \ell^+ \nu_\ell$	[iii]	(5.16$\pm$ 0.11) %		2257
$B^0 \rightarrow D^*(2010)^- \tau^+ \nu_\tau$		(1.6 $\pm$ 0.5) %	S=1.2	1837
$B^0 \rightarrow \overline{D}^0 \pi^- \ell^+ \nu_\ell$		(4.3 $\pm$ 0.6) $\times 10^{-3}$		2308
$B^0 \rightarrow D_0^*(2400)^- \ell^+ \nu_\ell \times$ B($D_0^{*-} \rightarrow \overline{D}^0 \pi^-$)		(3.0 $\pm$ 1.2) $\times 10^{-3}$	S=1.8	−
$B^0 \rightarrow D_2^*(2460)^- \ell^+ \nu_\ell \times$ B($D_2^{*-} \rightarrow \overline{D}^0 \pi^-$)		(2.2 $\pm$ 0.6) $\times 10^{-3}$		2067
$B^0 \rightarrow \overline{D}^{(*)} n \pi \ell^+ \nu_\ell (n \geq 1)$		(2.4 $\pm$ 0.5) %		−
$B^0 \rightarrow \overline{D}^{*0} \pi^- \ell^+ \nu_\ell$		(4.9 $\pm$ 0.8) $\times 10^{-3}$		2256
$B^0 \rightarrow D_1(2420)^- \ell^+ \nu_\ell \times$ B($D_1^- \rightarrow \overline{D}^{*0} \pi^-$)		(2.8 $\pm$ 0.5) $\times 10^{-3}$		−
$B^0 \rightarrow D_1'(2430)^- \ell^+ \nu_\ell \times$ B($D_1'^- \rightarrow \overline{D}^{*0} \pi^-$)		(3.1 $\pm$ 0.9) $\times 10^{-3}$		−
$B^0 \rightarrow D_2^*(2460)^- \ell^+ \nu_\ell \times$ B($D_2^{*-} \rightarrow \overline{D}^{*0} \pi^-$)		< 1.2 $\times 10^{-3}$ CL=90%		2067
$B^0 \rightarrow \rho^- \ell^+ \nu_\ell$	[iii]	(2.47$\pm$ 0.33) $\times 10^{-4}$		2583
$B^0 \rightarrow \pi^- \ell^+ \nu_\ell$	[iii]	(1.34$\pm$ 0.08) $\times 10^{-4}$		2638

Inclusive modes

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

D, D^*, or D_s modes

$B^0 \to D^- \pi^+$	(2.68$\pm$ 0.13) $\times 10^{-3}$		2306
$B^0 \to D^- \rho^+$	(7.6 $\pm$ 1.3) $\times 10^{-3}$		2235
$B^0 \to D^- K^0 \pi^+$	(4.9 $\pm$ 0.9) $\times 10^{-4}$		2259
$B^0 \to D^- K^*(892)^+$	(4.5 $\pm$ 0.7) $\times 10^{-4}$		2211
$B^0 \to D^- \omega \pi^+$	(2.8 $\pm$ 0.6) $\times 10^{-3}$		2204
$B^0 \to D^- K^+$	(2.0 $\pm$ 0.6) $\times 10^{-4}$		2279
$B^0 \to D^- K^+ \overline{K}^0$	< 3.1 $\times 10^{-4}$ CL=90%		2188
$B^0 \to D^- K^+ \overline{K}^*(892)^0$	(8.8 $\pm$ 1.9) $\times 10^{-4}$		2070
$B^0 \to \overline{D}^0 \pi^+ \pi^-$	(8.4 $\pm$ 0.9) $\times 10^{-4}$		2301
$B^0 \to D^*(2010)^- \pi^+$	(2.76$\pm$ 0.13) $\times 10^{-3}$		2255
$B^0 \to D^- \pi^+ \pi^+ \pi^-$	(8.0 $\pm$ 2.5) $\times 10^{-3}$		2287
$B^0 \to (D^- \pi^+ \pi^+ \pi^-)$ non-resonant	(3.9 $\pm$ 1.9) $\times 10^{-3}$		2287
$B^0 \to D^- \pi^+ \rho^0$	(1.1 $\pm$ 1.0) $\times 10^{-3}$		2206
$B^0 \to D^- a_1(1260)^+$	(6.0 $\pm$ 3.3) $\times 10^{-3}$		2121
$B^0 \to D^*(2010)^- \pi^+ \pi^0$	(1.5 $\pm$ 0.5) %		2247
$B^0 \to D^*(2010)^- \rho^+$	(6.8 $\pm$ 0.9) $\times 10^{-3}$		2180
$B^0 \to D^*(2010)^- K^+$	(2.14$\pm$ 0.16) $\times 10^{-4}$		2226
$B^0 \to D^*(2010)^- K^0 \pi^+$	(3.0 $\pm$ 0.8) $\times 10^{-4}$		2205
$B^0 \to D^*(2010)^- K^*(892)^+$	(3.3 $\pm$ 0.6) $\times 10^{-4}$		2155
$B^0 \to D^*(2010)^- K^+ \overline{K}^0$	< 4.7 $\times 10^{-4}$ CL=90%		2131
$B^0 \to D^*(2010)^- K^+ \overline{K}^*(892)^0$	(1.29$\pm$ 0.33) $\times 10^{-3}$		2007
$B^0 \to D^*(2010)^- \pi^+ \pi^+ \pi^-$	(7.0 $\pm$ 0.8) $\times 10^{-3}$	S=1.3	2235
$B^0 \to (D^*(2010)^- \pi^+ \pi^+ \pi^-)$ nonresonant	(0.0 $\pm$ 2.5) $\times 10^{-3}$		2235
$B^0 \to D^*(2010)^- \pi^+ \rho^0$	(5.7 $\pm$ 3.2) $\times 10^{-3}$		2150

$B^0 \rightarrow$ $D^*(2010)^- a_1(1260)^+$		(1.30 ± 0.27) %	2061
$B^0 \rightarrow D^*(2010)^- \pi^+ \pi^+ \pi^- \pi^0$		(1.76 ± 0.27) %	2218
$B^0 \rightarrow D^{*-} 3\pi^+ 2\pi^-$		(4.7 ± 0.9) $\times 10^{-3}$	2195
$B^0 \rightarrow \overline{D}^*(2010)^- \omega \pi^+$		(2.89 ± 0.30) $\times 10^{-3}$	2148
$B^0 \rightarrow D_1(2430)^0 \omega \times$ $B(D_1(2430)^0 \rightarrow$ $D^{*-}\pi^+)$		(4.1 ± 1.6) $\times 10^{-4}$	1992
$B^0 \rightarrow \overline{D}^{**-}\pi^+$	[mmm]	(2.1 ± 1.0) $\times 10^{-3}$	–
$B^0 \rightarrow D_1(2420)^- \pi^+ \times$ $B(D_1^- \rightarrow D^-\pi^+\pi^-)$		($8.9 \begin{smallmatrix}+2.3\\-3.5\end{smallmatrix}$) $\times 10^{-5}$	–
$B^0 \rightarrow D_1(2420)^- \pi^+ \times$ $B(D_1^- \rightarrow D^{*-}\pi^+\pi^-)$		< 3.3 $\times 10^{-5}$ CL=90%	–
$B^0 \rightarrow \overline{D}_2^*(2460)^- \pi^+ \times$ $B(D_2^*(2460)^- \rightarrow D^0\pi^-)$		(2.15 ± 0.35) $\times 10^{-4}$	2064
$B^0 \rightarrow \overline{D}_0^*(2400)^- \pi^+ \times$ $B(D_0^*(2400)^- \rightarrow D^0\pi^-)$		(6.0 ± 3.0) $\times 10^{-5}$	2090
$B^0 \rightarrow D_2^*(2460)^- \pi^+ \times$ $B((D_2^*)^- \rightarrow D^{*-}\pi^+\pi^-)$		< 2.4 $\times 10^{-5}$ CL=90%	–
$B^0 \rightarrow \overline{D}_2^*(2460)^- \rho^+$		< 4.9 $\times 10^{-3}$ CL=90%	1977
$B^0 \rightarrow D^0 \overline{D}^0$		< 4.3 $\times 10^{-5}$ CL=90%	1868
$B^0 \rightarrow D^{*0} \overline{D}^0$		< 2.9 $\times 10^{-4}$ CL=90%	1794
$B^0 \rightarrow D^- D^+$		(2.11 ± 0.31) $\times 10^{-4}$ S=1.2	1864
$B^0 \rightarrow D^- D_s^+$		(7.4 ± 0.7) $\times 10^{-3}$	1812
$B^0 \rightarrow D^*(2010)^- D_s^+$		(8.2 ± 1.1) $\times 10^{-3}$	1735
$B^0 \rightarrow D^- D_s^{*+}$		(7.5 ± 1.6) $\times 10^{-3}$	1731
$B^0 \rightarrow D^*(2010)^- D_s^{*+}$		(1.78 ± 0.14) %	1649
$B^0 \rightarrow D_{s0}(2317)^- K^+ \times$ $B(D_{s0}(2317)^- \rightarrow D_s^- \pi^0)$		(4.3 ± 1.4) $\times 10^{-5}$	2097
$B^0 \rightarrow D_{s0}(2317)^- \pi^+ \times$ $B(D_{s0}(2317)^- \rightarrow D_s^- \pi^0)$		< 2.5 $\times 10^{-5}$ CL=90%	2128
$B^0 \rightarrow D_{sJ}(2457)^- K^+ \times$ $B(D_{sJ}(2457)^- \rightarrow D_s^- \pi^0)$		< 9.4 $\times 10^{-6}$ CL=90%	–
$B^0 \rightarrow D_{sJ}(2457)^- \pi^+ \times$ $B(D_{sJ}(2457)^- \rightarrow D_s^- \pi^0)$		< 4.0 $\times 10^{-6}$ CL=90%	–
$B^0 \rightarrow D_s^- D_s^+$		< 3.6 $\times 10^{-5}$ CL=90%	1759
$B^0 \rightarrow D_s^{*-} D_s^+$		< 1.3 $\times 10^{-4}$ CL=90%	1674
$B^0 \rightarrow D_s^{*-} D_s^{*+}$		< 2.4 $\times 10^{-4}$ CL=90%	1583
$B^0 \rightarrow D_{s0}(2317)^+ D^- \times$ $B(D_{s0}(2317)^+ \rightarrow D_s^+ \pi^0)$		($9.9 \begin{smallmatrix}+4.0\\-3.3\end{smallmatrix}$) $\times 10^{-4}$ S=1.5	1602

$B^0 \to D_{s0}(2317)^+ D^- \times$ $\text{B}(D_{s0}(2317)^+ \to D_s^{*+}\gamma)$	$<$ 9.5	$\times 10^{-4}$ CL=90%	–
$B^0 \to$ $D_{s0}(2317)^+ D^*(2010)^- \times$ $\text{B}(D_{s0}(2317)^+ \to D_s^+\pi^0)$	(1.5 $\pm$ 0.6) $\times 10^{-3}$		1509
$B^0 \to D_{sJ}(2457)^+ D^-$	(3.5 $\pm$ 1.1) $\times 10^{-3}$		–
$B^0 \to D_{sJ}(2457)^+ D^- \times$ $\text{B}(D_{sJ}(2457)^+ \to D_s^+\gamma)$	(6.6 $^{+\ 1.7}_{-\ 1.4}$) $\times 10^{-4}$		–
$B^0 \to D_{sJ}(2457)^+ D^- \times$ $\text{B}(D_{sJ}(2457)^+ \to D_s^{*+}\gamma)$	$<$ 6.0	$\times 10^{-4}$ CL=90%	–
$B^0 \to D_{sJ}(2457)^+ D^- \times$ $\text{B}(D_{sJ}(2457)^+ \to$ $D_s^+\pi^+\pi^-)$	$<$ 2.0	$\times 10^{-4}$ CL=90%	–
$B^0 \to D_{sJ}(2457)^+ D^- \times$ $\text{B}(D_{sJ}(2457)^+ \to D_s^+\pi^0)$	$<$ 3.6	$\times 10^{-4}$ CL=90%	–
$B^0 \to D^*(2010)^- D_{sJ}(2457)^+$	(9.3 $\pm$ 2.2) $\times 10^{-3}$		–
$B^0 \to D_{sJ}(2457)^+ D^*(2010) \times$ $\text{B}(D_{sJ}(2457)^+ \to D_s^+\gamma)$	(2.3 $^{+\ 0.9}_{-\ 0.7}$) $\times 10^{-3}$		–
$B^0 \to D^- D_{s1}(2536)^+ \times$ $\text{B}(D_{s1}(2536)^+ \to D^{*0}K^+)$	(1.7 $\pm$ 0.6) $\times 10^{-4}$		1443
$B^0 \to$ $D^*(2010)^- D_{s1}(2536)^+ \times$ $\text{B}(D_{s1}(2536)^+ \to D^{*0}K^+)$	(3.3 $\pm$ 1.1) $\times 10^{-4}$		1336
$B^0 \to D^- D_{s1}(2536)^+ \times$ $\text{B}(D_{s1}(2536)^+ \to D^{*+}K^0)$	(2.6 $\pm$ 1.1) $\times 10^{-4}$		1443
$B^0 \to D^{*-} D_{s1}(2536)^+ \times$ $\text{B}(D_{s1}(2536)^+ \to D^{*+}K^0)$	(5.0 $\pm$ 1.7) $\times 10^{-4}$		1336
$B^0 \to D^- D_{sJ}(2573)^+ \times$ $\text{B}(D_{sJ}(2573)^+ \to D^0K^+)$	$<$ 1	$\times 10^{-4}$ CL=90%	1414
$B^0 \to$ $D^*(2010)^- D_{sJ}(2573)^+ \times$ $\text{B}(D_{sJ}(2573)^+ \to D^0K^+)$	$<$ 2	$\times 10^{-4}$ CL=90%	1303
$B^0 \to D_s^+\pi^-$	(2.4 $\pm$ 0.4) $\times 10^{-5}$		2270
$B^0 \to D_s^{*+}\pi^-$	(2.6 $^{+\ 0.5}_{-\ 0.4}$) $\times 10^{-5}$		2215
$B^0 \to D_s^+\rho^-$	$<$ 2.4	$\times 10^{-5}$ CL=90%	2197
$B^0 \to D_s^{*+}\rho^-$	(4.1 $\pm$ 1.3) $\times 10^{-5}$		2138
$B^0 \to D_s^+ a_0^-$	$<$ 1.9	$\times 10^{-5}$ CL=90%	–
$B^0 \to D_s^{*+} a_0^-$	$<$ 3.6	$\times 10^{-5}$ CL=90%	–
$B^0 \to D_s^+ a_1(1260)^-$	$<$ 2.2	$\times 10^{-3}$ CL=90%	2080
$B^0 \to D_s^{*+} a_1(1260)^-$	$<$ 1.8	$\times 10^{-3}$ CL=90%	2015
$B^0 \to D_s^+ a_2^-$	$<$ 1.9	$\times 10^{-4}$ CL=90%	–

$B^0 \rightarrow D_s^{*+} a_2^-$	<	2.0	$\times 10^{-4}$ CL=90%	−
$B^0 \rightarrow D_s^- K^+$	(	3.0 ± 0.4) $\times 10^{-5}$		2242
$B^0 \rightarrow D_s^{*-} K^+$	(	2.4 ± 0.4) $\times 10^{-5}$		2185
$B^0 \rightarrow D_s^- K^*(892)^+$	(	3.5 ± 1.0) $\times 10^{-5}$		2172
$B^0 \rightarrow D_s^{*-} K^*(892)^+$	(	$3.2 \,{}^{+}_{-}\, {}^{1.5}_{1.3}$) $\times 10^{-5}$		2112
$B^0 \rightarrow D_s^- \pi^+ K^0$	(	1.10 ± 0.33) $\times 10^{-4}$		2222
$B^0 \rightarrow D_s^{*-} \pi^+ K^0$	<	1.10	$\times 10^{-4}$ CL=90%	2164
$B^0 \rightarrow D_s^- \pi^+ K^*(892)^0$	<	3.1	$\times 10^{-3}$ CL=90%	2138
$B^0 \rightarrow D_s^{*-} \pi^+ K^*(892)^0$	<	1.7	$\times 10^{-3}$ CL=90%	2076
$B^0 \rightarrow \overline{D}^0 K^0$	(	5.2 ± 0.7) $\times 10^{-5}$		2280
$B^0 \rightarrow \overline{D}^0 K^+ \pi^-$	(	8.8 ± 1.7) $\times 10^{-5}$		2261
$B^0 \rightarrow \overline{D}^0 K^*(892)^0$	(	4.2 ± 0.6) $\times 10^{-5}$		2213
$B^0 \rightarrow D_2^*(2460)^- K^+ \times$ $\text{B}(D_2^*(2460)^- \rightarrow \overline{D}^0 \pi^-)$	(	1.8 ± 0.5) $\times 10^{-5}$		2031
$B^0 \rightarrow \overline{D}^0 K^+ \pi^-$ non-resonant	<	3.7	$\times 10^{-5}$ CL=90%	−
$B^0 \rightarrow \overline{D}^0 \pi^0$	(	2.61 ± 0.24) $\times 10^{-4}$		2308
$B^0 \rightarrow \overline{D}^0 \rho^0$	(	3.2 ± 0.5) $\times 10^{-4}$		2237
$B^0 \rightarrow \overline{D}^0 f_2$	(	1.2 ± 0.4) $\times 10^{-4}$		−
$B^0 \rightarrow \overline{D}^0 \eta$	(	2.02 ± 0.35) $\times 10^{-4}$	S=1.6	2274
$B^0 \rightarrow \overline{D}^0 \eta'$	(	1.25 ± 0.23) $\times 10^{-4}$	S=1.1	2198
$B^0 \rightarrow \overline{D}^0 \omega$	(	2.59 ± 0.30) $\times 10^{-4}$		2235
$B^0 \rightarrow D^0 \phi$	<	1.16	$\times 10^{-5}$ CL=90%	2182
$B^0 \rightarrow D^0 K^+ \pi^-$	<	1.9	$\times 10^{-5}$ CL=90%	2261
$B^0 \rightarrow D^0 K^*(892)^0$	<	1.1	$\times 10^{-5}$ CL=90%	2213
$B^0 \rightarrow \overline{D}^{*0} \gamma$	<	2.5	$\times 10^{-5}$ CL=90%	2258
$B^0 \rightarrow \overline{D}^*(2007)^0 \pi^0$	(	1.7 ± 0.4) $\times 10^{-4}$	S=1.5	2256
$B^0 \rightarrow \overline{D}^*(2007)^0 \rho^0$	<	5.1	$\times 10^{-4}$ CL=90%	2181
$B^0 \rightarrow \overline{D}^*(2007)^0 \eta$	(	1.8 ± 0.6) $\times 10^{-4}$	S=1.8	2220
$B^0 \rightarrow \overline{D}^*(2007)^0 \eta'$	(	1.23 ± 0.35) $\times 10^{-4}$		2141
$B^0 \rightarrow \overline{D}^*(2007)^0 \pi^+ \pi^-$	(	6.2 ± 2.2) $\times 10^{-4}$		2248
$B^0 \rightarrow \overline{D}^*(2007)^0 K^0$	(	3.6 ± 1.2) $\times 10^{-5}$		2227
$B^0 \rightarrow \overline{D}^*(2007)^0 K^*(892)^0$	<	6.9	$\times 10^{-5}$ CL=90%	2157
$B^0 \rightarrow D^*(2007)^0 K^*(892)^0$	<	4.0	$\times 10^{-5}$ CL=90%	2157
$B^0 \rightarrow D^*(2007)^0 \pi^+ \pi^+ \pi^- \pi^-$	(	2.7 ± 0.5) $\times 10^{-3}$		2219
$B^0 \rightarrow D^*(2010)^+ D^*(2010)^-$	(	8.2 ± 0.9) $\times 10^{-4}$		1711
$B^0 \rightarrow \overline{D}^*(2007)^0 \omega$	(	2.7 ± 0.8) $\times 10^{-4}$	S=1.5	2180
$B^0 \rightarrow D^*(2010)^+ D^-$	(	6.1 ± 1.5) $\times 10^{-4}$	S=1.6	1790
$B^0 \rightarrow D^*(2007)^0 \overline{D}^*(2007)^0$	<	9	$\times 10^{-5}$ CL=90%	1715
$B^0 \rightarrow D^- D^0 K^+$	(	1.7 ± 0.4) $\times 10^{-3}$		1574
$B^0 \rightarrow D^- D^*(2007)^0 K^+$	(	4.6 ± 1.0) $\times 10^{-3}$		1478
$B^0 \rightarrow D^*(2010)^- D^0 K^+$	(	$3.1 \,{}^{+}_{-}\, {}^{0.6}_{0.5}$) $\times 10^{-3}$		1479

$B^0 \rightarrow$ $D^*(2010)^- D^*(2007)^0 K^+$	(	1.18 ± 0.20) %		1366
$B^0 \rightarrow D^- D^+ K^0$	<	1.7 $\times 10^{-3}$	CL=90%	1568
$B^0 \rightarrow D^*(2010)^- D^+ K^0 +$ $D^- D^*(2010)^+ K^0$	(	6.5 ± 1.6) $\times 10^{-3}$		1473
$B^0 \rightarrow$ $D^*(2010)^- D^*(2010)^+ K^0$	(	7.8 ± 1.1) $\times 10^{-3}$		1360
$B^0 \rightarrow D^{*-} D_{s1}(2536)^+ \times$ $B(D_{s1}(2536)^+ \rightarrow$ $D^{*+} K^0)$	(	8.0 ± 2.4) $\times 10^{-4}$		1336
$B^0 \rightarrow \overline{D}^0 D^0 K^0$	<	1.4 $\times 10^{-3}$	CL=90%	1574
$B^0 \rightarrow \overline{D}^0 D^*(2007)^0 K^0 +$ $\overline{D}^*(2007)^0 D^0 K^0$	<	3.7 $\times 10^{-3}$	CL=90%	1478
$B^0 \rightarrow$ $\overline{D}^*(2007)^0 D^*(2007)^0 K^0$	<	6.6 $\times 10^{-3}$	CL=90%	1365
$B^0 \rightarrow (\overline{D}+\overline{D}^*)(D+D^*)K$	(	4.3 ± 0.7) %		–

Charmonium modes

$B^0 \rightarrow \eta_c K^0$	(	8.9 ± 1.6) $\times 10^{-4}$		1753
$B^0 \rightarrow \eta_c K^*(892)^0$	(	6.1 ± 1.0) $\times 10^{-4}$		1648
$B^0 \rightarrow \eta_c(2S) K^{*0}$	<	3.9 $\times 10^{-4}$	CL=90%	1159
$B^0 \rightarrow J/\psi(1S) K^0$	(	8.71 ± 0.32) $\times 10^{-4}$		1683
$B^0 \rightarrow J/\psi(1S) K^+ \pi^-$	(	1.2 ± 0.6) $\times 10^{-3}$		1652
$B^0 \rightarrow J/\psi(1S) K^*(892)^0$	(	1.33 ± 0.06) $\times 10^{-3}$		1571
$B^0 \rightarrow J/\psi(1S) \eta K^0_S$	(	8 ± 4) $\times 10^{-5}$		1508
$B^0 \rightarrow J/\psi(1S) \eta' K^0_S$	<	2.5 $\times 10^{-5}$	CL=90%	1271
$B^0 \rightarrow J/\psi(1S) \phi K^0$	(	9.4 ± 2.6) $\times 10^{-5}$		1224
$B^0 \rightarrow J/\psi(1S) \omega K^0$ nonresonant	(	3.1 ± 0.7) $\times 10^{-4}$		1386
$B^0 \rightarrow J/\psi(1S) K(1270)^0$	(	1.3 ± 0.5) $\times 10^{-3}$		1390
$B^0 \rightarrow J/\psi(1S) \pi^0$	(	1.76 ± 0.16) $\times 10^{-5}$	S=1.1	1728
$B^0 \rightarrow J/\psi(1S) \eta$	(	9.5 ± 1.9) $\times 10^{-6}$		1672
$B^0 \rightarrow J/\psi(1S) \pi^+ \pi^-$	(	4.6 ± 0.9) $\times 10^{-5}$		1716
$B^0 \rightarrow J/\psi(1S) \pi^+ \pi^-$ non-resonant	<	1.2 $\times 10^{-5}$	CL=90%	1716
$B^0 \rightarrow J/\psi(1S) f_2$	<	4.6 $\times 10^{-6}$	CL=90%	–
$B^0 \rightarrow J/\psi(1S) \rho^0$	(	2.7 ± 0.4) $\times 10^{-5}$		1612
$B^0 \rightarrow J/\psi(1S) \omega$	<	2.7 $\times 10^{-4}$	CL=90%	1609
$B^0 \rightarrow J/\psi(1S) \phi$	<	9.4 $\times 10^{-7}$	CL=90%	1520
$B^0 \rightarrow J/\psi(1S) \eta'(958)$	<	6.3 $\times 10^{-5}$	CL=90%	1546
$B^0 \rightarrow J/\psi(1S) K^0 \pi^+ \pi^-$	(	1.0 ± 0.4) $\times 10^{-3}$		1611
$B^0 \rightarrow J/\psi(1S) K^0 \rho^0$	(	5.4 ± 3.0) $\times 10^{-4}$		1390
$B^0 \rightarrow J/\psi(1S) K^*(892)^+ \pi^-$	(	8 ± 4) $\times 10^{-4}$		1514
$B^0 \rightarrow$ $J/\psi(1S) K^*(892)^0 \pi^+ \pi^-$	(	6.6 ± 2.2) $\times 10^{-4}$		1447

$B^0 \rightarrow X(3872)^- K^+$		$<$ 5	$\times 10^{-4}$ CL=90%	–
$B^0 \rightarrow X(3872)^- K^+ \times$ B$(X(3872)^- \rightarrow J/\psi(1S)\pi^-\pi^0)$	[nnn]	$<$ 5.4	$\times 10^{-6}$ CL=90%	–
$B^0 \rightarrow X(3872) K^0 \times$ B$(X \rightarrow J/\psi\pi^+\pi^-)$		$<$ 6.0	$\times 10^{-6}$ CL=90%	1139
$B^0 \rightarrow X(3872) K^0 \times$ B$(X \rightarrow D^0\overline{D}^0\pi^0)$		(1.7 $\pm$ 0.8) $\times 10^{-4}$		1139
$B^0 \rightarrow X(3872) K^0 \times$ B$(X \rightarrow \overline{D}^{*0} D^0)$		$<$ 4.37	$\times 10^{-4}$ CL=90%	1139
$B^0 \rightarrow X(4430)^\pm K^\mp \times$ B$(X^\pm \rightarrow \psi(2S)\pi^\pm)$		(4.1 $\pm$ 1.7) $\times 10^{-5}$		–
$B^0 \rightarrow J/\psi(1S) p\overline{p}$		$<$ 8.3	$\times 10^{-7}$ CL=90%	862
$B^0 \rightarrow J/\psi(1S)\gamma$		$<$ 1.6	$\times 10^{-6}$ CL=90%	1731
$B^0 \rightarrow J/\psi(1S)\overline{D}^0$		$<$ 1.3	$\times 10^{-5}$ CL=90%	877
$B^0 \rightarrow \psi(2S) K^0$		(6.2 $\pm$ 0.6) $\times 10^{-4}$		1283
$B^0 \rightarrow \psi(3770) K^0 \times$ B$(\psi \rightarrow \overline{D}^0 D^0)$		$<$ 1.23	$\times 10^{-4}$ CL=90%	1217
$B^0 \rightarrow \psi(3770) K^0 \times$ B$(\psi \rightarrow D^- D^+)$		$<$ 1.88	$\times 10^{-4}$ CL=90%	1217
$B^0 \rightarrow \psi(2S) K^+\pi^-$		$<$ 1	$\times 10^{-3}$ CL=90%	1238
$B^0 \rightarrow \psi(2S) K^*(892)^0$		(7.2 $\pm$ 0.8) $\times 10^{-4}$		1116
$B^0 \rightarrow \chi_{c0}(1P) K^0$		$<$ 1.13	$\times 10^{-4}$ CL=90%	1477
$B^0 \rightarrow \chi_{c0} K^*(892)^0$		(1.7 $\pm$ 0.4) $\times 10^{-4}$		–
$B^0 \rightarrow \chi_{c2} K^0$		$<$ 2.6	$\times 10^{-5}$ CL=90%	–
$B^0 \rightarrow \chi_{c2} K^*(892)^0$		$<$ 3.6	$\times 10^{-5}$ CL=90%	–
$B^0 \rightarrow \chi_{c1}(1P)\pi^0$		(1.12 $\pm$ 0.28) $\times 10^{-5}$		1468
$B^0 \rightarrow \chi_{c1}(1P) K^0$		(3.9 $\pm$ 0.4) $\times 10^{-4}$		1411
$B^0 \rightarrow \chi_{c1}(1P) K^-\pi^+$		(3.8 $\pm$ 0.4) $\times 10^{-4}$		1371
$B^0 \rightarrow \chi_{c1}(1P) K^*(892)^0$		(2.0 $^{+\ 0.6}_{-\ 0.4}$) $\times 10^{-4}$	S=1.8	1265
$B^0 \rightarrow X(4051)^+ K^- \times$ B$(X^+ \rightarrow \chi_{c1}\pi^+)$		(3.0 $^{+\ 4.0}_{-\ 1.8}$) $\times 10^{-5}$		–
$B^0 \rightarrow X(4248)^+ K^- \times$ B$(X^+ \rightarrow \chi_{c1}\pi^+)$		(4.0 $^{+20.0}_{-\ 1.0}$) $\times 10^{-5}$		–

K or K^* modes

$B^0 \rightarrow K^+\pi^-$		(1.94 $\pm$ 0.06) $\times 10^{-5}$		2615
$B^0 \rightarrow K^0\pi^0$		(9.8 $\pm$ 0.6) $\times 10^{-6}$		2615
$B^0 \rightarrow \eta' K^0$		(6.5 $\pm$ 0.4) $\times 10^{-5}$	S=1.2	2528
$B^0 \rightarrow \eta' K^*(892)^0$		(3.8 $\pm$ 1.2) $\times 10^{-6}$		2472
$B^0 \rightarrow \eta K^0$		$<$ 1.9	$\times 10^{-6}$ CL=90%	2587

$B^0 \rightarrow \eta K^*(892)^0$		$(\ 1.59 \pm\ 0.10) \times 10^{-5}$		2534
$B^0 \rightarrow \eta K_0^*(1430)^0$		$(\ 1.10 \pm\ 0.22) \times 10^{-5}$		2414
$B^0 \rightarrow \eta K_2^*(1430)^0$		$(\ 9.6\ \pm\ 2.1\ ) \times 10^{-6}$		2414
$B^0 \rightarrow \omega K^0$		$(\ 5.0\ \pm\ 0.6\ ) \times 10^{-6}$		2557
$B^0 \rightarrow a_0(980)^0 K^0 \times$ $\ \ \ \ B(a_0(980)^0 \rightarrow \eta\pi^0)$	$<$	7.8	$\times 10^{-6}$ CL=90%	$-$
$B^0 \rightarrow b_1^0 K^0 \times B(b_1^0 \rightarrow \omega\pi^0)$	$<$	7.8	$\times 10^{-6}$ CL=90%	$-$
$B^0 \rightarrow a_0(980)^\pm K^\mp \times$ $\ \ \ \ B(a_0(980)^\pm \rightarrow \eta\pi^\pm)$	$<$	1.9	$\times 10^{-6}$ CL=90%	$-$
$B^0 \rightarrow b_1^- K^+ \times B(b_1^- \rightarrow \omega\pi^-)$		$(\ 7.4\ \pm\ 1.4\ ) \times 10^{-6}$		$-$
$B^0 \rightarrow a_0(1450)^\pm K^\mp \times$ $\ \ \ \ B(a_0(1450)^\pm \rightarrow \eta\pi^\pm)$	$<$	3.1	$\times 10^{-6}$ CL=90%	$-$
$B^0 \rightarrow K_S^0 X^0 \text{(Familon)}$	$<$	5.3	$\times 10^{-5}$ CL=90%	$-$
$B^0 \rightarrow \omega K^*(892)^0$		$(\ 2.0\ \pm\ 0.5\ ) \times 10^{-6}$		2503
$B^0 \rightarrow \omega (K\pi)_0^{*0}$		$(\ 1.84 \pm\ 0.25) \times 10^{-5}$		$-$
$B^0 \rightarrow \omega K_0^*(1430)^0$		$(\ 1.60 \pm\ 0.34) \times 10^{-5}$		2380
$B^0 \rightarrow \omega K_2^*(1430)^0$		$(\ 1.01 \pm\ 0.23) \times 10^{-5}$		2380
$B^0 \rightarrow \omega K^+\pi^- \text{ nonresonant}$		$(\ 5.1\ \pm\ 1.0\ ) \times 10^{-6}$		2542
$B^0 \rightarrow K^+\pi^-\pi^0$		$(\ 3.59^{+\ 0.28}_{-\ 0.24}) \times 10^{-5}$		2609
$\quad B^0 \rightarrow K^+\rho^-$		$(\ 8.4\ ^{+\ 1.6}_{-\ 2.2}\ ) \times 10^{-6}$	S=1.6	2559
$\quad B^0 \rightarrow K^+\rho(1450)^-$	$<$	2.1	$\times 10^{-6}$ CL=90%	$-$
$\quad B^0 \rightarrow K^+\rho(1700)^-$	$<$	1.1	$\times 10^{-6}$ CL=90%	$-$
$\quad B^0 \rightarrow (K^+\pi^-\pi^0) \text{ non-} \\ \text{resonant}$		$(\ 4.4\ \pm\ 1.0\ ) \times 10^{-6}$		$-$
$B^0 \rightarrow (K\pi)_0^{*+}\pi^- \times$ $\ \ \ \ B((K\pi)_0^{*+} \rightarrow K^+\pi^0)$		$(\ 9.4\ \pm\ 2.5\ ) \times 10^{-6}$		$-$
$B^0 \rightarrow$ $\ (K\pi)_0^{*0}\pi^0 \times B((K\pi)_0^{*0} \rightarrow$ $\ K^+\pi^-)$		$(\ 8.7\ \pm\ 2.9\ ) \times 10^{-6}$		$-$
$B^0 \rightarrow K_2^*(1430)^0\pi^0$	$<$	4.0	$\times 10^{-6}$ CL=90%	2445
$B^0 \rightarrow K^*(1680)^0\pi^0$	$<$	7.5	$\times 10^{-6}$ CL=90%	2358
$B^0 \rightarrow K_x^{*0}\pi^0$	$[qqq]$	$(\ 6.1\ \pm\ 1.6\ ) \times 10^{-6}$		$-$
$B^0 \rightarrow K^0\pi^+\pi^- \text{ charmless}$		$(\ 4.48 \pm\ 0.26) \times 10^{-5}$		2609
$B^0 \rightarrow K^0\pi^+\pi^- \text{ non-} \\ \text{resonant}$		$(\ 1.99 \pm\ 0.31) \times 10^{-5}$		$-$
$B^0 \rightarrow K^0\rho^0$		$(\ 5.4\ \pm\ 0.9\ ) \times 10^{-6}$		2558
$B^0 \rightarrow K^0 f_0(980)$		$(\ 5.5\ \pm\ 0.9\ ) \times 10^{-6}$		2524
$B^0 \rightarrow K^*(892)^+\pi^-$		$(\ 1.05^{+\ 0.12}_{-\ 0.11}) \times 10^{-5}$	S=1.2	2562
$B^0 \rightarrow K_0^*(1430)^+\pi^-$		$(\ 5.0\ ^{+\ 0.8}_{-\ 0.9}\ ) \times 10^{-5}$		$-$
$B^0 \rightarrow K_x^{*+}\pi^-$	$[qqq]$	$(\ 5.1\ \pm\ 1.6\ ) \times 10^{-6}$		$-$

$B^0 \rightarrow K^*(1410)^+ \pi^- \times$ $\quad B(K^*(1410)^+ \rightarrow K^0 \pi^+)$		$<$ 3.8	$\times 10^{-6}$ CL=90%	–
$B^0 \rightarrow f_0(980) K^0 \times$ $\quad B(f_0(980) \rightarrow \pi^+ \pi^-)$		$(7.6 \; {}^{+\,1.9}_{-\,2.1}) \times 10^{-6}$		2524
$B^0 \rightarrow f_2(1270) K^0$		$<$ 2.5	$\times 10^{-6}$ CL=90%	2459
$B^0 \rightarrow K^*(892)^0 \pi^0$		$(3.6 \pm 0.8) \times 10^{-6}$		2563
$B^0 \rightarrow K_2^*(1430)^+ \pi^-$		$<$ 6	$\times 10^{-6}$ CL=90%	2445
$B^0 \rightarrow K^*(1680)^+ \pi^-$		$<$ 1.0	$\times 10^{-5}$ CL=90%	2358
$B^0 \rightarrow K^+ \pi^- \pi^+ \pi^-$	[rrr]	$<$ 2.3	$\times 10^{-4}$ CL=90%	2600
$B^0 \rightarrow K^*(892)^0 \pi^+ \pi^-$		$(5.4 \pm 0.5) \times 10^{-5}$		2557
$B^0 \rightarrow K^*(892)^0 \rho^0$		$(5.6 \pm 1.6) \times 10^{-6}$		2504
$B^0 \rightarrow K^*(892)^0 f_0(980)$		$<$ 4.3	$\times 10^{-6}$ CL=90%	2468
$B^0 \rightarrow K_1(1400)^+ \pi^-$		$<$ 1.1	$\times 10^{-3}$ CL=90%	2451
$B^0 \rightarrow a_1(1260)^- K^+$	[rrr]	$(1.6 \pm 0.4) \times 10^{-5}$		2471
$B^0 \rightarrow K^*(892)^+ \rho^-$		$<$ 1.20	$\times 10^{-5}$ CL=90%	2504
$B^0 \rightarrow K_1(1400)^0 \rho^0$		$<$ 3.0	$\times 10^{-3}$ CL=90%	2388
$B^0 \rightarrow K^+ K^-$		$<$ 4.1	$\times 10^{-7}$ CL=90%	2593
$B^0 \rightarrow K^0 \overline{K}^0$		$(9.6 \; {}^{+\,2.0}_{-\,1.8}) \times 10^{-7}$		2592
$B^0 \rightarrow K^0 K^- \pi^+$		$<$ 1.8	$\times 10^{-5}$ CL=90%	2578
$B^0 \rightarrow \overline{K}^{*0} K^0 + K^{*0} \overline{K}^0$		$<$ 1.9	$\times 10^{-6}$	–
$B^0 \rightarrow K^+ K^- \pi^0$		$<$ 1.9	$\times 10^{-5}$ CL=90%	2579
$B^0 \rightarrow K^0 K^+ K^-$		$(2.47 \pm 0.23) \times 10^{-5}$		2522
$B^0 \rightarrow K^0 \phi$		$(8.6 \; {}^{+\,1.3}_{-\,1.1}) \times 10^{-6}$		2516
$B^0 \rightarrow K_S^0 K_S^0 K_S^0$		$(6.2 \; {}^{+\,1.2}_{-\,1.1}) \times 10^{-6}$	S=1.3	2521
$B^0 \rightarrow K_S^0 K_S^0 K_L^0$		$<$ 1.6	$\times 10^{-5}$ CL=90%	2521
$B^0 \rightarrow K^*(892)^0 K^+ K^-$		$(2.75 \pm 0.26) \times 10^{-5}$		2466
$B^0 \rightarrow K^*(892)^0 \phi$		$(9.8 \pm 0.6) \times 10^{-6}$		2460
$B^0 \rightarrow K^*(892)^0 K^- \pi^+$		$(4.6 \pm 1.4) \times 10^{-6}$		2524
$B^0 \rightarrow K^*(892)^0 \overline{K}^*(892)^0$		$(1.28 \; {}^{+\,0.40}_{-\,0.32}) \times 10^{-6}$		2485
$B^0 \rightarrow K^*(892)^0 K^+ \pi^-$		$<$ 2.2	$\times 10^{-6}$ CL=90%	2524
$B^0 \rightarrow K^*(892)^0 K^*(892)^0$		$<$ 4.1	$\times 10^{-7}$ CL=90%	2485
$B^0 \rightarrow K^*(892)^+ K^*(892)^-$		$<$ 2.0	$\times 10^{-6}$ CL=90%	2485
$B^0 \rightarrow K_1(1400)^0 \phi$		$<$ 5.0	$\times 10^{-3}$ CL=90%	2339
$B^0 \rightarrow \phi (K\pi)_0^{*0}$		$(4.3 \pm 0.7) \times 10^{-6}$		–
$B^0 \rightarrow \phi (K\pi)_0^{*0}$ $\quad (1.60 < m_{K\pi} < 2.15)$	[sss]	$<$ 1.7	$\times 10^{-6}$ CL=90%	–
$B^0 \rightarrow K_0^*(1430)^0 \phi$		$(3.9 \pm 0.8) \times 10^{-6}$		2333
$B^0 \rightarrow K^*(1680)^0 \phi$		$<$ 3.5	$\times 10^{-6}$ CL=90%	2238
$B^0 \rightarrow K^*(1780)^0 \phi$		$<$ 2.7	$\times 10^{-6}$ CL=90%	–
$B^0 \rightarrow K^*(2045)^0 \phi$		$<$ 1.53	$\times 10^{-5}$ CL=90%	–
$B^0 \rightarrow K_2^*(1430)^0 \rho^0$		$<$ 1.1	$\times 10^{-3}$ CL=90%	2381

$B^0 \rightarrow \phi\eta$	<	6	$\times 10^{-7}$ CL=90%	2511
$B^0 \rightarrow \phi\eta'$	<	5	$\times 10^{-7}$ CL=90%	2447
$B^0 \rightarrow \phi\rho^0$	<	3.3	$\times 10^{-7}$ CL=90%	2480
$B^0 \rightarrow \phi f_0(980) \times \mathrm{B}(f_0 \rightarrow \pi^+\pi^-)$	<	3.8	$\times 10^{-7}$ CL=90%	2443
$B^0 \rightarrow \phi\omega$	<	1.2	$\times 10^{-6}$ CL=90%	2479
$B^0 \rightarrow \phi\phi$	<	2	$\times 10^{-7}$ CL=90%	2435
$B^0 \rightarrow a_0(980)^{\pm}\pi^{\mp} \times \mathrm{B}(a_0(980)^{\pm} \rightarrow \eta\pi^{\pm})$	<	3.1	$\times 10^{-6}$ CL=90%	–
$B^0 \rightarrow a_0(1450)^{\pm}\pi^{\mp} \times \mathrm{B}(a_0(1450)^{\pm} \rightarrow \eta\pi^{\pm})$	<	2.3	$\times 10^{-6}$ CL=90%	–
$B^0 \rightarrow \pi^+\pi^-\pi^0$	<	7.2	$\times 10^{-4}$ CL=90%	2631
$B^0 \rightarrow \rho^0\pi^0$	(	2.0 $\pm$ 0.5)	$\times 10^{-6}$	2581
$B^0 \rightarrow \rho^{\mp}\pi^{\pm}$	[gg] (	2.30 $\pm$ 0.23)	$\times 10^{-5}$	2581
$B^0 \rightarrow \pi^+\pi^-\pi^+\pi^-$	<	1.93	$\times 10^{-5}$ CL=90%	2621
$B^0 \rightarrow \rho^0\pi^+\pi^-$	<	8.8	$\times 10^{-6}$ CL=90%	2575
$B^0 \rightarrow \rho^0\rho^0$	(	7.3 $\pm$ 2.8)	$\times 10^{-7}$	2523
$B^0 \rightarrow f_0(980)\pi^+\pi^-$	<	3.8	$\times 10^{-6}$ CL=90%	2541
$B^0 \rightarrow \rho^0 f_0(980) \times \mathrm{B}(f_0(980) \rightarrow \pi^+\pi^-)$	<	3	$\times 10^{-7}$ CL=90%	2488
$B^0 \rightarrow f_0(980) f_0(980) \times \mathrm{B}(f_0(980) \rightarrow \pi^+\pi^-)^2$	<	1	$\times 10^{-7}$ CL=90%	2451
$B^0 \rightarrow f_0(980) f_0(980) \times \mathrm{B}(f_0 \rightarrow \pi^+\pi^-) \times \mathrm{B}(f_0 \rightarrow K^+K^-)$	<	2.3	$\times 10^{-7}$ CL=90%	2451
$B^0 \rightarrow a_1(1260)^{\mp}\pi^{\pm}$	[gg] (	3.3 $\pm$ 0.5)	$\times 10^{-5}$	2494
$B^0 \rightarrow a_2(1320)^{\mp}\pi^{\pm}$	[gg] <	3.0	$\times 10^{-4}$ CL=90%	2473
$B^0 \rightarrow \pi^+\pi^-\pi^0\pi^0$	<	3.1	$\times 10^{-3}$ CL=90%	2622
$B^0 \rightarrow \rho^+\rho^-$	(	2.42 $\pm$ 0.31)	$\times 10^{-5}$	2523
$B^0 \rightarrow a_1(1260)^0\pi^0$	<	1.1	$\times 10^{-3}$ CL=90%	2495
$B^0 \rightarrow \omega\pi^0$	<	5	$\times 10^{-7}$ CL=90%	2580
$B^0 \rightarrow \pi^+\pi^+\pi^-\pi^-\pi^0$	<	9.0	$\times 10^{-3}$ CL=90%	2609
$B^0 \rightarrow a_1(1260)^+\rho^-$	<	6.1	$\times 10^{-5}$ CL=90%	2433
$B^0 \rightarrow a_1(1260)^0\rho^0$	<	2.4	$\times 10^{-3}$ CL=90%	2433
$B^0 \rightarrow b_1^{\mp}\pi^{\pm} \times \mathrm{B}(b_1^{\mp} \rightarrow \omega\pi^{\mp})$	(	1.09 $\pm$ 0.15)	$\times 10^{-5}$	–
$B^0 \rightarrow b_1^0\pi^0 \times \mathrm{B}(b_1^0 \rightarrow \omega\pi^0)$	<	1.9	$\times 10^{-6}$ CL=90%	–
$B^0 \rightarrow \pi^+\pi^+\pi^+\pi^-\pi^-\pi^-$	<	3.0	$\times 10^{-3}$ CL=90%	2592
$B^0 \rightarrow a_1(1260)^+ a_1(1260)^-$	<	2.8	$\times 10^{-3}$ CL=90%	2336
$B^0 \rightarrow \pi^+\pi^+\pi^+\pi^-\pi^-\pi^-\pi^0$	<	1.1	% CL=90%	2572

Baryon modes

$B^0 \to p\overline{p}$	<	1.1	$\times 10^{-7}$ CL=90%	2467
$B^0 \to p\overline{p}\pi^+\pi^-$	<	2.5	$\times 10^{-4}$ CL=90%	2406
$B^0 \to p\overline{p}K^0$	(	$2.66\pm 0.32)\times 10^{-6}$		2347
$B^0 \to \Theta(1540)^+\overline{p}\times$ $B(\Theta(1540)^+ \to pK_S^0)$	[ttt] <	5	$\times 10^{-8}$ CL=90%	2318
$B^0 \to f_J(2220)K^0\times$ $B(f_J(2220) \to p\overline{p})$	<	4.5	$\times 10^{-7}$ CL=90%	2135
$B^0 \to p\overline{p}K^*(892)^0$	(	$1.24^{+\,0.28}_{-\,0.25})\times 10^{-6}$		2215
$B^0 \to f_J(2220)K_0^*\times$ $B(f_J(2220) \to p\overline{p})$	<	1.5	$\times 10^{-7}$ CL=90%	–
$B^0 \to p\overline{\Lambda}\pi^-$	(	$3.2 \pm 0.4\ )\times 10^{-6}$		2401
$B^0 \to p\overline{\Sigma}(1385)^-$	<	2.6	$\times 10^{-7}$ CL=90%	2363
$B^0 \to \Delta^0\overline{\Lambda}$	<	9.3	$\times 10^{-7}$ CL=90%	2364
$B^0 \to p\overline{\Lambda}K^-$	<	8.2	$\times 10^{-7}$ CL=90%	2308
$B^0 \to p\overline{\Sigma}^0\pi^-$	<	3.8	$\times 10^{-6}$ CL=90%	2383
$B^0 \to \overline{\Lambda}\Lambda$	<	3.2	$\times 10^{-7}$ CL=90%	2392
$B^0 \to \Delta^0\overline{\Delta}^0$	<	1.5	$\times 10^{-3}$ CL=90%	2335
$B^0 \to \Delta^{++}\overline{\Delta}^{--}$	<	1.1	$\times 10^{-4}$ CL=90%	2335
$B^0 \to \overline{D}^0 p\overline{p}$	(	$1.14\pm 0.09)\times 10^{-4}$		1862
$B^0 \to D_s^-\overline{\Lambda}p$	(	$2.9 \pm 0.9\ )\times 10^{-5}$		1710
$B^0 \to \overline{D}^*(2007)^0 p\overline{p}$	(	$1.03\pm 0.13)\times 10^{-4}$		1788
$B^0 \to D^*(2010)^- p\overline{n}$	(	$1.5 \pm 0.4\ )\times 10^{-3}$		1785
$B^0 \to D^- p\overline{p}\pi^+$	(	$3.38\pm 0.32)\times 10^{-4}$		1786
$B^0 \to D^*(2010)^- p\overline{p}\pi^+$	(	$5.0 \pm 0.5\ )\times 10^{-4}$		1707
$B^0 \to \Theta_c\overline{p}\pi^+\times B(\Theta_c \to D^- p)$	<	9	$\times 10^{-6}$ CL=90%	–
$B^0 \to \Theta_c\overline{p}\pi^+\times B(\Theta_c \to D^{*-} p)$	<	1.4	$\times 10^{-5}$ CL=90%	–
$B^0 \to \overline{\Sigma}_c^{--}\Delta^{++}$	<	1.0	$\times 10^{-3}$ CL=90%	1839
$B^0 \to \overline{\Lambda}_c^- p\pi^+\pi^-$	(	$1.3 \pm 0.4\ )\times 10^{-3}$		1934
$B^0 \to \overline{\Lambda}_c^- p$	(	$2.0 \pm 0.4\ )\times 10^{-5}$		2021
$B^0 \to \overline{\Lambda}_c^- p\pi^0$	<	5.9	$\times 10^{-4}$ CL=90%	1982
$B^0 \to \overline{\Lambda}_c^- p\pi^+\pi^-\pi^0$	<	5.07	$\times 10^{-3}$ CL=90%	1882
$B^0 \to \overline{\Lambda}_c^- p\pi^+\pi^-\pi^+\pi^-$	<	2.74	$\times 10^{-3}$ CL=90%	1821
$B^0 \to \Lambda_c^+\overline{p}\pi^+\pi^-$	(	$1.12\pm 0.32)\times 10^{-3}$		1934
$B^0 \to \Lambda_c^+\overline{p}\pi^+\pi^-$ (nonresonant)	(	$6.4 \pm 1.9\ )\times 10^{-4}$		1934
$B^0 \to \overline{\Sigma}_c(2520)^{--} p\pi^+$	(	$1.2 \pm 0.4\ )\times 10^{-4}$		1860
$B^0 \to \overline{\Sigma}_c(2520)^0 p\pi^-$	<	3.8	$\times 10^{-5}$ CL=90%	1860
$B^0 \to \overline{\Sigma}_c(2455)^0 p\pi^-$	(	$1.5 \pm 0.5\ )\times 10^{-4}$		1895
$B^0 \to \overline{\Sigma}_c(2455)^0 N^0\times$ $B(N^0 \to p\pi^-)$	(	$8.0 \pm 2.9\ )\times 10^{-5}$		–

$B^0 \to \overline{\Sigma}_c(2455)^{--} p \pi^+$			(2.2 ± 0.7) $\times 10^{-4}$		1895
$B^0 \to \overline{\Lambda}_c^- \Lambda_c^+$		<	6.2	$\times 10^{-5}$ CL=90%	1319
$B^0 \to$ $\overline{\Lambda}_c(2593)^- / \overline{\Lambda}_c(2625)^- p$		<	1.1	$\times 10^{-4}$ CL=90%	–
$B^0 \to \overline{\Xi}_c^- \Lambda_c^+ \times \mathrm{B}(\overline{\Xi}_c^- \to \Xi^+ \pi^- \pi^-)$			(2.2 ± 2.3) $\times 10^{-5}$	S=1.9	1147
$B^0 \to \Lambda_c^+ \Lambda_c^- K^0$			(5.4 ± 3.2) $\times 10^{-4}$		–

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

$B^0 \to \gamma\gamma$	B1		<	6.2	$\times 10^{-7}$ CL=90%	2640
$B^0 \to e^+ e^-$	B1		<	1.13	$\times 10^{-7}$ CL=90%	2640
$B^0 \to e^+ e^- \gamma$	B1		<	1.2	$\times 10^{-7}$ CL=90%	2640
$B^0 \to \mu^+ \mu^-$	B1		<	1.5	$\times 10^{-8}$ CL=90%	2638
$B^0 \to \mu^+ \mu^- \gamma$	B1		<	1.6	$\times 10^{-7}$ CL=90%	2638
$B^0 \to \tau^+ \tau^-$	B1		<	4.1	$\times 10^{-3}$ CL=90%	1952
$B^0 \to \pi^0 \ell^+ \ell^-$	B1		<	1.2	$\times 10^{-7}$ CL=90%	2638
$B^0 \to \pi^0 e^+ e^-$	B1		<	1.4	$\times 10^{-7}$ CL=90%	2638
$B^0 \to \pi^0 \mu^+ \mu^-$	B1		<	1.8	$\times 10^{-7}$ CL=90%	2634
$B^0 \to \pi^0 \nu \overline{\nu}$	B1		<	2.2	$\times 10^{-4}$ CL=90%	2638
$B^0 \to K^0 \ell^+ \ell^-$	B1	[*iii*]	(	$2.9 {}^{+1.6}_{-1.3}$	) $\times 10^{-7}$	2616
$B^0 \to K^0 \nu \overline{\nu}$	B1		<	1.6	$\times 10^{-4}$ CL=90%	2616
$B^0 \to \rho^0 \nu \overline{\nu}$	B1		<	4.4	$\times 10^{-4}$ CL=90%	2583
$B^0 \to K^0 e^+ e^-$	B1		(	$1.3 {}^{+1.6}_{-1.1}$	) $\times 10^{-7}$	2616
$B^0 \to K^0 \mu^+ \mu^-$	B1		(	$5.7 {}^{+2.2}_{-1.8}$	) $\times 10^{-7}$	2612
$B^0 \to K^*(892)^0 \ell^+ \ell^-$	B1	[*iii*]	(	9.5 ± 1.8	) $\times 10^{-7}$	2564
$B^0 \to K^*(892)^0 e^+ e^-$	B1		(	$1.04 {}^{+0.35}_{-0.31}$	) $\times 10^{-6}$	2564
$B^0 \to K^*(892)^0 \mu^+ \mu^-$	B1		(	9.8 ± 2.1	) $\times 10^{-7}$	2560
$B^0 \to K^*(892)^0 \nu \overline{\nu}$	B1		<	1.2	$\times 10^{-4}$ CL=90%	2564
$B^0 \to \phi \nu \overline{\nu}$	B1		<	5.8	$\times 10^{-5}$ CL=90%	2541
$B^0 \to e^\pm \mu^\mp$	LF	[*gg*]	<	9.2	$\times 10^{-8}$ CL=90%	2639
$B^0 \to \pi^0 e^\pm \mu^\mp$	LF		<	1.4	$\times 10^{-7}$ CL=90%	2637
$B^0 \to K^0 e^\pm \mu^\mp$	LF		<	2.7	$\times 10^{-7}$ CL=90%	2615
$B^0 \to K^*(892)^0 e^+ \mu^-$	LF		<	5.3	$\times 10^{-7}$ CL=90%	2563
$B^0 \to K^*(892)^0 e^- \mu^+$	LF		<	3.4	$\times 10^{-7}$ CL=90%	2563
$B^0 \to K^*(892)^0 e^\pm \mu^\mp$	LF		<	5.8	$\times 10^{-7}$ CL=90%	2563
$B^0 \to e^\pm \tau^\mp$	LF	[*gg*]	<	2.8	$\times 10^{-5}$ CL=90%	2341
$B^0 \to \mu^\pm \tau^\mp$	LF	[*gg*]	<	2.2	$\times 10^{-5}$ CL=90%	2339
$B^0 \to$ invisible	B1		<	2.2	$\times 10^{-4}$ CL=90%	–
$B^0 \to \nu \overline{\nu} \gamma$	B1		<	4.7	$\times 10^{-5}$ CL=90%	2640

$B^{\pm}/B^0$ ADMIXTURE

CP violation

$$A_{CP}(B \to K^*(892)\gamma) = -0.010 \pm 0.028$$
$$A_{CP}(B \to s\gamma) = -0.014 \pm 0.028$$
$$A_{CP}(b \to (s+d)\gamma) = -0.11 \pm 0.12$$
$$A_{CP}(b \to X_s\ell^+\ell^-) = -0.22 \pm 0.26$$

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

For inclusive branching fractions, *e.g.*, $B \to D^{\pm}$ 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. Event 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.

$\overline{B}$ 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	*p* (MeV/*c*)
Semileptonic and leptonic modes				
$B \to e^+\nu_e$ anything	[uuu]	(10.74 $\pm$ 0.16) %		–
$B \to \overline{p}e^+\nu_e$ anything		< 5.9 $\times 10^{-4}$	CL=90%	–
$B \to \mu^+\nu_\mu$ anything	[uuu]	(10.74 $\pm$ 0.16) %		–
$B \to \ell^+\nu_\ell$ anything	[iii,uuu]	(10.74 $\pm$ 0.16) %		–
$B \to D^-\ell^+\nu_\ell$ anything	[iii]	(2.8 $\pm$ 0.9) %		–
$B \to \overline{D}^0\ell^+\nu_\ell$ anything	[iii]	(7.2 $\pm$ 1.4) %		–
$B \to D\tau^+\nu_\tau$		(8.6 $\pm$ 2.7) $\times 10^{-3}$		1911
$B \to D^{*-}\ell^+\nu_\ell$ anything	[vvv]	(6.7 $\pm$ 1.3) $\times 10^{-3}$		–
$B \to D^*\tau^+\nu_\tau$		(1.62 $\pm$ 0.33) %		–
$B \to \overline{D}^{**}\ell^+\nu_\ell$	[iii,www]	(2.7 $\pm$ 0.7) %		–
$B \to \overline{D}_1(2420)\ell^+\nu_\ell$ anything		(3.8 $\pm$ 1.3) $\times 10^{-3}$	S=2.4	–

$B \to D\pi\ell^+\nu_\ell$ anything $+ D^*\pi\ell^+\nu_\ell$ anything		(2.6 $\pm$ 0.5) %		S=1.5	–
$B \to D\pi\ell^+\nu_\ell$ anything		(1.5 $\pm$ 0.6) %			–
$B \to D^*\pi\ell^+\nu_\ell$ anything		(1.9 $\pm$ 0.4) %			–
$B \to \overline{D}_2^*(2460)\ell^+\nu_\ell$ anything		(4.4 $\pm$ 1.6) $\times 10^{-3}$			–
$B \to D^{*-}\pi^+\ell^+\nu_\ell$ anything		(1.00 $\pm$ 0.34) %			–
$B \to D_s^-\ell^+\nu_\ell$ anything	[iii]	< 7	$\times 10^{-3}$	CL=90%	–
$B \to D_s^-\ell^+\nu_\ell K^+$ anything	[iii]	< 5	$\times 10^{-3}$	CL=90%	–
$B \to D_s^-\ell^+\nu_\ell K^0$ anything	[iii]	< 7	$\times 10^{-3}$	CL=90%	–
$B \to \ell^+\nu_\ell$ charm		(10.57 $\pm$ 0.15) %			–
$B \to X_u\ell^+\nu_\ell$		(2.33 $\pm$ 0.22) $\times 10^{-3}$			–
$B \to \pi\ell\nu_\ell$		(1.35 $\pm$ 0.10) $\times 10^{-4}$			2638
$B \to K^+\ell^+\nu_\ell$ anything	[iii]	(6.2 $\pm$ 0.5) %			–
$B \to K^-\ell^+\nu_\ell$ anything	[iii]	(10 $\pm$ 4) $\times 10^{-3}$			–
$B \to K^0/\overline{K}^0\ell^+\nu_\ell$ anything	[iii]	(4.5 $\pm$ 0.5) %			–

D, D*, or D_s modes

$B \to D^\pm$ anything		(23.3 $\pm$ 1.3) %			–
$B \to D^0/\overline{D}^0$ anything		(62.2 $\pm$ 2.9) %		S=1.3	–
$B \to D^*(2010)^\pm$ anything		(22.5 $\pm$ 1.5) %			–
$B \to D^*(2007)^0$ anything		(26.0 $\pm$ 2.7) %			–
$B \to D_s^\pm$ anything	[gg]	(8.4 $\pm$ 0.8) %			–
$B \to D_s^{*\pm}$ anything		(6.5 $\pm$ 1.0) %			–
$B \to D_s^{*\pm}\overline{D}^{(*)}$		(3.4 $\pm$ 0.6) %			–
$B \to D^{(*)}\overline{D}^{(*)}K^0 + D^{(*)}\overline{D}^{(*)}K^\pm$	[gg,xxx]	(7.1 $^{+\,2.7}_{-\,1.7}$) %			–
$b \to c\bar{c}s$		(22 $\pm$ 4) %			–
$B \to D_s^{(*)}\overline{D}^{(*)}$	[gg,xxx]	(4.0 $\pm$ 0.4) %			–
$B \to D^*D^*(2010)^\pm$	[gg]	< 5.9	$\times 10^{-3}$	CL=90%	1711
$B \to DD^*(2010)^\pm + D^*D^\pm$	[gg]	< 5.5	$\times 10^{-3}$	CL=90%	–
$B \to DD^\pm$	[gg]	< 3.1	$\times 10^{-3}$	CL=90%	1866
$B \to D_s^{(*)\pm}\overline{D}^{(*)}X(n\pi^\pm)$	[gg,xxx]	(9 $^{+\,5}_{-\,4}$) %			–

$B \rightarrow D^*(2010)\gamma$		< 1.1	$\times 10^{-3}$	CL=90%	2257
$B \rightarrow D_s^+\pi^-, D_s^{*+}\pi^-,$	[gg]	< 4	$\times 10^{-4}$	CL=90%	–
$\quad D_s^+\rho^-, D_s^{*+}\rho^-, D_s^+\pi^0,$					
$\quad D_s^{*+}\pi^0, D_s^+\eta, D_s^{*+}\eta,$					
$\quad D_s^+\rho^0, D_s^{*+}\rho^0, D_s^+\omega,$					
$\quad D_s^{*+}\omega$					
$B \rightarrow D_{s1}(2536)^+$ anything		< 9.5	$\times 10^{-3}$	CL=90%	–

Charmonium modes

$B \rightarrow J/\psi(1S)$ anything	(1.094± 0.032) %		S=1.1	–
$\quad B \rightarrow J/\psi(1S)$ (direct) anything	(7.8 ± 0.4) $\times 10^{-5}$		S=1.1	–
$B \rightarrow \psi(2S)$ anything	(3.07 ± 0.21) $\times 10^{-3}$			–
$B \rightarrow \chi_{c1}(1P)$ anything	(3.86 ± 0.27) $\times 10^{-3}$			–
$\quad B \rightarrow \chi_{c1}(1P)$ (direct) anything	(3.23 ± 0.25) $\times 10^{-3}$			–
$B \rightarrow \chi_{c2}(1P)$ anything	(1.4 ± 0.4) $\times 10^{-3}$		S=1.9	–
$\quad B \rightarrow \chi_{c2}(1P)$ (direct) anything	(1.65 ± 0.31) $\times 10^{-3}$			–
$B \rightarrow \eta_c(1S)$ anything	< 9	$\times 10^{-3}$	CL=90%	–
$B^0 \rightarrow X(3872)K \times B(X \rightarrow D^0\overline{D}^0\pi^0)$	(1.2 ± 0.4) $\times 10^{-4}$			1140
$B \rightarrow KX(3945) \times$ B$(X(3945) \rightarrow \omega J/\psi)$	[yyy] (7.1 ± 3.4) $\times 10^{-5}$			1105

K or K* modes

$B \rightarrow K^\pm$ anything	[gg] (78.9 ± 2.5) %			–
$\quad B \rightarrow K^+$ anything	(66 ± 5) %			–
$\quad B \rightarrow K^-$ anything	(13 ± 4) %			–
$B \rightarrow K^0/\overline{K}^0$ anything	[gg] (64 ± 4) %			–
$B \rightarrow K^*(892)^\pm$ anything	(18 ± 6) %			–
$B \rightarrow K^*(892)^0/\overline{K}^*(892)^0$ anything	[gg] (14.6 ± 2.6) %			–
$B \rightarrow K^*(892)\gamma$	(4.2 ± 0.6) $\times 10^{-5}$			2564
$B \rightarrow \eta K\gamma$	(8.5 $^{+1.8}_{-1.6}$) $\times 10^{-6}$			2588
$B \rightarrow K_1(1400)\gamma$	< 1.27	$\times 10^{-4}$	CL=90%	2453
$B \rightarrow K_2^*(1430)\gamma$	(1.7 $^{+0.6}_{-0.5}$) $\times 10^{-5}$			2447
$B \rightarrow K_2(1770)\gamma$	< 1.2	$\times 10^{-3}$	CL=90%	2342
$B \rightarrow K_3^*(1780)\gamma$	< 3.7	$\times 10^{-5}$	CL=90%	2341
$B \rightarrow K_4^*(2045)\gamma$	< 1.0	$\times 10^{-3}$	CL=90%	2244
$B \rightarrow K\eta'(958)$	(8.3 ± 1.1) $\times 10^{-5}$			2528

$B \to K^*(892)\eta'(958)$		(4.1 $\pm$ 1.1) $\times 10^{-6}$			2472
$B \to K\eta$		< 5.2 $\times 10^{-6}$		CL=90%	2588
$B \to K^*(892)\eta$		(1.8 $\pm$ 0.5) $\times 10^{-5}$			2534
$B \to K\phi\phi$		(2.3 $\pm$ 0.9) $\times 10^{-6}$			2306
$B \to \overline{b} \to \overline{s}\gamma$		(3.56 $\pm$ 0.25) $\times 10^{-4}$			–
$B \to \overline{b} \to \overline{s}$ gluon		< 6.8 %		CL=90%	–
$B \to \eta$ anything		< 4.4 $\times 10^{-4}$		CL=90%	–
$B \to \eta'$ anything		(4.2 $\pm$ 0.9) $\times 10^{-4}$			–

Light unflavored meson modes

$B \to \rho\gamma$		(1.39 $\pm$ 0.25) $\times 10^{-6}$		S=1.2	2583
$B \to \rho/\omega\gamma$		(1.30 $\pm$ 0.23) $\times 10^{-6}$		S=1.2	–
$B \to \pi^{\pm}$ anything	[gg,zzz]	(358 $\pm$ 7) %			–
$B \to \pi^0$ anything		(235 $\pm$11) %			–
$B \to \eta$ anything		(17.6 $\pm$ 1.6) %			–
$B \to \rho^0$ anything		(21 $\pm$ 5) %			–
$B \to \omega$ anything		< 81 %		CL=90%	–
$B \to \phi$ anything		(3.43 $\pm$ 0.12) %			–
$B \to \phi K^*(892)$		< 2.2 $\times 10^{-5}$		CL=90%	2460

Baryon modes

$B \to \Lambda_c^+ / \overline{\Lambda}_c^-$ anything		(4.5 $\pm$ 1.2) %			–
$B \to \overline{\Lambda}_c^- e^+$ anything		< 2.3 $\times 10^{-3}$		CL=90%	–
$B \to \overline{\Lambda}_c^- p$ anything		(2.6 $\pm$ 0.8) %			–
$B \to \overline{\Lambda}_c^- p e^+ \nu_e$		< 1.0 $\times 10^{-3}$		CL=90%	2021
$B \to \overline{\Sigma}_c^{--}$ anything		(4.2 $\pm$ 2.4) $\times 10^{-3}$			–
$B \to \overline{\Sigma}_c^-$ anything		< 9.6 $\times 10^{-3}$		CL=90%	–
$B \to \overline{\Sigma}_c^0$ anything		(4.6 $\pm$ 2.4) $\times 10^{-3}$			–
$B \to \overline{\Sigma}_c^0 N(N = p \text{ or } n)$		< 1.5 $\times 10^{-3}$		CL=90%	1938
$B \to \Xi_c^0$ anything $\times B(\Xi_c^0 \to \Xi^-\pi^+)$		(1.93 $\pm$ 0.30) $\times 10^{-4}$		S=1.1	–
$B \to \Xi_c^+$ anything $\times B(\Xi_c^+ \to \Xi^-\pi^+\pi^+)$		(4.5 $^{+1.3}_{-1.2}$) $\times 10^{-4}$			–
$B \to p/\overline{p}$ anything	[gg]	(8.0 $\pm$ 0.4) %			–
$B \to p/\overline{p}$ (direct) anything	[gg]	(5.5 $\pm$ 0.5) %			–
$B \to \Lambda/\overline{\Lambda}$ anything	[gg]	(4.0 $\pm$ 0.5) %			–
$B \to \Xi^-/\overline{\Xi}^+$ anything	[gg]	(2.7 $\pm$ 0.6) $\times 10^{-3}$			–
$B \to$ baryons anything		(6.8 $\pm$ 0.6) %			–
$B \to p\overline{p}$ anything		(2.47 $\pm$ 0.23) %			–
$B \to \Lambda\overline{p}/\overline{\Lambda}p$ anything	[gg]	(2.5 $\pm$ 0.4) %			–
$B \to \Lambda\overline{\Lambda}$ anything		< 5 $\times 10^{-3}$		CL=90%	–

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

$B \to s\,e^+\,e^-$	*B1*		(	4.7 ± 1.3	$) \times 10^{-6}$		–
$B \to s\,\mu^+\,\mu^-$	*B1*		(	4.3 ± 1.2	$) \times 10^{-6}$		–
$B \to s\,\ell^+\,\ell^-$	*B1*	[*iii*]	(	4.5 ± 1.0	$) \times 10^{-6}$		–
$B \to \pi\,\ell^+\,\ell^-$			<	6.2	$\times 10^{-8}$	CL=90%	2638
$B \to K\,e^+\,e^-$	*B1*		(	$3.8 \,^{+\,0.8}_{-\,0.7}$	$) \times 10^{-7}$		2617
$B \to K^*(892)\,e^+\,e^-$	*B1*		(	1.13 ± 0.27	$) \times 10^{-6}$		2564
$B \to K\,\mu^+\,\mu^-$	*B1*		(	$4.2 \,^{+\,0.9}_{-\,0.8}$	$) \times 10^{-7}$		2612
$B \to K^*(892)\,\mu^+\,\mu^-$	*B1*		(	$1.03 \,^{+\,0.26}_{-\,0.23}$	$) \times 10^{-6}$		2560
$B \to K\,\ell^+\,\ell^-$	*B1*		(	3.9 ± 0.7	$) \times 10^{-7}$	S=1.2	2617
$B \to K^*(892)\,\ell^+\,\ell^-$	*B1*		(	9.4 ± 1.8	$) \times 10^{-7}$	S=1.1	2564
$B \to K^*\,\nu\,\overline{\nu}$			<	8	$\times 10^{-5}$	CL=90%	–
$B \to s\,e^\pm\,\mu^\mp$	*LF*	[*gg*] <		2.2	$\times 10^{-5}$	CL=90%	–
$B \to \pi\,e^\pm\,\mu^\mp$	*LF*		<	9.2	$\times 10^{-8}$	CL=90%	2637
$B \to \rho\,e^\pm\,\mu^\mp$	*LF*		<	3.2	$\times 10^{-6}$	CL=90%	2582
$B \to K\,e^\pm\,\mu^\mp$	*LF*		<	3.8	$\times 10^{-8}$	CL=90%	2616
$B \to K^*(892)\,e^\pm\,\mu^\mp$	*LF*		<	5.1	$\times 10^{-7}$	CL=90%	2563

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

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

Mean life $\tau = (1.568 \pm 0.009) \times 10^{-12}$ s

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

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

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

$|\Delta\tau_b|/\tau_{b,\overline{b}} = -0.001 \pm 0.014$

The branching fraction measurements are for an admixture of B mesons and baryons at energies above the $\Upsilon(4S)$. Only the highest energy results (LEP, Tevatron, S$p\overline{p}$S) are used in the branching fraction averages. In the following, we assume that the production fractions are the same at the 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 $\overline{b}$ initial state. b modes are their charge conjugates. Reactions indicate the weak decay vertex and do not include mixing.

$\overline{b}$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)

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 (HFAG) as described in the note "B^0-$\overline{B}^0$ Mixing" in the B^0 Particle Listings. The production fractions in b-hadronic Z decay or $p\overline{p}$ collisions at the Tevatron are also listed at the end of the section. Values assume

$$B(\overline{b} \rightarrow B^+) = B(\overline{b} \rightarrow B^0)$$
$$B(\overline{b} \rightarrow B^+) + B(\overline{b} \rightarrow B^0) + B(\overline{b} \rightarrow B^0_s) + B(b \rightarrow b\text{-baryon}) = 100 \text{ \%}.$$

The correlation coefficients between production fractions are also reported:
$$cor(B^0_s, b\text{-baryon}) = -0.061$$
$$cor(B^0_s, B^{\pm}=B^0) = -0.463$$
$$cor(b\text{-baryon}, B^{\pm}=B^0) = -0.857.$$

The notation for production fractions varies in the literature (f_d, d_{B^0}, $f(b \rightarrow \overline{B}^0)$, $Br(b \rightarrow \overline{B}^0)$). We use our own branching fraction notation here, $B(\overline{b} \rightarrow B^0)$.

B^+	(40.0 $\pm$ 1.2) %		—
B^0	(40.0 $\pm$ 1.2) %		—
B^0_s	(11.4 $\pm$ 1.2) %		—
b-baryon	(8.6 $\pm$ 2.1) %		—
B_c	—		—

DECAY MODES

Semileptonic and leptonic modes

ν anything	(23.1 $\pm$ 1.5) %		—
$\ell^+ \nu_\ell$ anything	[*iii*] (10.69$\pm$ 0.22) %		—
$e^+ \nu_e$ anything	(10.86$\pm$ 0.35) %		—
$\mu^+ \nu_\mu$ anything	(10.95$^{+\ 0.29}_{-\ 0.25}$) %		—

$D^- \ell^+ \nu_\ell$ anything	[*iii*]	(2.2 $\pm$ 0.4) %	S=1.8	–
$D^- \pi^+ \ell^+ \nu_\ell$ anything		(4.9 $\pm$ 1.9) $\times 10^{-3}$		–
$D^- \pi^- \ell^+ \nu_\ell$ anything		(2.6 $\pm$ 1.6) $\times 10^{-3}$		–
$\overline{D}^0 \ell^+ \nu_\ell$ anything	[*iii*]	(6.82 $\pm$ 0.35) %		–
$\overline{D}^0 \pi^- \ell^+ \nu_\ell$ anything		(1.07 $\pm$ 0.27) %		–
$\overline{D}^0 \pi^+ \ell^+ \nu_\ell$ anything		(2.3 $\pm$ 1.6) $\times 10^{-3}$		–
$D^{*-} \ell^+ \nu_\ell$ anything	[*iii*]	(2.75 $\pm$ 0.19) %		–
$D^{*-} \pi^- \ell^+ \nu_\ell$ anything		(6 $\pm$ 7) $\times 10^{-4}$		–
$D^{*-} \pi^+ \ell^+ \nu_\ell$ anything		(4.8 $\pm$ 1.0) $\times 10^{-3}$		–
$\overline{D}^0_j \ell^+ \nu_\ell$ anything $\times$ B($\overline{D}^0_j \to D^{*+} \pi^-$)	[*iii,aaaa*]	(2.6 $\pm$ 0.9) $\times 10^{-3}$		–
$D^-_j \ell^+ \nu_\ell$ anything $\times$ B($D^-_j \to D^0 \pi^-$)	[*iii,aaaa*]	(7.0 $\pm$ 2.3) $\times 10^{-3}$		–
$\overline{D}^*_2(2460)^0 \ell^+ \nu_\ell$ anything $\times$ B($\overline{D}^*_2(2460)^0 \to D^{*-} \pi^+$)		< 1.4 $\times 10^{-3}$ CL=90%		–
$D^*_2(2460)^- \ell^+ \nu_\ell$ anything $\times$ B($D^*_2(2460)^- \to D^0 \pi^-$)		(4.2 $^{+ 1.5}_{- 1.8}$) $\times 10^{-3}$		–
$\overline{D}^*_2(2460)^0 \ell^+ \nu_\ell$ anything $\times$ B($\overline{D}^*_2(2460)^0 \to D^- \pi^+$)		(1.6 $\pm$ 0.8) $\times 10^{-3}$		–
charmless $\ell \overline{\nu}_\ell$	[*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) $\times 10^{-3}$		–
$\overline{c} \to \ell^- \overline{\nu}_\ell$ anything	[*iii*]	(8.02 $\pm$ 0.19) %		–
$c \to \ell^+ \nu$ anything		(1.6 $^{+ 0.4}_{- 0.5}$) %		–

Charmed meson and baryon modes

$\overline{D}^0$ anything		(59.3 $\pm$ 2.9) %	–
$D^0 D^\pm_s$ anything	[*gg*]	(9.1 $^{+ 4.0}_{- 2.8}$) %	–
$D^\mp D^\pm_s$ anything	[*gg*]	(4.0 $^{+ 2.3}_{- 1.8}$) %	–
$\overline{D}^0 D^0$ anything	[*gg*]	(5.1 $^{+ 2.0}_{- 1.8}$) %	–
$D^0 D^\pm$ anything	[*gg*]	(2.7 $^{+ 1.8}_{- 1.6}$) %	–
$D^\pm D^\mp$ anything	[*gg*]	< 9 $\times 10^{-3}$ CL=90%	–
D^- anything		(22.9 $\pm$ 1.7) %	–
$D^*(2010)^+$ anything		(17.3 $\pm$ 2.0) %	–
$D_1(2420)^0$ anything		(5.0 $\pm$ 1.5) %	–
$D^*(2010)^\mp D^\pm_s$ anything	[*gg*]	(3.3 $^{+ 1.6}_{- 1.3}$) %	–

$D^0 D^*(2010)^\pm$ anything	[gg]	($3.0 \, ^{+\,1.1}_{-\,0.9}$) %	—
$D^*(2010)^\pm D^\mp$ anything	[gg]	($2.5 \, ^{+\,1.2}_{-\,1.0}$) %	—
$D^*(2010)^\pm D^*(2010)^\mp$ anything	[gg]	(1.2 ± 0.4) %	—
$\overline{D} D$ anything		($10 \, ^{+11}_{-10}$) %	—
$D_2^*(2460)^0$ anything		(4.7 ± 2.7) %	—
D_s^- anything		(15.0 ± 2.1) %	—
D_s^+ anything		(10.1 ± 3.1) %	—
Λ_c^+ anything		(9.7 ± 2.9) %	—
$\overline{c}/c$ anything	[zzz]	(116.2 ± 3.2) %	—

Charmonium modes

$J/\psi(1S)$ anything	(1.16 ± 0.10) %	—
$\psi(2S)$ anything	(4.8 ± 2.4) $\times 10^{-3}$	—
$\chi_{c1}(1P)$ anything	(1.4 ± 0.4) %	—

K or K* modes

$\overline{s} \gamma$	(3.1 ± 1.1) $\times 10^{-4}$	—
$\overline{s} \nu \nu$	< 6.4 $\times 10^{-4}$ CL=90%	—
$K^\pm$ anything	(74 ± 6) %	—
K_S^0 anything	(29.0 ± 2.9) %	—

Pion modes

$\pi^\pm$ anything		(397 ± 21) %	—
π^0 anything	[zzz]	(278 ± 60) %	—
ϕ anything		(2.82 ± 0.23) %	—

Baryon modes

$p/\overline{p}$ anything	(13.1 ± 1.1) %	—

Other modes

charged anything	[zzz]	(497 ± 7) %	—
hadron$^+$ hadron$^-$		($1.7 \, ^{+\,1.0}_{-\,0.7}$) $\times 10^{-5}$	—
charmless		(7 ± 21) $\times 10^{-3}$	—

Baryon modes

$\Lambda/\overline{\Lambda}$ anything	(5.9 ± 0.6) %	—
b-baryon anything	(10.2 ± 2.8) %	—

$\Delta B = 1$ weak neutral current (*B1*) modes

$\mu^+ \mu^-$ anything	*B1*	< 3.2 $\times 10^{-4}$ CL=90%	—

$\boxed{\textbf{B*}}$	$I(J^P) = \tfrac{1}{2}(1^-)$

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

Mass $m_{B^*} = 5325.1 \pm 0.5$ MeV
$m_{B^*} - m_B = 45.78 \pm 0.35$ MeV

B^* DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B\gamma$	dominant	45

$B_1(5721)^0$

$I(J^P) = \frac{1}{2}(1^+)$
I, J, P need confirmation.

$B_1(5721)^0$ MASS $= 5723.4 \pm 2.0$ MeV (S = 1.1)
$m_{B_1^0} - m_{B^+} = 444.3 \pm 2.0$ MeV (S = 1.1)

$B_1(5721)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^{*+}\pi^-$	dominant	−

$B_2^*(5747)^0$

$I(J^P) = \frac{1}{2}(2^+)$
I, J, P need confirmation.

$B_2^*(5747)^0$ MASS $= 5743 \pm 5$ MeV (S = 2.8)
Full width $\Gamma = 23^{+5}_{-11}$ MeV
$m_{B_2^{*0}} - m_{B_1^0} = 19 \pm 6$ MeV (S = 3.0)

$B_2^*(5747)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^+\pi^-$	dominant	424
$B^{*+}\pi^-$	dominant	−

BOTTOM, STRANGE MESONS
($B = \pm 1$, $S = \mp 1$)

$B_s^0 = s\bar{b}$, $\overline{B}_s^0 = \bar{s}b$, 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.

Mass $m_{B_s^0} = 5366.3 \pm 0.6$ MeV (S = 1.1)
Mean life $\tau = (1.472^{+0.024}_{-0.026}) \times 10^{-12}$ s
$c\tau = 441$ μm

B_s^0-$\overline{B}_s^0$ mixing parameters

$$\Delta m_{B_s^0} = m_{B_{sH}^0} - m_{B_{sL}^0} = (17.77 \pm 0.12) \times 10^{12}\ \hbar\ \text{s}^{-1}$$

$$= (117.0 \pm 0.8) \times 10^{-10}\ \text{MeV}$$

$$x_s = \Delta m_{B_s^0}/\Gamma_{B_s^0} = 26.2 \pm 0.5$$

$$\chi_s = 0.49927 \pm 0.00003$$

CP violation parameters in B_s^0

$$\text{Re}(\epsilon_{B_s^0})\ /\ (1 + |\epsilon_{B_s^0}|^2) = (-0.92 \pm 2.35) \times 10^{-3}$$

$$CP \text{ Violation phase } \beta_s = 0.47^{+0.13}_{-0.21} \text{ or } 1.09^{+0.21}_{-0.13}$$

These branching fractions all scale with B($\overline{b} \to B_s^0$), the LEP B_s^0 production fraction. The first four were evaluated using B($\overline{b} \to B_s^0$) = (10.7 ± 1.2)% and the rest assume B($\overline{b} \to B_s^0$) = 12%.

The branching fraction B($B_s^0 \to D_s^- \ell^+ \nu_\ell$ anything) is not a pure measurement since the measured product branching fraction B($\overline{b} \to B_s^0$) $\times$ B($B_s^0 \to D_s^- \ell^+ \nu_\ell$ anything) was used to determine B($\overline{b} \to B_s^0$), as described in the note on "B^0-$\overline{B}^0$ Mixing"

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

B_s^0 DECAY MODES		Fraction (Γ_i/Γ)		Confidence level	p (MeV/c)
D_s^- anything		(93	± 25) %		—
$D_s^- \ell^+ \nu_\ell$ anything	[bbbb]	(7.9	$\pm$ 2.4) %		—
$D_{s1}(2536)^- \mu^+ \nu_\mu X \times$		(2.3	$\pm$ 0.7) $\times 10^{-3}$		—
$\quad$ B($D_{s1}^- \to D^{*-} K_S^0$)					
$D_s^- \pi^+$		(3.3	$\pm$ 0.5) $\times 10^{-3}$		2320
$D_s^- \pi^+ \pi^+ \pi^-$		(8.4	$\pm$ 3.3) $\times 10^{-3}$		2301
$D_s^- K^+$		(2.4	$^{+1.3}_{-1.1}$) $\times 10^{-4}$		2292
$D_s^+ D_s^-$		(1.1	$\pm$ 0.4) %		1823
$D_s^{*+} D_s^-$		< 12.1	%	90%	1742
$D_s^{*+} D_s^{*-}$		< 25.7	%	90%	1655
$D_s^{(*)+} D_s^{(*)-}$		(3.9	$\pm$ 1.5) %		—
$J/\psi(1S)\phi$		(1.3	$\pm$ 0.4) $\times 10^{-3}$		1587
$J/\psi(1S)\pi^0$		< 1.2	$\times 10^{-3}$	90%	1786
$J/\psi(1S)\eta$		< 3.8	$\times 10^{-3}$	90%	1733
$\psi(2S)\phi$		(6.8	$\pm$ 3.0) $\times 10^{-4}$		1119

$\pi^+\pi^-$		< 1.7	$\times 10^{-6}$	90%	2680
$\pi^0\pi^0$		< 2.1	$\times 10^{-4}$	90%	2680
$\eta\pi^0$		< 1.0	$\times 10^{-3}$	90%	2653
$\eta\eta$		< 1.5	$\times 10^{-3}$	90%	2627
$\rho^0\rho^0$		< 3.20	$\times 10^{-4}$	90%	2569
$\phi\rho^0$		< 6.17	$\times 10^{-4}$	90%	2526
$\phi\phi$		(1.4 $\pm$ 0.8) $\times 10^{-5}$			2482
$\pi^+ K^-$		< 5.6	$\times 10^{-6}$	90%	2659
$K^+ K^-$		(3.3 $\pm$ 0.9) $\times 10^{-5}$			2637
$\overline{K}^*(892)^0\rho^0$		< 7.67	$\times 10^{-4}$	90%	2550
$\overline{K}^*(892)^0 K^*(892)^0$		< 1.681	$\times 10^{-3}$	90%	2531
$\phi K^*(892)^0$		< 1.013	$\times 10^{-3}$	90%	2507
$p\overline{p}$		< 5.9	$\times 10^{-5}$	90%	2514
$\gamma\gamma$	B1	< 8.7	$\times 10^{-6}$	90%	2683
$\phi\gamma$		(5.7 $^{+\ 2.2}_{-\ 1.9}$) $\times 10^{-5}$			2586

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

$\mu^+\mu^-$	B1	< 4.7	$\times 10^{-8}$	90%	2681
$e^+ e^-$	B1	< 5.4	$\times 10^{-5}$	90%	2683
$e^\pm\mu^\mp$	LF	[gg] < 6.1	$\times 10^{-6}$	90%	2682
$\phi(1020)\mu^+\mu^-$	B1	< 3.2	$\times 10^{-6}$	90%	2582
$\phi\nu\overline{\nu}$	B1	< 5.4	$\times 10^{-3}$	90%	2586

B^*_s $I(J^P) = 0(1^-)$

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

Mass $m = 5415.4 \pm 1.4$ MeV   (S = 2.5)

$m_{B^*_s} - m_{B_s} = 49.0 \pm 1.5$ MeV   (S = 2.0)

B^*_s DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B_s\gamma$	dominant	–

$B_{s1}(5830)^0$ $I(J^P) = \frac{1}{2}(1^+)$

I, *J*, *P* need confirmation.

Mass $m = 5829.4 \pm 0.7$ MeV

$m_{B^0_{s1}} - m_{B^{*+}} = 504.41 \pm 0.25$ MeV

$B_{s1}(5830)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^{*+} K^-$	dominant	−

$B_{s2}^*(5840)^0$

$I(J^P) = \frac{1}{2}(2^+)$
I, J, P need confirmation.

Mass $m = 5839.7 \pm 0.6$ MeV
$m_{B_{s2}^{*0}} - m_{B_{s1}^0} = 10.5 \pm 0.6$ MeV

$B_{s2}^*(5840)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^+ K^-$	dominant	252

BOTTOM, CHARMED MESONS
($B = C = \pm 1$)

$B_c^+ = c\overline{b}$, $B_c^- = \overline{c}b$,   similarly for B_c^*'s

$B_c^\pm$

$I(J^P) = 0(0^-)$
I, J, P need confirmation.
Quantum numbers shown are quark-model predictions.

Mass $m = 6.277 \pm 0.006$ GeV   (S = 1.6)
Mean life $\tau = (0.453 \pm 0.041) \times 10^{-12}$ s

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

B_c^+ DECAY MODES × B($\overline{b} \rightarrow B_c$)	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
The following quantities are not pure branching ratios; rather the fraction $\Gamma_i/\Gamma \times$ B($\overline{b} \rightarrow B_c$).			
$J/\psi(1S)\ell^+\nu_\ell$ anything	$(5.2^{+2.4}_{-2.1}) \times 10^{-5}$		−
$J/\psi(1S)\pi^+$	$< 8.2 \times 10^{-5}$	90%	2372
$J/\psi(1S)\pi^+\pi^+\pi^-$	$< 5.7 \times 10^{-4}$	90%	2352
$J/\psi(1S)a_1(1260)$	$< 1.2 \times 10^{-3}$	90%	2171
$D^*(2010)^+\overline{D}^0$	$< 6.2 \times 10^{-3}$	90%	2468

$c\overline{c}$ MESONS

$\eta_c(1S)$

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

Mass $m = 2980.5 \pm 1.2$ MeV   (S = 1.7)
Full width $\Gamma = 27.4 \pm 2.9$ MeV   (S = 2.0)

$\eta_c(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
Decays involving hadronic resonances			
$\eta'(958)\pi\pi$	$(4.1 \pm 1.7)\%$		1321
$\rho\rho$	$(2.0 \pm 0.7)\%$		1273
$K^*(892)^0 K^-\pi^+ + $ c.c.	$(2.0 \pm 0.7)\%$		1276
$K^*(892)\overline{K}^*(892)$	$(9.2 \pm 3.4)\times 10^{-3}$		1194
$K^{*0}\overline{K}^{*0}\pi^+\pi^-$	$(1.1 \pm 0.5)\%$		1071
$\phi K^+ K^-$	$(2.9 \pm 1.4)\times 10^{-3}$		1102
$\phi\phi$	$(2.7 \pm 0.9)\times 10^{-3}$		1087
$\phi 2(\pi^+\pi^-)$	$< 3.5 \quad \times 10^{-3}$	90%	1249
$a_0(980)\pi$	$< 2 \quad \%$	90%	1325
$a_2(1320)\pi$	$< 2 \quad \%$	90%	1194
$K^*(892)\overline{K} + $ c.c.	$< 1.28 \quad \%$	90%	1308
$f_2(1270)\eta$	$< 1.1 \quad \%$	90%	1143
$\omega\omega$	$< 3.1 \quad \times 10^{-3}$	90%	1268
$\omega\phi$	$< 1.7 \quad \times 10^{-3}$	90%	1183
$f_2(1270)f_2(1270)$	$(7.6 {}^{+3.1}_{-3.4})\times 10^{-3}$		771
$f_2(1270)f'_2(1525)$	$(1.0 {}^{+0.5}_{-0.4})\%$		509
Decays into stable hadrons			
$K\overline{K}\pi$	$(7.0 \pm 1.2)\%$		1379
$\eta\pi\pi$	$(4.9 \pm 1.8)\%$		1427
$\pi^+\pi^- K^+ K^-$	$(1.5 \pm 0.6)\%$		1343
$K^+ K^- 2(\pi^+\pi^-)$	$(7.0 \pm 2.9)\times 10^{-3}$		1252
$2(K^+ K^-)$	$(1.5 \pm 0.7)\times 10^{-3}$		1053
$2(\pi^+\pi^-)$	$(1.20 \pm 0.30)\%$		1457
$3(\pi^+\pi^-)$	$(1.5 \pm 0.5)\%$		1405
$p\overline{p}$	$(1.3 \pm 0.4)\times 10^{-3}$		1158
$\Lambda\overline{\Lambda}$	$(1.04 \pm 0.31)\times 10^{-3}$		988
$K\overline{K}\eta$	$< 3.1 \quad \%$	90%	1263
$\pi^+\pi^- p\overline{p}$	$< 1.2 \quad \%$	90%	1025
Radiative decays			
$\gamma\gamma$	$(1.8 {}^{+0.6}_{-0.5})\times 10^{-4}$		1490

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

$\pi^+\pi^-$	P,CP	< 6	$\times 10^{-4}$	90%	1484
$\pi^0\pi^0$	P,CP	< 4	$\times 10^{-4}$	90%	1484
K^+K^-	P,CP	< 6	$\times 10^{-4}$	90%	1406
$K^0_S K^0_S$	P,CP	< 3.1	$\times 10^{-4}$	90%	1405

$J/\psi(1S)$ $\qquad\qquad I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 3096.916 \pm 0.011$ MeV
Full width $\Gamma = 93.2 \pm 2.1$ keV
$\Gamma_{ee} = 5.55 \pm 0.14 \pm 0.02$ keV

$J/\psi(1S)$ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons		(87.7 ± 0.5) %		–
virtual $\gamma \to$ hadrons		(13.50 ± 0.30) %		–
e^+e^-		(5.94 ± 0.06) %		1548
$\mu^+\mu^-$		(5.93 ± 0.06) %		1545

Decays involving hadronic resonances

$\rho\pi$		(1.69 ± 0.15) %	S=2.4	1448
$\rho^0\pi^0$		$(5.6 \pm 0.7) \times 10^{-3}$		1448
$a_2(1320)\rho$		(1.09 ± 0.22) %		1123
$\omega\pi^+\pi^+\pi^-\pi^-$		$(8.5 \pm 3.4) \times 10^{-3}$		1392
$\omega\pi^+\pi^-\pi^0$		$(4.0 \pm 0.7) \times 10^{-3}$		1418
$\omega\pi^+\pi^-$		$(8.6 \pm 0.7) \times 10^{-3}$	S=1.1	1435
$\omega f_2(1270)$		$(4.3 \pm 0.6) \times 10^{-3}$		1142
$K^*(892)^0\overline{K}_2^*(1430)^0 +$ c.c.		$(6.0 \pm 0.6) \times 10^{-3}$		1012
$K^*(892)^0\overline{K}_2(1770)^0 +$ c.c. $\to$ $K^*(892)^0 K^-\pi^+ +$ c.c.		$(6.9 \pm 0.9) \times 10^{-4}$		–
$\omega K^*(892)\overline{K} +$ c.c.		$(6.1 \pm 0.9) \times 10^{-3}$		1097
$K^+\overline{K}^*(892)^- +$ c.c.		$(5.12 \pm 0.30) \times 10^{-3}$		1373
$K^+\overline{K}^*(892)^- +$ c.c. $\to$ $K^+ K^-\pi^0$		$(1.97 \pm 0.20) \times 10^{-3}$		–
$K^+\overline{K}^*(892)^- +$ c.c. $\to$ $K^0 K^\pm\pi^\mp$		$(3.0 \pm 0.4) \times 10^{-3}$		–
$K^0\overline{K}^*(892)^0 +$ c.c.		$(4.39 \pm 0.31) \times 10^{-3}$		1373
$K^0\overline{K}^*(892)^0 +$ c.c. $\to$ $K^0 K^\pm\pi^\mp$		$(3.2 \pm 0.4) \times 10^{-3}$		–
$K_1(1400)^\pm K^\mp$		$(3.8 \pm 1.4) \times 10^{-3}$		1170
$\overline{K}^*(892)^0 K^+\pi^- +$ c.c.		seen		1343
$\omega\pi^0\pi^0$		$(3.4 \pm 0.8) \times 10^{-3}$		1436
$b_1(1235)^\pm\pi^\mp$	[gg]	$(3.0 \pm 0.5) \times 10^{-3}$		1300
$\omega K^\pm K^0_S\pi^\mp$	[gg]	$(3.4 \pm 0.5) \times 10^{-3}$		1210

$b_1(1235)^0 \pi^0$		$(\ 2.3\ \pm 0.6\ ) \times 10^{-3}$		1300
$\eta K^\pm K_S^0 \pi^\mp$	[gg]	$(\ 2.2\ \pm 0.4\ ) \times 10^{-3}$		1278
$\phi K^*(892)\overline{K} +$ c.c.		$(\ 2.18\pm 0.23) \times 10^{-3}$		969
$\omega K \overline{K}$		$(\ 1.6\ \pm 0.5\ ) \times 10^{-4}$		1268
$\omega f_0(1710) \rightarrow\ \omega K \overline{K}$		$(\ 4.8\ \pm 1.1\ ) \times 10^{-4}$		878
$\phi 2(\pi^+ \pi^-)$		$(\ 1.66\pm 0.23) \times 10^{-3}$		1318
$\Delta(1232)^{++} \overline{p} \pi^-$		$(\ 1.6\ \pm 0.5\ ) \times 10^{-3}$		1030
$\omega \eta$		$(\ 1.74\pm 0.20) \times 10^{-3}$	S=1.6	1394
$\phi K \overline{K}$		$(\ 1.83\pm 0.24) \times 10^{-3}$	S=1.5	1179
$\phi f_0(1710) \rightarrow\ \phi K \overline{K}$		$(\ 3.6\ \pm 0.6\ ) \times 10^{-4}$		875
$\Delta(1232)^{++} \overline{\Delta}(1232)^{--}$		$(\ 1.10\pm 0.29) \times 10^{-3}$		938
$\Sigma(1385)^- \overline{\Sigma}(1385)^+$ (or c.c.)	[gg]	$(\ 1.03\pm 0.13) \times 10^{-3}$		697
$\phi f_2'(1525)$		$(\ 8\ \ \ \pm 4\ \ \ ) \times 10^{-4}$	S=2.7	871
$\phi \pi^+ \pi^-$		$(\ 9.4\ \pm 0.9\ ) \times 10^{-4}$	S=1.2	1365
$\phi \pi^0 \pi^0$		$(\ 5.6\ \pm 1.6\ ) \times 10^{-4}$		1366
$\phi K^\pm K_S^0 \pi^\mp$	[gg]	$(\ 7.2\ \pm 0.8\ ) \times 10^{-4}$		1114
$\omega f_1(1420)$		$(\ 6.8\ \pm 2.4\ ) \times 10^{-4}$		1062
$\phi \eta$		$(\ 7.5\ \pm 0.8\ ) \times 10^{-4}$	S=1.5	1320
$\Xi^0 \overline{\Xi}^0$		$(\ 1.20\pm 0.24) \times 10^{-3}$		818
$\Xi(1530)^- \overline{\Xi}^+$		$(\ 5.9\ \pm 1.5\ ) \times 10^{-4}$		600
$p K^- \overline{\Sigma}(1385)^0$		$(\ 5.1\ \pm 3.2\ ) \times 10^{-4}$		646
$\omega \pi^0$		$(\ 4.5\ \pm 0.5\ ) \times 10^{-4}$	S=1.4	1446
$\phi \eta'(958)$		$(\ 4.0\ \pm 0.7\ ) \times 10^{-4}$	S=2.1	1192
$\phi f_0(980)$		$(\ 3.2\ \pm 0.9\ ) \times 10^{-4}$	S=1.9	1182
$\phi f_0(980) \rightarrow\ \phi \pi^+ \pi^-$		$(\ 1.8\ \pm 0.4\ ) \times 10^{-4}$		−
$\phi f_0(980) \rightarrow\ \phi \pi^0 \pi^0$		$(\ 1.7\ \pm 0.7\ ) \times 10^{-4}$		−
$\Xi(1530)^0 \overline{\Xi}^0$		$(\ 3.2\ \pm 1.4\ ) \times 10^{-4}$		608
$\Sigma(1385)^- \overline{\Sigma}^+$ (or c.c.)	[gg]	$(\ 3.1\ \pm 0.5\ ) \times 10^{-4}$		855
$\phi f_1(1285)$		$(\ 2.6\ \pm 0.5\ ) \times 10^{-4}$	S=1.1	1032
$\eta \pi^+ \pi^-$		$(\ 4.0\ \pm 1.7\ ) \times 10^{-4}$		1487
$\rho \eta$		$(\ 1.93\pm 0.23) \times 10^{-4}$		1396
$\omega \eta'(958)$		$(\ 1.82\pm 0.21) \times 10^{-4}$		1279
$\omega f_0(980)$		$(\ 1.4\ \pm 0.5\ ) \times 10^{-4}$		1271
$\rho \eta'(958)$		$(\ 1.05\pm 0.18) \times 10^{-4}$		1281
$a_2(1320)^\pm \pi^\mp$	[gg]	$<\ \ 4.3\ \ \ \ \ \ \ \ \ \ \times 10^{-3}$	CL=90%	1263
$K \overline{K}_2^*(1430) +$ c.c.		$<\ \ 4.0\ \ \ \ \ \ \ \ \ \ \times 10^{-3}$	CL=90%	1159
$K_1(1270)^\pm K^\mp$		$<\ \ 3.0\ \ \ \ \ \ \ \ \ \ \times 10^{-3}$	CL=90%	1231
$K_2^*(1430)^0 \overline{K}_2^*(1430)^0$		$<\ \ 2.9\ \ \ \ \ \ \ \ \ \ \times 10^{-3}$	CL=90%	604
$K^*(892)^0 \overline{K}^*(892)^0$		$(\ 2.3\ \pm 0.7\ ) \times 10^{-4}$		1266
$\phi f_2(1270)$		$(\ 7.2\ \pm 1.3\ ) \times 10^{-4}$		1036
$\phi \eta(1405) \rightarrow\ \phi \eta \pi \pi$		$<\ \ 2.5\ \ \ \ \ \ \ \ \ \ \times 10^{-4}$	CL=90%	946
$\omega f_2'(1525)$		$<\ \ 2.2\ \ \ \ \ \ \ \ \ \ \times 10^{-4}$	CL=90%	1003
$\Sigma(1385)^0 \overline{\Lambda}$		$<\ \ 2\ \ \ \ \ \ \ \ \ \ \ \times 10^{-4}$	CL=90%	912

$\Delta(1232)^+\overline{p}$	$<$ 1	$\times 10^{-4}$	CL=90%	1100
$\Theta(1540)\overline{\Theta}(1540) \to$	$<$ 1.1	$\times 10^{-5}$	CL=90%	–
$\quad K^0_S p K^- \overline{n} +$ c.c.				
$\Theta(1540) K^- \overline{n} \to K^0_S p K^- \overline{n}$	$<$ 2.1	$\times 10^{-5}$	CL=90%	–
$\Theta(1540) K^0_S \overline{p} \to K^0_S \overline{p} K^+ n$	$<$ 1.6	$\times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540) K^+ n \to K^0_S \overline{p} K^+ n$	$<$ 5.6	$\times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540) K^0_S p \to K^0_S p K^- \overline{n}$	$<$ 1.1	$\times 10^{-5}$	CL=90%	–
$\Sigma^0 \overline{\Lambda}$	$<$ 9	$\times 10^{-5}$	CL=90%	1032
$\phi \pi^0$	$<$ 6.4	$\times 10^{-6}$	CL=90%	1377

Decays into stable hadrons

$2(\pi^+\pi^-)\pi^0$		(4.1 $\pm$0.5) %	S=2.4	1496
$3(\pi^+\pi^-)\pi^0$		(2.9 $\pm$0.6) %		1433
$\pi^+\pi^-\pi^0$		(2.07$\pm$0.13) %	S=1.7	1533
$\pi^+\pi^-\pi^0 K^+ K^-$		(1.79$\pm$0.29) %	S=2.2	1368
$4(\pi^+\pi^-)\pi^0$		(9.0 $\pm$3.0) $\times 10^{-3}$		1345
$\pi^+\pi^- K^+ K^-$		(6.6 $\pm$0.5) $\times 10^{-3}$		1407
$\pi^+\pi^- K^+ K^- \eta$		(1.84$\pm$0.28) $\times 10^{-3}$		1221
$\pi^0\pi^0 K^+ K^-$		(2.45$\pm$0.31) $\times 10^{-3}$		1410
$\eta\phi f_0(980) \to \eta\phi\pi^+\pi^-$		(3.2 $\pm$1.0) $\times 10^{-4}$		–
$K\overline{K}\pi$		(6.1 $\pm$1.0) $\times 10^{-3}$		1442
$2(\pi^+\pi^-)$		(3.55$\pm$0.23) $\times 10^{-3}$		1517
$3(\pi^+\pi^-)$		(4.3 $\pm$0.4) $\times 10^{-3}$		1466
$2(\pi^+\pi^-\pi^0)$		(1.62$\pm$0.21) %		1468
$2(\pi^+\pi^-)\eta$		(2.29$\pm$0.24) $\times 10^{-3}$		1446
$3(\pi^+\pi^-)\eta$		(7.2 $\pm$1.5) $\times 10^{-4}$		1379
$p\overline{p}$		(2.17$\pm$0.07) $\times 10^{-3}$		1232
$p\overline{p}\pi^0$		(1.09$\pm$0.09) $\times 10^{-3}$		1176
$p\overline{p}\pi^+\pi^-$		(6.0 $\pm$0.5) $\times 10^{-3}$	S=1.3	1107
$p\overline{p}\pi^+\pi^-\pi^0$	[cccc]	(2.3 $\pm$0.9) $\times 10^{-3}$	S=1.9	1033
$p\overline{p}\eta$		(2.09$\pm$0.18) $\times 10^{-3}$		948
$p\overline{p}\rho$		$<$ 3.1 $\times 10^{-4}$	CL=90%	774
$p\overline{p}\omega$		(1.10$\pm$0.15) $\times 10^{-3}$	S=1.3	768
$p\overline{p}\eta'(958)$		(9 $\pm$4) $\times 10^{-4}$	S=1.7	596
$p\overline{p}\phi$		(4.5 $\pm$1.5) $\times 10^{-5}$		527
$n\overline{n}$		(2.2 $\pm$0.4) $\times 10^{-3}$		1231
$n\overline{n}\pi^+\pi^-$		(4 $\pm$4) $\times 10^{-3}$		1106
$\Sigma^+\overline{\Sigma}^-$		(1.50$\pm$0.24) $\times 10^{-3}$		992
$\Sigma^0\overline{\Sigma}^0$		(1.29$\pm$0.09) $\times 10^{-3}$		988
$2(\pi^+\pi^-)K^+ K^-$		(4.7 $\pm$0.7) $\times 10^{-3}$	S=1.3	1320
$p\overline{n}\pi^-$		(2.12$\pm$0.09) $\times 10^{-3}$		1174
$n N(1440)$		seen		978
$n N(1520)$		seen		924
$n N(1535)$		seen		914

$\Xi^- \overline{\Xi}^+$		(8.5 $\pm$1.6) $\times 10^{-4}$	S=1.5	807
$\Lambda \overline{\Lambda}$		(1.61$\pm$0.15) $\times 10^{-3}$	S=2.0	1074
$\Lambda \overline{\Sigma}^- \pi^+$ (or c.c.)	[gg]	(8.3 $\pm$0.7) $\times 10^{-4}$	S=1.2	950
$p K^- \overline{\Lambda}$		(8.9 $\pm$1.6) $\times 10^{-4}$		876
$2(K^+ K^-)$		(7.6 $\pm$0.9) $\times 10^{-4}$		1131
$p K^- \overline{\Sigma}^0$		(2.9 $\pm$0.8) $\times 10^{-4}$		819
$K^+ K^-$		(2.37$\pm$0.31) $\times 10^{-4}$		1468
$K^0_S K^0_L$		(1.46$\pm$0.26) $\times 10^{-4}$	S=2.7	1466
$\Lambda \overline{\Lambda} \eta$		(2.6 $\pm$0.7) $\times 10^{-4}$		672
$\Lambda \overline{\Lambda} \pi^0$		< 6.4 $\times 10^{-5}$	CL=90%	998
$\overline{\Lambda} n K^0_S$ + c.c.		(6.5 $\pm$1.1) $\times 10^{-4}$		872
$\pi^+ \pi^-$		(1.47$\pm$0.23) $\times 10^{-4}$		1542
$\Lambda \overline{\Sigma}$ + c.c.		< 1.5 $\times 10^{-4}$	CL=90%	1034
$K^0_S K^0_S$		< 1 $\times 10^{-6}$	CL=95%	1466

Radiative decays

3γ		(1.2 $\pm$0.4) $\times 10^{-5}$		1548
4γ		< 9 $\times 10^{-6}$	CL=90%	1548
5γ		< 1.5 $\times 10^{-5}$	CL=90%	1548
$\gamma \eta_c(1S)$		(1.7 $\pm$0.4) %	S=1.7	114
$\gamma \eta_c(1S) \rightarrow 3\gamma$		(1.2 $^{+2.7}_{-1.1}$) $\times 10^{-6}$		–
$\gamma \pi^+ \pi^- 2\pi^0$		(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) $\times 10^{-4}$		–
$\gamma \eta(1405/1475) \rightarrow \gamma K \overline{K} \pi$	[p]	(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%	–
$\gamma \rho \rho$		(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
$\gamma \eta'(958)$		(4.71$\pm$0.27) $\times 10^{-3}$	S=1.1	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) $\times 10^{-4}$		879
$\gamma f_2(1270) f_2(1270)$ (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
$\gamma f_2(1270)$		(1.43$\pm$0.11) $\times 10^{-3}$		1286
$\gamma f_0(1710) \rightarrow \gamma K \overline{K}$		(8.5 $^{+1.2}_{-0.9}$) $\times 10^{-4}$	S=1.2	1075
$\gamma f_0(1710) \rightarrow \gamma \pi \pi$		(4.0 $\pm$1.0) $\times 10^{-4}$		–

$\gamma f_0(1710) \rightarrow \gamma\omega\omega$	$(3.1 \pm 1.0) \times 10^{-4}$		–
$\gamma\eta$	$(9.8 \pm 1.0) \times 10^{-4}$	S=1.7	1500
$\gamma f_1(1420) \rightarrow \gamma K\overline{K}\pi$	$(7.9 \pm 1.3) \times 10^{-4}$		1220
$\gamma f_1(1285)$	$(6.1 \pm 0.8) \times 10^{-4}$		1283
$\gamma f_1(1510) \rightarrow \gamma\eta\pi^+\pi^-$	$(4.5 \pm 1.2) \times 10^{-4}$		–
$\gamma f_2'(1525)$	$(4.5 {}^{+0.7}_{-0.4}) \times 10^{-4}$		1173
$\gamma f_2(1640) \rightarrow \gamma\omega\omega$	$(2.8 \pm 1.8) \times 10^{-4}$		–
$\gamma f_2(1910) \rightarrow \gamma\omega\omega$	$(2.0 \pm 1.4) \times 10^{-4}$		–
$\gamma f_2(1950) \rightarrow$ $\gamma K^*(892)\overline{K}^*(892)$	$(7.0 \pm 2.2) \times 10^{-4}$		–
$\gamma K^*(892)\overline{K}^*(892)$	$(4.0 \pm 1.3) \times 10^{-3}$		1266
$\gamma\phi\phi$	$(4.0 \pm 1.2) \times 10^{-4}$	S=2.1	1166
$\gamma p\overline{p}$	$(3.8 \pm 1.0) \times 10^{-4}$		1232
$\gamma\eta(2225)$	$(3.3 \pm 0.5) \times 10^{-4}$		749
$\gamma\eta(1760) \rightarrow \gamma\rho^0\rho^0$	$(1.3 \pm 0.9) \times 10^{-4}$		1048
$\gamma\eta(1760) \rightarrow \gamma\omega\omega$	$(1.98 \pm 0.33) \times 10^{-3}$		–
$\gamma X(1835)$	$(2.2 \pm 0.6) \times 10^{-4}$		1006
$\gamma(K\overline{K}\pi)[J^{PC}=0^{-+}]$	$(7 \pm 4) \times 10^{-4}$	S=2.1	1442
$\gamma\pi^0$	$(3.3 {}^{+0.6}_{-0.4}) \times 10^{-5}$		1546
$\gamma p\overline{p}\pi^+\pi^-$	$< 7.9 \times 10^{-4}$	CL=90%	1107
$\gamma\Lambda\overline{\Lambda}$	$< 1.3 \times 10^{-4}$	CL=90%	1074
$\gamma f_J(2220)$	$> 2.50 \times 10^{-3}$	CL=99.9%	745
$\gamma f_J(2220) \rightarrow \gamma\pi\pi$	$(8 \pm 4) \times 10^{-5}$		–
$\gamma f_J(2220) \rightarrow \gamma K\overline{K}$	$(8.1 \pm 3.0) \times 10^{-5}$		–
$\gamma f_J(2220) \rightarrow \gamma p\overline{p}$	$(1.5 \pm 0.8) \times 10^{-5}$		–
$\gamma f_0(1500)$	$>(5.7 \pm 0.8) \times 10^{-4}$		1183
$\gamma e^+ e^-$	$(8.8 \pm 1.4) \times 10^{-3}$		1548

Weak decays

$D^- e^+ \nu_e +$ c.c.	$< 1.2 \times 10^{-5}$	CL=90%	984
$\overline{D}^0 e^+ e^- +$ c.c.	$< 1.1 \times 10^{-5}$	CL=90%	987
$D_s^- e^+ \nu_e +$ c.c.	$< 3.6 \times 10^{-5}$	CL=90%	923
$D^- \pi^+ +$ c.c.	$< 7.5 \times 10^{-5}$	CL=90%	977
$\overline{D}^0 \overline{K}^0 +$ c.c.	$< 1.7 \times 10^{-4}$	CL=90%	898
$D_s^- \pi^+ +$ c.c.	$< 1.3 \times 10^{-4}$	CL=90%	915

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

$\gamma\gamma$	C	$< 5 \times 10^{-6}$	CL=90%	1548
$e^\pm \mu^\mp$	LF	$< 1.1 \times 10^{-6}$	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

Other decays

invisible	< 7	$\times 10^{-4}$	CL=90%	—

$\chi_{c0}(1P)$ $I^G(J^{PC}) = 0^+(0^{++})$

Mass $m = 3414.75 \pm 0.31$ MeV

Full width $\Gamma = 10.4 \pm 0.7$ MeV

$\chi_{c0}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Hadronic decays			
$2(\pi^+\pi^-)$	(2.25 ± 0.19) %		1679
$\rho^0\pi^+\pi^-$	$(8.8\ \pm2.8\ )\times 10^{-3}$		1607
$f_0(980)f_0(980)$	$(6.9\ \pm2.2\ )\times 10^{-4}$		1398
$\pi^+\pi^-\pi^0\pi^0$	$(3.5\ \pm0.4\ )$ %		1680
$\rho^+\pi^-\pi^0 +$ c.c.	$(3.0\ \pm0.5\ )$ %		1607
$\pi^+\pi^- K^+ K^-$	(1.80 ± 0.15) %		1580
$K_0^*(1430)^0\overline{K}_0^*(1430)^0 \to$ $\pi^+\pi^- K^+ K^-$	$(1.02^{+0.40}_{-0.29})\times 10^{-3}$		—
$K_0^*(1430)^0\overline{K}_2^*(1430)^0 +$ c.c. $\to$ $\pi^+\pi^- K^+ K^-$	$(8.3\ ^{+2.0}_{-2.5}\ )\times 10^{-4}$		—
$K_1(1270)^+ K^- +$ c.c. $\to$ $\pi^+\pi^- K^+ K^-$	$(6.5\ \pm2.0\ )\times 10^{-3}$		—
$K_1(1400)^+ K^- +$ c.c. $\to$ $\pi^+\pi^- K^+ K^-$	< 2.8 $\times 10^{-3}$	CL=90%	—
$f_0(980)f_0(980)$	$(1.7\ ^{+1.1}_{-0.9}\ )\times 10^{-4}$		1398
$f_0(980)f_0(2200)$	$(8.2\ ^{+2.1}_{-2.6}\ )\times 10^{-4}$		595
$f_0(1370)f_0(1370)$	< 2.8 $\times 10^{-4}$	CL=90%	1019
$f_0(1370)f_0(1500)$	< 1.8 $\times 10^{-4}$	CL=90%	920
$f_0(1370)f_0(1710)$	$(7.0\ ^{+4.0}_{-2.4}\ )\times 10^{-4}$		723
$f_0(1500)f_0(1370)$	< 1.4 $\times 10^{-4}$	CL=90%	920
$f_0(1500)f_0(1500)$	< 5 $\times 10^{-5}$	CL=90%	805
$f_0(1500)f_0(1710)$	< 7 $\times 10^{-5}$	CL=90%	559
$K^+ K^-\pi^0\pi^0$	$(5.8\ \pm0.9\ )\times 10^{-3}$		1582
$K^+\pi^- K^0\pi^0 +$ c.c.	(2.58 ± 0.35) %		1581
$\rho^+ K^- K^0 +$ c.c.	(1.25 ± 0.22) %		1458
$K^*(892)^- K^+\pi^0 \to$ $K^+\pi^- K^0\pi^0 +$ c.c.	$(4.8\ \pm1.2\ )\times 10^{-3}$		—
$K_S^0 K_S^0\pi^+\pi^-$	$(5.9\ \pm1.1\ )\times 10^{-3}$		1579
$K^+ K^-\eta\pi^0$	$(3.1\ \pm0.7\ )\times 10^{-3}$		1468
$3(\pi^+\pi^-)$	(1.20 ± 0.18) %		1633
$K^+\overline{K}^*(892)^0\pi^- +$ c.c.	$(7.3\ \pm1.6\ )\times 10^{-3}$		1523

$K^*(892)^0 \overline{K}^*(892)^0$	$(1.8 \pm 0.6) \times 10^{-3}$		1456
$\pi\pi$	$(7.2 \pm 0.6) \times 10^{-3}$		1702
$\pi^0\eta$	$< 1.7 \times 10^{-4}$		1661
$\pi^0\eta'$	$< 1.0 \times 10^{-3}$		1570
$\eta\eta$	$(2.2 \pm 0.4) \times 10^{-3}$		1617
$\eta\eta'$	$< 5 \times 10^{-4}$	CL=90%	1521
$\eta'\eta'$	$(1.7 \pm 0.4) \times 10^{-3}$		1413
$\omega\omega$	$(2.2 \pm 0.7) \times 10^{-3}$		1517
$K^+ K^-$	$(5.8 \pm 0.6) \times 10^{-3}$		1634
$K_S^0 K_S^0$	$(2.84 \pm 0.28) \times 10^{-3}$		1633
$\pi^+ \pi^- \eta$	$< 2.1 \times 10^{-4}$	CL=90%	1651
$\pi^+ \pi^- \eta'$	$< 4 \times 10^{-4}$	CL=90%	1560
$\overline{K}^0 K^+ \pi^- + $ c.c.	$< 1.0 \times 10^{-4}$	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
$K^+ K^- K_S^0 K_S^0$	$(1.5 \pm 0.5) \times 10^{-3}$		1331
$K^+ K^- K^+ K^-$	$(2.83 \pm 0.30) \times 10^{-3}$		1333
$K^+ K^- \phi$	$(1.01 \pm 0.26) \times 10^{-3}$		1381
$\phi\phi$	$(9.3 \pm 1.9) \times 10^{-4}$		1370
$p\overline{p}$	$(2.39 \pm 0.15) \times 10^{-4}$		1426
$p\overline{p}\pi^0$	$(5.8 \pm 1.2) \times 10^{-4}$		1379
$p\overline{p}\eta$	$(3.8 \pm 1.1) \times 10^{-4}$		1187
$\pi^+ \pi^- p\overline{p}$	$(2.1 \pm 0.7) \times 10^{-3}$	S=1.4	1320
$\pi^0 \pi^0 p\overline{p}$	$(1.08 \pm 0.29) \times 10^{-3}$		1324
$K_S^0 K_S^0 p\overline{p}$	$< 8.8 \times 10^{-4}$	CL=90%	884
$p\overline{n}\pi^-$	$(1.17 \pm 0.32) \times 10^{-3}$		1376
$\Lambda\overline{\Lambda}$	$(3.4 \pm 0.4) \times 10^{-4}$		1292
$\Lambda\overline{\Lambda}\pi^+ \pi^-$	$< 4.0 \times 10^{-3}$	CL=90%	1153
$K^+ \overline{p}\Lambda + $ c.c.	$(1.05 \pm 0.20) \times 10^{-3}$		1132
$\Sigma^0 \overline{\Sigma}^0$	$(4.3 \pm 0.7) \times 10^{-4}$		1222
$\Sigma^+ \overline{\Sigma}^-$	$(3.2 \pm 0.7) \times 10^{-4}$		1225
$\Xi^0 \overline{\Xi}^0$	$(3.3 \pm 0.8) \times 10^{-4}$		1089
$\Xi^- \overline{\Xi}^+$	$(5.0 \pm 0.7) \times 10^{-4}$		1081

Radiative decays

$\gamma J/\psi(1S)$	(1.14 ± 0.08) %		303
$\gamma \rho^0$	$< 9 \times 10^{-6}$	CL=90%	1619
$\gamma\omega$	$< 9 \times 10^{-6}$	CL=90%	1618
$\gamma\phi$	$< 6 \times 10^{-6}$	CL=90%	1555
$\gamma\gamma$	$(2.27 \pm 0.18) \times 10^{-4}$		1707

$\boxed{\chi_{c1}(1P)}$ $\qquad\qquad I^G(J^{PC}) = 0^+(1^{++})$

Mass $m = 3510.66 \pm 0.07$ MeV   (S = 1.5)

Full width $\Gamma = 0.86 \pm 0.05$ MeV

$\chi_{c1}(1P)$ **DECAY MODES**	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
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
$\pi^+\pi^-\pi^0\pi^0$	(1.26 ± 0.17) %		1729
$\rho^+\pi^-\pi^0 +$ c.c.	(1.53 ± 0.26) %		1658
$\rho^0\pi^+\pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$		1657
$\pi^+\pi^- K^+ K^-$	$(4.5 \pm 1.0) \times 10^{-3}$		1632
$K^+ K^-\pi^0\pi^0$	$(1.18 \pm 0.29) \times 10^{-3}$		1634
$K^+\pi^- K^0\pi^0 +$ c.c.	$(9.0 \pm 1.5) \times 10^{-3}$		1632
$\rho^+ K^- K^0 +$ c.c.	$(5.3 \pm 1.3) \times 10^{-3}$		1514
$K^*(892)^0 K^0\pi^0 \to$ $K^+\pi^- K^0\pi^0 +$ c.c.	$(2.5 \pm 0.7) \times 10^{-3}$		–
$K^+ K^-\eta\pi^0$	$(1.2 \pm 0.4) \times 10^{-3}$		1523
$\pi^+\pi^- K^0_S K^0_S$	$(7.3 \pm 3.1) \times 10^{-4}$		1630
$K^+ K^-\eta$	$(3.3 \pm 1.0) \times 10^{-4}$		1566
$K^0 K^+\pi^- +$ c.c.	$(7.3 \pm 0.6) \times 10^{-3}$		1661
$K^*(892)^0 \overline{K}^0 +$ c.c.	$(1.0 \pm 0.4) \times 10^{-3}$		1602
$K^*(892)^+ K^- +$ c.c.	$(1.5 \pm 0.7) \times 10^{-3}$		1602
$K^*_J(1430)^0 \overline{K}^0 +$ c.c. $\to$ $K^0_S K^+\pi^- +$ c.c.	$< 8 \times 10^{-4}$	CL=90%	–
$K^*_J(1430)^+ K^- +$ c.c. $\to$ $K^0_S K^+\pi^- +$ c.c.	$< 2.3 \times 10^{-3}$	CL=90%	–
$K^+ K^-\pi^0$	$(1.92 \pm 0.26) \times 10^{-3}$		1662
$\eta\pi^+\pi^-$	$(5.0 \pm 0.5) \times 10^{-3}$		1701
$a_0(980)^+\pi^- +$ c.c. $\to \eta\pi^+\pi^-$	$(1.9 \pm 0.7) \times 10^{-3}$		–
$f_2(1270)\eta$	$(2.8 \pm 0.8) \times 10^{-3}$		1468
$\pi^+\pi^-\eta'$	$(2.4 \pm 0.5) \times 10^{-3}$		1612
$K^+ \overline{K}^*(892)^0\pi^- +$ c.c.	$(3.2 \pm 2.1) \times 10^{-3}$		1577
$K^*(892)^0 \overline{K}^*(892)^0$	$(1.5 \pm 0.4) \times 10^{-3}$		1512
$K^+ K^- K^0_S K^0_S$	$< 5 \times 10^{-4}$	CL=90%	1390
$K^+ K^- K^+ K^-$	$(5.6 \pm 1.2) \times 10^{-4}$		1393
$K^+ K^-\phi$	$(4.3 \pm 1.6) \times 10^{-4}$		1440
$p\overline{p}$	$(7.4 \pm 0.4) \times 10^{-5}$		1484
$p\overline{p}\pi^0$	$(1.2 \pm 0.5) \times 10^{-4}$		1438
$p\overline{p}\eta$	$< 1.6 \times 10^{-4}$	CL=90%	1254
$\pi^+\pi^- p\overline{p}$	$(5.0 \pm 1.9) \times 10^{-4}$		1381
$K^0_S K^0_S p\overline{p}$	$< 4.5 \times 10^{-4}$	CL=90%	968
$\Lambda\overline{\Lambda}$	$(1.19 \pm 0.19) \times 10^{-4}$		1355

$\Lambda\overline{\Lambda}\pi^+\pi^-$	< 1.5	$\times 10^{-3}$	CL=90%	1223
$K^+\overline{p}\Lambda$	(3.2 ±1.0) $\times 10^{-4}$			1203
$\Sigma^0\overline{\Sigma}^0$	< 4	$\times 10^{-5}$	CL=90%	1288
$\Sigma^+\overline{\Sigma}^-$	< 6	$\times 10^{-5}$	CL=90%	1291
$\Xi^0\overline{\Xi}^0$	< 6	$\times 10^{-5}$	CL=90%	1163
$\Xi^-\overline{\Xi}^+$	(8.4 ±2.3) $\times 10^{-5}$			1155
$\pi^+\pi^- + K^+K^-$	< 2.1	$\times 10^{-3}$		–
$K^0_S K^0_S$	< 6	$\times 10^{-5}$	CL=90%	1683

Radiative decays

$\gamma J/\psi(1S)$	(34.1 ±1.5) %			389
$\gamma\rho^0$	(2.29±0.27) $\times 10^{-4}$			1670
$\gamma\omega$	(7.8 ±1.8) $\times 10^{-5}$			1668
$\gamma\phi$	< 2.5	$\times 10^{-5}$	CL=90%	1607

$h_c(1P)$

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

Mass $m = 3525.67 \pm 0.32$ MeV   (S = 2.3)
Full width $\Gamma < 1$ MeV

$h_c(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi(1S)\pi\pi$	not seen	313
$\eta_c\gamma$	seen	503

$\chi_{c2}(1P)$

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

Mass $m = 3556.20 \pm 0.09$ MeV
Full width $\Gamma = 1.98 \pm 0.11$ MeV

$\chi_{c2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
Hadronic decays			
$2(\pi^+\pi^-)$	(1.09 ± 0.11) %		1751
$\pi^+\pi^-\pi^0\pi^0$	(2.01 ± 0.26) %		1752
$\rho^+\pi^-\pi^0 +$ c.c.	$(2.4\ \pm0.4\ )$ %		1682
$K^+K^-\pi^0\pi^0$	$(2.3\ \pm0.5\ )\times10^{-3}$		1658
$K^+\pi^-K^0\pi^0 +$ c.c.	(1.51 ± 0.22) %		1657
$\rho^+K^-\overline{K}^0 +$ c.c.	$(4.5\ \pm1.4\ )\times10^{-3}$		1540
$K^*(892)^0 K^+\pi^- \to$ $K^+\pi^-\overline{K}^0\pi^0 +$ c.c.	$(3.2\ \pm0.9\ )\times10^{-3}$		–
$K^*(892)^0 \overline{K}^0\pi^0 \to$ $K^+\pi^-\overline{K}^0\pi^0 +$ c.c.	$(4.2\ \pm1.0\ )\times10^{-3}$		–
$K^*(892)^- K^+\pi^0 \to$ $K^+\pi^-\overline{K}^0\pi^0 +$ c.c.	$(4.1\ \pm0.9\ )\times10^{-3}$		–
$K^*(892)^+ \overline{K}^0\pi^- \to$ $K^+\pi^-\overline{K}^0\pi^0 +$ c.c.	$(3.2\ \pm0.9\ )\times10^{-3}$		–
$K^+K^-\eta\pi^0$	$(1.4\ \pm0.5\ )\times10^{-3}$		1549
$\pi^+\pi^-K^+K^-$	$(9.0\ \pm1.1\ )\times10^{-3}$		1656
$K^+\overline{K}^*(892)^0\pi^- +$ c.c.	$(2.3\ \pm1.2\ )\times10^{-3}$		1602
$K^*(892)^0\overline{K}^*(892)^0$	$(2.5\ \pm0.5\ )\times10^{-3}$		1538
$3(\pi^+\pi^-)$	$(8.6\ \pm1.8\ )\times10^{-3}$		1707
$\phi\phi$	$(1.47\pm0.28)\times10^{-3}$		1457
$\omega\omega$	$(1.9\ \pm0.6\ )\times10^{-3}$		1597
$\pi\pi$	$(2.09\pm0.23)\times10^{-3}$		1773
$\rho^0\pi^+\pi^-$	$(3.9\ \pm1.7\ )\times10^{-3}$		1681
$\pi^+\pi^-\eta$	$(5.3\ \pm1.4\ )\times10^{-4}$		1724
$\pi^+\pi^-\eta'$	$(5.5\ \pm2.0\ )\times10^{-4}$		1636
$\eta\eta$	$<\ 5\qquad\times10^{-4}$	90%	1692
K^+K^-	$(7.6\ \pm1.3\ )\times10^{-4}$		1708
$K^0_S K^0_S$	$(6.2\ \pm0.8\ )\times10^{-4}$		1707
$\overline{K}^0 K^+\pi^- +$ c.c.	$(1.33\pm0.20)\times10^{-3}$		1685
$K^+K^-\pi^0$	$(3.3\ \pm0.8\ )\times10^{-4}$		1686
$K^+K^-\eta$	$<\ 3.5\qquad\times10^{-4}$	90%	1592
$\eta\eta'$	$<\ 2.5\qquad\times10^{-4}$	90%	1600
$\eta'\eta'$	$<\ 3.3\qquad\times10^{-4}$	90%	1498
$\pi^+\pi^-K^0_S K^0_S$	$(2.4\ \pm0.6\ )\times10^{-3}$		1655
$K^+K^-K^0_S K^0_S$	$<\ 4\qquad\times10^{-4}$	90%	1418
$K^+K^-K^+K^-$	$(1.77\pm0.22)\times10^{-3}$		1421
$K^+K^-\phi$	$(1.56\pm0.33)\times10^{-3}$		1468
$K^0_S K^0_S p\overline{p}$	$<\ 7.9\qquad\times10^{-4}$	90%	1007
$p\overline{p}$	$(7.2\ \pm0.4\ )\times10^{-5}$		1510
$p\overline{p}\pi^0$	$(4.7\ \pm1.0\ )\times10^{-4}$		1465

$p\overline{p}\eta$	$(\ 2.0\ \pm0.8\ )\times 10^{-4}$		1285
$\pi^+\pi^-\,p\overline{p}$	$(\ 1.32\pm0.34)\times 10^{-3}$		1410
$\pi^0\pi^0\,p\overline{p}$	$(\ 8.6\ \pm2.6\ )\times 10^{-4}$		1414
$p\overline{n}\pi^-$	$(\ 1.1\ \pm0.4\ )\times 10^{-3}$		1463
$\Lambda\overline{\Lambda}$	$(\ 1.87\pm0.27)\times 10^{-4}$		1385
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$<\ \ 3.5\qquad\times 10^{-3}$	90%	1255
$K^+\overline{p}\Lambda$ + c.c.	$(\ 9.1\ \pm1.8\ )\times 10^{-4}$		1236
$\Sigma^0\overline{\Sigma}^0$	$<\ \ 8\qquad\times 10^{-5}$	90%	1319
$\Sigma^+\overline{\Sigma}^-$	$<\ \ 7\qquad\times 10^{-5}$	90%	1322
$\Xi^0\overline{\Xi}^0$	$<\ \ 1.1\qquad\times 10^{-4}$	90%	1197
$\Xi^-\overline{\Xi}^+$	$(\ 1.56\pm0.35)\times 10^{-4}$		1189
$J/\psi(1S)\pi^+\pi^-\pi^0$	$<\ \ 1.5\qquad\%$	90%	185

Radiative decays

$\gamma J/\psi(1S)$	$(19.4\ \pm0.8\ )\,\%$		430
$\gamma\rho^0$	$<\ \ 5\qquad\times 10^{-5}$	90%	1694
$\gamma\omega$	$<\ \ 7\qquad\times 10^{-6}$	90%	1692
$\gamma\phi$	$<\ \ 1.2\qquad\times 10^{-5}$	90%	1632
$\gamma\gamma$	$(\ 2.60\pm0.16)\times 10^{-4}$		1778

$\boxed{\eta_c(2S)}$ $\qquad\qquad I^G(J^{PC}) = 0^+(0^{-+})$

Quantum numbers are quark model predictions.

Mass $m = 3637 \pm 4$ MeV   (S = 1.7)
Full width $\Gamma = 14 \pm 7$ MeV

$\eta_c(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
hadrons	not seen		—
$K\overline{K}\pi$	$(1.9\pm1.2)\,\%$		1729
$2\pi^+2\pi^-$	not seen		1792
$K^+K^-\pi^+\pi^-$	not seen		1700
$2K^+2K^-$	not seen		1470
$p\overline{p}$	not seen		1558
$\gamma\gamma$	$<\ 5\qquad\times 10^{-4}$	90%	1819

$\boxed{\psi(2S)}$ $\qquad\qquad I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 3686.09 \pm 0.04$ MeV   (S = 1.6)
Full width $\Gamma = 309 \pm 9$ keV
$\Gamma_{ee} = 2.36 \pm 0.04$ keV

$\psi(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
hadrons	(97.85 ± 0.13) %		—
virtual$\gamma \to$ hadrons	(1.73 ± 0.14) %	S=1.5	—
light hadrons	$(15.4\ \pm1.5\ )$ %		—
e^+e^-	$(7.65\pm0.17)\times10^{-3}$		1843
$\mu^+\mu^-$	$(7.6\ \pm0.8\ )\times10^{-3}$		1840
$\tau^+\tau^-$	$(3.0\ \pm0.4\ )\times10^{-3}$		490

Decays into $J/\psi(1S)$ and anything

$J/\psi(1S)$ anything	$(58.7\ \pm0.8\ )$ %		—
$J/\psi(1S)$ neutrals	$(24.3\ \pm0.4\ )$ %		—
$J/\psi(1S)\pi^+\pi^-$	$(33.1\ \pm0.5\ )$ %		477
$J/\psi(1S)\pi^0\pi^0$	(17.51 ± 0.34) %		481
$J/\psi(1S)\eta$	(3.24 ± 0.07) %		199
$J/\psi(1S)\pi^0$	$(1.30\pm0.10)\times10^{-3}$	S=1.4	528

Hadronic decays

$3(\pi^+\pi^-)\pi^0$	$(3.5\ \pm1.6\ )\times10^{-3}$		1746
$2(\pi^+\pi^-)\pi^0$	$(2.9\ \pm1.0\ )\times10^{-3}$	S=4.6	1799
$\rho\,a_2(1320)$	$(2.6\ \pm0.9\ )\times10^{-4}$		1500
$p\overline{p}$	$(2.75\pm0.12)\times10^{-4}$		1586
$\Delta^{++}\overline{\Delta}^{--}$	$(1.28\pm0.35)\times10^{-4}$		1371
$\Lambda\overline{\Lambda}\pi^0$	$<\ 1.2\ \ \times10^{-4}$	CL=90%	1412
$\Lambda\overline{\Lambda}\eta$	$<\ 4.9\ \ \times10^{-5}$	CL=90%	1197
$\Lambda\overline{p}K^+$	$(1.00\pm0.14)\times10^{-4}$		1327
$\Lambda\overline{p}K^+\pi^+\pi^-$	$(1.8\ \pm0.4\ )\times10^{-4}$		1167
$\Lambda\overline{\Lambda}\pi^+\pi^-$	$(2.8\ \pm0.6\ )\times10^{-4}$		1346
$\Lambda\overline{\Lambda}$	$(2.8\ \pm0.5\ )\times10^{-4}$	S=2.6	1467
$\Sigma^+\overline{\Sigma}^-$	$(2.6\ \pm0.8\ )\times10^{-4}$		1408
$\Sigma^0\overline{\Sigma}^0$	$(2.2\ \pm0.4\ )\times10^{-4}$	S=1.5	1405
$\Sigma(1385)^+\overline{\Sigma}(1385)^-$	$(1.1\ \pm0.4\ )\times10^{-4}$		1218
$\Xi^-\overline{\Xi}^+$	$(1.8\ \pm0.6\ )\times10^{-4}$	S=2.8	1284
$\Xi^0\overline{\Xi}^0$	$(2.8\ \pm0.9\ )\times10^{-4}$		1291
$\Xi(1530)^0\overline{\Xi}(1530)^0$	$<\ 8.1\ \ \times10^{-5}$	CL=90%	1025
$\Omega^-\overline{\Omega}^+$	$<\ 7.3\ \ \times10^{-5}$	CL=90%	774
$\pi^0 p\overline{p}$	$(1.33\pm0.17)\times10^{-4}$		1543
$\eta\,p\overline{p}$	$(6.0\ \pm1.2\ )\times10^{-5}$		1373
$\omega\,p\overline{p}$	$(6.9\ \pm2.1\ )\times10^{-5}$		1247
$\phi\,p\overline{p}$	$<\ 2.4\ \ \times10^{-5}$	CL=90%	1109
$\pi^+\pi^-p\overline{p}$	$(6.0\ \pm0.4\ )\times10^{-4}$		1491
$p\overline{n}\pi^-$ or c.c.	$(2.48\pm0.17)\times10^{-4}$		—
$p\overline{n}\pi^-\pi^0$	$(3.2\ \pm0.7\ )\times10^{-4}$		1492
$2(\pi^+\pi^-\pi^0)$	$(4.7\ \pm1.5\ )\times10^{-3}$		1776
$\eta\,\pi^+\pi^-$	$<\ 1.6\ \ \times10^{-4}$	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
$\eta'\pi^+\pi^-\pi^0$	$(\ 4.5\ \pm 2.1\ )\times 10^{-4}$		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
$\pi^+\pi^-K^+K^-$	$(\ 7.5\ \pm 0.9\ )\times 10^{-4}$	S=1.9	1726
$\rho^0 K^+K^-$	$(\ 2.2\ \pm 0.4\ )\times 10^{-4}$		1616
$K^*(892)^0\overline{K}_2^*(1430)^0$	$(\ 1.9\ \pm 0.5\ )\times 10^{-4}$		1418
$K^+K^-\pi^+\pi^-\eta$	$(\ 1.3\ \pm 0.7\ )\times 10^{-3}$		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
$K_1(1270)^\pm K^\mp$	$(\ 1.00 \pm 0.28)\times 10^{-3}$		1581
$K_S^0 K_S^0\pi^+\pi^-$	$(\ 2.2\ \pm 0.4\ )\times 10^{-4}$		1724
$\rho^0 p\overline{p}$	$(\ 5.0\ \pm 2.2\ )\times 10^{-5}$		1251
$K^+\overline{K}^*(892)^0\pi^- +$ 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
$\omega f_0(1710)\rightarrow\ \omega K^+K^-$	$(\ 5.9\ \pm 2.2\ )\times 10^{-5}$		$-$
$K^*(892)^0 K^-\pi^+\pi^0 +$ c.c.	$(\ 8.6\ \pm 2.2\ )\times 10^{-4}$		$-$
$K^*(892)^+ K^-\pi^+\pi^- +$ c.c.	$(\ 9.6\ \pm 2.8\ )\times 10^{-4}$		$-$
$K^*(892)^+ K^-\rho^0 +$ c.c.	$(\ 7.3\ \pm 2.6\ )\times 10^{-4}$		$-$
$K^*(892)^0 K^-\rho^+ +$ c.c.	$(\ 6.1\ \pm 1.8\ )\times 10^{-4}$		$-$
ηK^+K^-	$<\ 1.3\ \qquad\times 10^{-4}$	CL=90%	1664
ωK^+K^-	$(\ 1.85 \pm 0.25)\times 10^{-4}$	S=1.1	1614
$3(\pi^+\pi^-)$	$(\ 3.5\ \pm 2.0\ )\times 10^{-4}$	S=2.8	1774
$p\overline{p}\pi^+\pi^-\pi^0$	$(\ 7.3\ \pm 0.7\ )\times 10^{-4}$		1435
K^+K^-	$(\ 6.3\ \pm 0.7\ )\times 10^{-5}$		1776
$K_S^0 K_L^0$	$(\ 5.4\ \pm 0.5\ )\times 10^{-5}$		1775
$\pi^+\pi^-\pi^0$	$(\ 1.68 \pm 0.26)\times 10^{-4}$	S=1.4	1830
$\rho(2150)\pi\rightarrow\ \pi^+\pi^-\pi^0$	$(\ 1.9\ ^{+1.2}_{-0.4}\ )\times 10^{-4}$		$-$
$\rho(770)\pi\rightarrow\ \pi^+\pi^-\pi^0$	$(\ 3.2\ \pm 1.2\ )\times 10^{-5}$	S=1.8	$-$
$\pi^+\pi^-$	$(\ 8\ \ \pm 5\ \ )\times 10^{-5}$		1838
$K_1(1400)^\pm K^\mp$	$<\ 3.1\ \qquad\times 10^{-4}$	CL=90%	1532
$K^+K^-\pi^0$	$<\ 2.96\ \qquad\times 10^{-5}$	CL=90%	1754
$K^+\overline{K}^*(892)^- +$ c.c.	$(\ 1.7\ ^{+0.8}_{-0.7}\ )\times 10^{-5}$		1698
$K^*(892)^0\overline{K}^0 +$ c.c.	$(\ 1.09 \pm 0.20)\times 10^{-4}$		1697
$\phi\pi^+\pi^-$	$(\ 1.17 \pm 0.29)\times 10^{-4}$	S=1.7	1690
$\phi f_0(980)\rightarrow\ \pi^+\pi^-$	$(\ 6.8\ \pm 2.4\ )\times 10^{-5}$	S=1.1	$-$
$2(K^+K^-)$	$(\ 6.0\ \pm 1.4\ )\times 10^{-5}$		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
$\phi\eta$	$(2.8 ^{+1.0}_{-0.8}) \times 10^{-5}$		1654
$\phi\eta'$	$(3.1 \pm 1.6) \times 10^{-5}$		1555
$\omega\eta'$	$(3.2 ^{+2.5}_{-2.1}) \times 10^{-5}$		1623
$\omega\pi^0$	$(2.1 \pm 0.6) \times 10^{-5}$		1757
$\rho\eta'$	$(1.9 ^{+1.7}_{-1.2}) \times 10^{-5}$		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
$\phi\pi^0$	$< 4 \times 10^{-6}$	CL=90%	1699
$\eta_c \pi^+ \pi^- \pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	–
$p\overline{p}K^+ K^-$	$(2.7 \pm 0.7) \times 10^{-5}$		1118
$\overline{\Lambda}n K^0_S + $ c.c.	$(8.1 \pm 1.8) \times 10^{-5}$		1324
$\phi f'_2(1525)$	$(4.4 \pm 1.6) \times 10^{-5}$		1321
$\Theta(1540)\overline{\Theta}(1540) \to K^0_S p K^- \overline{n}+$ c.c.	$< 8.8 \times 10^{-6}$	CL=90%	–
$\Theta(1540)K^- \overline{n} \to K^0_S p K^- \overline{n}$	$< 1.0 \times 10^{-5}$	CL=90%	–
$\Theta(1540)K^0_S \overline{p} \to K^0_S \overline{p} K^+ n$	$< 7.0 \times 10^{-6}$	CL=90%	–
$\overline{\Theta}(1540)K^+ n \to K^0_S \overline{p} K^+ n$	$< 2.6 \times 10^{-5}$	CL=90%	–
$\overline{\Theta}(1540)K^0_S p \to K^0_S p K^- \overline{n}$	$< 6.0 \times 10^{-6}$	CL=90%	–
$K^0_S K^0_S$	$< 4.6 \times 10^{-6}$		1775

Radiative decays

$\gamma\chi_{c0}(1P)$	$(9.42 \pm 0.31) \%$		261
$\gamma\chi_{c1}(1P)$	$(9.2 \pm 0.4) \%$		171
$\gamma\chi_{c2}(1P)$	$(8.69 \pm 0.35) \%$		128
$\pi^0 h_c \to \gamma\eta_c(1S)\pi^0$	$(4.2 \pm 0.5) \times 10^{-4}$		–
$\gamma\eta_c(1S)$	$(3.4 \pm 0.5) \times 10^{-3}$	S=1.3	638
$\gamma\eta_c(2S)$	$< 2.0 \times 10^{-3}$	CL=90%	48
$\gamma\pi^0$	$< 5.4 \times 10^{-3}$	CL=95%	1841
$\gamma\eta'(958)$	$(1.36 \pm 0.24) \times 10^{-4}$		1719
$\gamma f_2(1270)$	$(2.1 \pm 0.4) \times 10^{-4}$		1622
$\gamma f_0(1710) \to \gamma\pi\pi$	$(3.0 \pm 1.3) \times 10^{-5}$		–
$\gamma f_0(1710) \to \gamma K\overline{K}$	$(6.0 \pm 1.6) \times 10^{-5}$		–
$\gamma\gamma$	$< 1.4 \times 10^{-4}$	CL=90%	1843
$\gamma\eta$	$< 9 \times 10^{-5}$	CL=90%	1802
$\gamma\eta\pi^+ \pi^-$	$(8.7 \pm 2.1) \times 10^{-4}$		1791
$\gamma\eta(1405) \to \gamma K\overline{K}\pi$	$< 9 \times 10^{-5}$	CL=90%	1569
$\gamma\eta(1405) \to \eta\pi^+ \pi^-$	$(3.6 \pm 2.5) \times 10^{-5}$		–
$\gamma\eta(1475) \to K\overline{K}\pi$	$< 1.4 \times 10^{-4}$	CL=90%	–
$\gamma\eta(1475) \to \eta\pi^+ \pi^-$	$< 8.8 \times 10^{-5}$	CL=90%	–
$\gamma 2(\pi^+ \pi^-)$	$(4.0 \pm 0.6) \times 10^{-4}$		1817

$\gamma K^{*0} K^+ \pi^- +$ c.c.	$(3.7 \pm 0.9) \times 10^{-4}$		1674
$\gamma K^{*0} \overline{K}^{*0}$	$(2.4 \pm 0.7) \times 10^{-4}$		1613
$\gamma K^0_S K^+ \pi^- +$ 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
$\gamma p \overline{p}$	$(2.9 \pm 0.6) \times 10^{-5}$		1586
$\gamma \pi^+ \pi^- p \overline{p}$	$(2.8 \pm 1.4) \times 10^{-5}$		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

$\psi(3770)$

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

Mass $m = 3772.92 \pm 0.35$ MeV   (S = 1.1)
Full width $\Gamma = 27.3 \pm 1.0$ MeV
$\Gamma_{ee} = 0.265 \pm 0.018$ keV   (S = 1.3)

In addition to the dominant decay mode to $D\overline{D}$, $\psi(3770)$ 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)
$D\overline{D}$	$(85.3 \pm 3.2)\%$		285
$\quad D^0 \overline{D}^0$	$(48.7 \pm 3.2)\%$		285
$\quad D^+ D^-$	$(36.1 \pm 2.8)\%$		251
$J/\psi \pi^+ \pi^-$	$(1.93 \pm 0.28) \times 10^{-3}$		560
$J/\psi \pi^0 \pi^0$	$(8.0 \pm 3.0) \times 10^{-4}$		564
$J/\psi \eta$	$(9 \pm 4) \times 10^{-4}$		359
$J/\psi \pi^0$	$< 2.8 \times 10^{-4}$	CL=90%	603
$\gamma \chi_{c0}$	$(7.3 \pm 0.9) \times 10^{-3}$		–
$\gamma \chi_{c1}$	$(2.9 \pm 0.6) \times 10^{-3}$		–
$\gamma \chi_{c2}$	$< 9 \times 10^{-4}$	CL=90%	–
$e^+ e^-$	$(9.7 \pm 0.7) \times 10^{-6}$	S=1.2	1886
$K^0_S K^0_L$	$< 1.2 \times 10^{-5}$	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%	1843
$2(\pi^+ \pi^- \pi^0)$	$< 5.85 \%$	CL=90%	1821
$\quad \omega \pi^+ \pi^-$	$< 6.0 \times 10^{-4}$	CL=90%	1794
$3(\pi^+ \pi^-)$	$< 9.1 \times 10^{-3}$		1819
$3(\pi^+ \pi^-)\pi^0$	$< 1.37 \%$		1792
$3(\pi^+ \pi^-)2\pi^0$	$< 11.74 \%$	CL=90%	1759
$\eta \pi^+ \pi^-$	$< 1.24 \times 10^{-3}$	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
$\eta 3\pi$	<	1.34	$\times 10^{-3}$	CL=90%	1824
$\eta 2(\pi^+ \pi^-)$	<	2.43	%		1804
$\eta' 3\pi$	<	2.44	$\times 10^{-3}$	CL=90%	1740
$K^+ K^- \pi^+ \pi^-$	<	9.0	$\times 10^{-4}$	CL=90%	1772
$\phi \pi^+ \pi^-$	<	4.1	$\times 10^{-4}$	CL=90%	1737
$K^+ K^- 2\pi^0$	<	4.2	$\times 10^{-3}$	CL=90%	1774
$\phi \pi^0$		not seen			1746
$\phi \eta$	(	3.1 ± 0.7)	$\times 10^{-4}$		1703
$4(\pi^+ \pi^-)$	<	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%	1600
$K^+ K^- \pi^+ \pi^- \pi^0$	<	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%	1622
$\omega K^+ K^-$	<	3.4	$\times 10^{-4}$	CL=90%	1664
$\phi \pi^+ \pi^- \pi^0$	<	3.8	$\times 10^{-3}$	CL=90%	1722
$K^{*0} K^- \pi^+ \pi^0 +$ c.c.	<	1.62	%	CL=90%	1693
$K^{*+} K^- \pi^+ \pi^- +$ c.c.	<	3.23	%	CL=90%	1692
$K^+ K^- \pi^+ \pi^- 2\pi^0$	<	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%	1660
$\eta K^+ K^-$	<	4.1	$\times 10^{-4}$	CL=90%	1711
$\rho^0 K^+ K^-$	<	5.0	$\times 10^{-3}$	CL=90%	1665
$2(K^+ K^-)$	<	6.0	$\times 10^{-4}$	CL=90%	1551
$\phi K^+ K^-$	<	7.5	$\times 10^{-4}$	CL=90%	1597
$2(K^+ K^-)\pi^0$	<	2.9	$\times 10^{-4}$	CL=90%	1493
$2(K^+ K^-)\pi^+ \pi^-$	<	3.2	$\times 10^{-3}$	CL=90%	1425
$K^0_S K^- \pi^+$	<	3.2	$\times 10^{-3}$	CL=90%	1799
$K^0_S K^- \pi^+ \pi^0$	<	1.33	%	CL=90%	1773
$K^0_S K^- 2\pi^+ \pi^-$	<	8.7	$\times 10^{-3}$	CL=90%	1739
$K^0_S K^- 2\pi^+ \pi^- \pi^0$	<	4.18	%	CL=90%	1703
$K^0_S K^- \pi^+ 2(\pi^+ \pi^-)$	<	1.22	%	CL=90%	1658
$K^0_S K^- \pi^+ 2\pi^0$	<	2.65	%	CL=90%	1741
$K^{*0} K^- \pi^+ +$ c.c.	<	9.7	$\times 10^{-3}$	CL=90%	1721
$p\overline{p}\pi^0$	<	1.2	$\times 10^{-3}$		1595
$p\overline{p}\pi^+ \pi^-$	<	5.8	$\times 10^{-4}$	CL=90%	1544
$\Lambda \overline{\Lambda}$	<	1.2	$\times 10^{-4}$	CL=90%	1521
$p\overline{p}\pi^+ \pi^- \pi^0$	<	1.85	$\times 10^{-3}$	CL=90%	1490
$\omega p\overline{p}$	<	2.9	$\times 10^{-4}$	CL=90%	1309
$\Lambda \overline{\Lambda}\pi^0$	<	1.2	$\times 10^{-3}$	CL=90%	1468
$p\overline{p}2(\pi^+ \pi^-)$	<	2.6	$\times 10^{-3}$	CL=90%	1425
$\eta p\overline{p}$	<	5.4	$\times 10^{-4}$	CL=90%	1430
$\rho^0 p\overline{p}$	<	1.7	$\times 10^{-3}$	CL=90%	1313

$p\overline{p}K^+K^-$	< 3.2	$\times 10^{-4}$	CL=90%	1185
$\phi p\overline{p}$	< 1.3	$\times 10^{-4}$	CL=90%	1178
$\Lambda\overline{\Lambda}\pi^+\pi^-$	< 2.5	$\times 10^{-4}$	CL=90%	1404
$\Lambda\overline{p}K^+$	< 2.8	$\times 10^{-4}$	CL=90%	1387
$\Lambda\overline{p}K^+\pi^+\pi^-$	< 6.3	$\times 10^{-4}$	CL=90%	1234
$\pi^+\pi^-\pi^0$	not seen			1874
$\rho\pi$	not seen			1804
$\omega\pi^0$	not seen			1803
$\rho\eta$	not seen			1763
$\omega\eta$	not seen			1762
$\rho\eta'$	not seen			1674
$\omega\eta'$	not seen			1672
$\phi\eta'$	not seen			1606
$K^{*0}\overline{K}^0$	not seen			1744
$K^{*+}K^-$	not seen			1745
$b_1\pi$	not seen			1683

$X(3872)$ $\quad\quad\quad\quad I^G(J^{PC}) = 0^?(?^{?+})$

Quantum numbers not established.

Mass $m = 3872.3 \pm 0.8$ MeV $\quad$ (S = 2.3)

$m_{X(3872)} - m_{J/\psi} = 775 \pm 4$ MeV

$m_{X(3872)} - m_{\psi(2S)}$

Full width $\Gamma = 3.0^{+2.1}_{-1.7}$ MeV

$X(3872)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
e^+e^-	<8 $\times 10^{-5}$	90%	1936
$\pi^+\pi^- J/\psi(1S)$	>2.6 %	90%	650
$\rho^0 J/\psi(1S)$	seen		†
$D^0\overline{D}^0$	not seen		521
D^+D^-	not seen		503
$D^0\overline{D}^0\pi^0$	seen		122

$X(3945)$ $\quad\quad\quad\quad I^G(J^{PC}) = ?^?(?^{?+})$

Observed in $\omega J/\psi$, thus $C = +$

Mass $m = 3916 \pm 6$ MeV $\quad$ (S = 1.6)

Full width $\Gamma = 40^{+18}_{-13}$ MeV $\quad$ (S = 1.5)

X(3945) DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega J/\psi$	seen	216

$\psi(4040)$ [dddd] $I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 4039 \pm 1$ MeV
Full width $\Gamma = 80 \pm 10$ MeV
$\Gamma_{ee} = 0.86 \pm 0.07$ keV

$\psi(4040)$ **DECAY MODES**	Fraction (Γ_i/Γ)		Confidence level	p (MeV/c)
$e^+ e^-$	$(1.07 \pm 0.16) \times 10^{-5}$			2019
$D^0 \overline{D}^0$	seen			775
$D^*(2007)^0 \overline{D}^0 +$ c.c.	seen			575
$D^*(2007)^0 \overline{D}^*(2007)^0$	seen			225
$J/\psi \pi^+ \pi^-$	< 4	$\times 10^{-3}$	90%	794
$J/\psi \pi^0 \pi^0$	< 2	$\times 10^{-3}$	90%	797
$J/\psi \eta$	< 7	$\times 10^{-3}$	90%	675
$J/\psi \pi^0$	< 2	$\times 10^{-3}$	90%	823
$J/\psi \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%	746
$\chi_{c1} \gamma$	< 1.1	%	90%	494
$\chi_{c2} \gamma$	< 1.7	%	90%	454
$\chi_{c1} \pi^+ \pi^- \pi^0$	< 1.1	%	90%	306
$\chi_{c2} \pi^+ \pi^- \pi^0$	< 3.2	%	90%	233
$\phi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%	1880

$\psi(4160)$ [dddd] $I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 4153 \pm 3$ MeV
Full width $\Gamma = 103 \pm 8$ MeV
$\Gamma_{ee} = 0.83 \pm 0.07$ keV

$\psi(4160)$ DECAY MODES	Fraction (Γ_i/Γ)		Confidence level	p (MeV/c)
$e^+ e^-$	$(8.1 \pm 0.9) \times 10^{-6}$			2076
$J/\psi \pi^+ \pi^-$	< 3	$\times 10^{-3}$	90%	888
$J/\psi \pi^0 \pi^0$	< 3	$\times 10^{-3}$	90%	891
$J/\psi K^+ K^-$	< 2	$\times 10^{-3}$	90%	324
$J/\psi \eta$	< 8	$\times 10^{-3}$	90%	786
$J/\psi \pi^0$	< 1	$\times 10^{-3}$	90%	914
$J/\psi \eta'$	< 5	$\times 10^{-3}$	90%	385
$J/\psi \pi^+ \pi^- \pi^0$	< 1	$\times 10^{-3}$	90%	847
$\psi(2S) \pi^+ \pi^-$	< 4	$\times 10^{-3}$	90%	353
$\chi_{c1} \gamma$	< 7	$\times 10^{-3}$	90%	593
$\chi_{c2} \gamma$	< 1.3	%	90%	554
$\chi_{c1} \pi^+ \pi^- \pi^0$	< 2	$\times 10^{-3}$	90%	452
$\chi_{c2} \pi^+ \pi^- \pi^0$	< 8	$\times 10^{-3}$	90%	398
$\phi \pi^+ \pi^-$	< 2	$\times 10^{-3}$	90%	1941

$X(4260)$

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

Mass $m = 4263^{+8}_{-9}$ MeV   (S = 1.1)
Full width $\Gamma = 95 \pm 14$ MeV

$X(4260)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$J/\psi \pi^+ \pi^-$	seen	976
$J/\psi \pi^0 \pi^0$	[eeee] seen	978
$J/\psi K^+ K^-$	[eeee] seen	530
$J/\psi \eta$	[eeee] not seen	886
$J/\psi \pi^0$	[eeee] not seen	999
$J/\psi \eta'$	[eeee] not seen	569
$J/\psi \pi^+ \pi^- \pi^0$	[eeee] not seen	939
$J/\psi \eta \eta$	[eeee] not seen	339
$\psi(2S) \pi^+ \pi^-$	[eeee] not seen	470
$\psi(2S) \eta$	[eeee] not seen	167
$\chi_{c0} \omega$	[eeee] not seen	284
$\chi_{c1} \gamma$	[eeee] not seen	686
$\chi_{c2} \gamma$	[eeee] not seen	648
$\chi_{c1} \pi^+ \pi^- \pi^0$	[eeee] not seen	571
$\chi_{c2} \pi^+ \pi^- \pi^0$	[eeee] not seen	524
$\phi \pi^+ \pi^-$	[eeee] not seen	1999
$D \overline{D}$	not seen	1032

$\psi(4415)$ [dddd] $\qquad\qquad I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 4421 \pm 4$ MeV
Full width $\Gamma = 62 \pm 20$ MeV
$\Gamma_{ee} = 0.58 \pm 0.07$ keV

$\psi(4415)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
hadrons	dominant		–
$(D^0 D^- \pi^+)_{non-res}$	< 2.3 %	90%	–
$D\overline{D}_2^*(2460) \to D^0 D^- \pi^+$	(10 $\pm$4) %		–
$e^+ e^-$	(9.4$\pm$3.2) $\times 10^{-6}$		2210

$b\overline{b}$ MESONS

$\Upsilon(1S)$ $\qquad\qquad I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 9460.30 \pm 0.26$ MeV $\quad$ (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)	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			
$\eta'(958)$ anything	(2.94$\pm$0.24) %		–
$J/\psi(1S)$ anything	(6.5 $\pm$0.7) $\times 10^{-4}$		4223
χ_{c0} anything	< 5 $\times 10^{-3}$	90%	–
χ_{c1} anything	(2.3 $\pm$0.7) $\times 10^{-4}$		–
χ_{c2} anything	(3.4 $\pm$1.0) $\times 10^{-4}$		–
$\psi(2S)$ anything	(2.7 $\pm$0.9) $\times 10^{-4}$		–
$\rho\pi$	< 2 $\times 10^{-4}$	90%	4697
$\pi^+ \pi^-$	< 5 $\times 10^{-4}$	90%	4728
$K^+ K^-$	< 5 $\times 10^{-4}$	90%	4704
$p\overline{p}$	< 5 $\times 10^{-4}$	90%	4636
$\pi^0 \pi^+ \pi^-$	< 1.84 $\times 10^{-5}$	90%	4725
$\overline{d}$ anything	(2.86$\pm$0.28) $\times 10^{-5}$		–

Radiative decays

$\gamma \pi^+ \pi^-$		$(6.3 \pm 1.8) \times 10^{-5}$		4728
$\gamma \pi^0 \pi^0$		$(1.7 \pm 0.7) \times 10^{-5}$		4728
$\gamma \pi^0 \eta$		$< 2.4 \quad \times 10^{-6}$	90%	4713
$\gamma K^+ K^-$	[ffff]	$(1.14 \pm 0.13) \times 10^{-5}$		4704
$\gamma p \overline{p}$	[gggg]	$< 6 \quad \times 10^{-6}$	90%	4636
$\gamma 2h^+ 2h^-$		$(7.0 \pm 1.5) \times 10^{-4}$		4720
$\gamma 3h^+ 3h^-$		$(5.4 \pm 2.0) \times 10^{-4}$		4703
$\gamma 4h^+ 4h^-$		$(7.4 \pm 3.5) \times 10^{-4}$		4679
$\gamma \pi^+ \pi^- K^+ K^-$		$(2.9 \pm 0.9) \times 10^{-4}$		4686
$\gamma 2\pi^+ 2\pi^-$		$(2.5 \pm 0.9) \times 10^{-4}$		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
$\gamma \pi^+ \pi^- p \overline{p}$		$(1.5 \pm 0.6) \times 10^{-4}$		4604
$\gamma 2\pi^+ 2\pi^- p \overline{p}$		$(4 \pm 6) \times 10^{-5}$		4563
$\gamma 2K^+ 2K^-$		$(2.0 \pm 2.0) \times 10^{-5}$		4601
$\gamma \eta'(958)$		$< 1.9 \quad \times 10^{-6}$	90%	4682
$\gamma \eta$		$< 1.0 \quad \times 10^{-6}$	90%	4714
$\gamma f_0(980)$		$< 3 \quad \times 10^{-5}$	90%	4679
$\gamma f_2'(1525)$		$(3.7 {}^{+1.2}_{-1.1}) \times 10^{-5}$		4607
$\gamma f_2(1270)$		$(1.01 \pm 0.09) \times 10^{-4}$		4644
$\gamma \eta(1405)$		$< 8.2 \quad \times 10^{-5}$	90%	4625
$\gamma f_0(1500)$		$< 1.5 \quad \times 10^{-5}$	90%	4610
$\gamma f_0(1710)$		$< 2.6 \quad \times 10^{-4}$	90%	4574
$\gamma f_0(1710) \rightarrow \gamma K^+ K^-$		$< 7 \quad \times 10^{-6}$	90%	—
$\gamma f_0(1710) \rightarrow \gamma \pi^0 \pi^0$		$< 1.4 \quad \times 10^{-6}$	90%	—
$\gamma f_0(1710) \rightarrow \gamma \eta \eta$		$< 1.8 \quad \times 10^{-6}$	90%	—
$\gamma f_4(2050)$		$< 5.3 \quad \times 10^{-5}$	90%	4515
$\gamma f_0(2200) \rightarrow \gamma K^+ K^-$		$< 2 \quad \times 10^{-4}$	90%	4475
$\gamma f_J(2220) \rightarrow \gamma K^+ K^-$		$< 8 \quad \times 10^{-7}$	90%	4469
$\gamma f_J(2220) \rightarrow \gamma \pi^+ \pi^-$		$< 6 \quad \times 10^{-7}$	90%	—
$\gamma f_J(2220) \rightarrow \gamma p \overline{p}$		$< 1.1 \quad \times 10^{-6}$	90%	—
$\gamma \eta(2225) \rightarrow \gamma \phi \phi$		$< 3 \quad \times 10^{-3}$	90%	4469
γX	[hhhh]	$< 3 \quad \times 10^{-5}$	90%	—
$\gamma X \overline{X}$	[iiii]	$< 1 \quad \times 10^{-3}$	90%	—
$\gamma X \rightarrow \gamma + \geq 4$ prongs	[jjjj]	$< 1.78 \quad \times 10^{-4}$	95%	—

Lepton Flavor (*LF*) violating or Invisible decays

$\mu^\pm \tau^\mp$	LF	$< 6.0 \quad \times 10^{-6}$	95%	4563
invisible		$< 2.5 \quad \times 10^{-3}$	90%	—

$$\boxed{\chi_{b0}(1P)^{[kkkk]}} \qquad I^G(J^{PC}) = 0^+(0^{++})$$

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)
$\gamma \Upsilon(1S)$	< 6	%	90%	391
$D^0 X$	< 10.4	%	90%	–
$\pi^+ \pi^- K^+ K^- \pi^0$	< 1.6	$\times 10^{-4}$	90%	4875
$2\pi^+ \pi^- K^- K^0_S$	< 5	$\times 10^{-5}$	90%	4875
$2\pi^+ \pi^- K^- K^0_S 2\pi^0$	< 5	$\times 10^{-4}$	90%	4846
$2\pi^+ 2\pi^- 2\pi^0$	< 2.1	$\times 10^{-4}$	90%	4905
$2\pi^+ 2\pi^- K^+ K^-$	$(1.1\pm0.6) \times 10^{-4}$			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
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	< 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
$3\pi^+ 3\pi^- K^+ K^-$	$(2.4\pm1.2) \times 10^{-4}$			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

$\chi_{b1}(1P)$ [kkkk]

$$I^G(J^{PC}) = 0^+(1^{++})$$
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 ± 8) %			423
$D^0 X$	(12.6 ± 2.2) %			–
$\pi^+ \pi^- K^+ K^- \pi^0$	$(2.0\pm0.6) \times 10^{-4}$			4892
$2\pi^+ \pi^- K^- K^0_S$	$(1.3\pm0.5) \times 10^{-4}$			4892
$2\pi^+ \pi^- K^- K^0_S 2\pi^0$	< 6	$\times 10^{-4}$	90%	4863
$2\pi^+ 2\pi^- 2\pi^0$	$(8.0\pm2.5) \times 10^{-4}$			4921
$2\pi^+ 2\pi^- K^+ K^-$	$(1.5\pm0.5) \times 10^{-4}$			4878
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(3.5\pm1.2) \times 10^{-4}$			4863
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(8.6\pm3.2) \times 10^{-4}$			4845
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	$(9.3\pm3.3) \times 10^{-4}$			4844
$3\pi^+ 3\pi^-$	$(1.9\pm0.6) \times 10^{-4}$			4921
$3\pi^+ 3\pi^- 2\pi^0$	$(1.7\pm0.5) \times 10^{-3}$			4898
$3\pi^+ 3\pi^- K^+ K^-$	$(2.6\pm0.8) \times 10^{-4}$			4844
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(7.5\pm2.6) \times 10^{-4}$			4825
$4\pi^+ 4\pi^-$	$(2.6\pm0.9) \times 10^{-4}$			4897
$4\pi^+ 4\pi^- 2\pi^0$	$(1.4\pm0.6) \times 10^{-3}$			4867

$\chi_{b2}(1P)$ [kkkk]

$I^G(J^{PC}) = 0^+(2^{++})$
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)
$\gamma\,\Upsilon(1S)$	$(22 \pm 4\ )\,\%$		442
$D^0 X$	$< 7.9\quad \%$	90%	−
$\pi^+\pi^- K^+ K^- \pi^0$	$(8 \pm 5\ ) \times 10^{-5}$		4902
$2\pi^+\pi^- K^- K^0_S$	$< 1.0\quad \times 10^{-4}$	90%	4901
$2\pi^+\pi^- K^- K^0_S 2\pi^0$	$(5.3 \pm 2.4) \times 10^{-4}$		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
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	$< 5\quad \times 10^{-4}$	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
$3\pi^+ 3\pi^- K^+ K^-$	$< 8\quad \times 10^{-5}$	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

$\Upsilon(2S)$

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

Mass $m = 10.02326 \pm 0.00031$ GeV
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)
$\Upsilon(1S)\pi^+\pi^-$	$(18.1 \pm 0.4)\%$		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
$\Upsilon(1S)\pi^0$	$< 1.8 \times 10^{-4}$	CL=90%	531
$\Upsilon(1S)\eta$	$(2.1 ^{+0.8}_{-0.7})\times 10^{-4}$		126
$J/\psi(1S)$ anything	$< 6 \times 10^{-3}$	CL=90%	4533
$\overline{d}$ anything	$(3.4 \pm 0.6)\times 10^{-5}$		–
hadrons	$(94 \pm 11)\%$		–

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%	4864
$\gamma f_2'(1525)$	$< 5.3 \times 10^{-4}$	CL=90%	4896
$\gamma f_2(1270)$	$< 2.41 \times 10^{-4}$	CL=90%	4931
$\gamma\eta_b(1S)$	$< 5.1 \times 10^{-4}$	CL=90%	614
$\gamma X \to \gamma + \geq 4$ prongs	[llll] $< 1.95 \times 10^{-4}$	CL=95%	–

Lepton Flavor (LF) violating decays

$\mu^\pm\tau^\mp$	LF	$< 1.44 \times 10^{-5}$	CL=95%	4854

$\chi_{b0}(2P)$ [kkkk]

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

Mass $m = 10.2325 \pm 0.0004 \pm 0.0005$ GeV

$\chi_{b0}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)		Confidence level	p (MeV/c)
$\gamma\, \Upsilon(2S)$	(4.6 ± 2.1) %			207
$\gamma\, \Upsilon(1S)$	$(9\ \pm6\ )\times10^{-3}$			743
$D^0 X$	< 8.2	%	90%	−
$\pi^+\pi^- K^+ K^- \pi^0$	< 3.4	$\times10^{-5}$	90%	5064
$2\pi^+\pi^- K^- K^0_S$	< 5	$\times10^{-5}$	90%	5063
$2\pi^+\pi^- K^- K^0_S 2\pi^0$	< 2.2	$\times10^{-4}$	90%	5036
$2\pi^+ 2\pi^- 2\pi^0$	< 2.4	$\times10^{-4}$	90%	5092
$2\pi^+ 2\pi^- K^+ K^-$	< 1.5	$\times10^{-4}$	90%	5050
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.2	$\times10^{-4}$	90%	5035
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 1.1	$\times10^{-3}$	90%	5019
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	< 7	$\times10^{-4}$	90%	5018
$3\pi^+ 3\pi^-$	< 7	$\times10^{-5}$	90%	5091
$3\pi^+ 3\pi^- 2\pi^0$	< 1.2	$\times10^{-3}$	90%	5070
$3\pi^+ 3\pi^- K^+ K^-$	< 1.5	$\times10^{-4}$	90%	5017
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 7	$\times10^{-4}$	90%	4999
$4\pi^+ 4\pi^-$	< 1.7	$\times10^{-4}$	90%	5069
$4\pi^+ 4\pi^- 2\pi^0$	< 6	$\times10^{-4}$	90%	5039

$\chi_{b1}(2P)$ [kkkk]

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

Mass $m = 10.25546 \pm 0.00022 \pm 0.00050$ GeV

$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)} = 23.5 \pm 1.0$ MeV

$\chi_{b1}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$\omega\, \Upsilon(1S)$	$(1.63^{+0.40}_{-0.34})$ %		135
$\gamma\, \Upsilon(2S)$	$(21\ \pm4\ )$ %	1.5	230
$\gamma\, \Upsilon(1S)$	(8.5 ± 1.3) %	1.3	764
$\pi\pi\chi_{b1}(1P)$	$(8.6\pm3.1)\times10^{-3}$		238
$D^0 X$	(8.8 ± 1.7) %		−
$\pi^+\pi^- K^+ K^- \pi^0$	$(3.1\pm1.0)\times10^{-4}$		5075
$2\pi^+\pi^- K^- K^0_S$	$(1.1\pm0.5)\times10^{-4}$		5075
$2\pi^+\pi^- K^- K^0_S 2\pi^0$	$(7.7\pm3.2)\times10^{-4}$		5047
$2\pi^+ 2\pi^- 2\pi^0$	$(5.9\pm2.0)\times10^{-4}$		5104
$2\pi^+ 2\pi^- K^+ K^-$	$(10\ \pm4\ )\times10^{-5}$		5062
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(5.5\pm1.8)\times10^{-4}$		5047
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(10\ \pm4\ )\times10^{-4}$		5030
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	$(6.7\pm2.6)\times10^{-4}$		5029
$3\pi^+ 3\pi^-$	$(1.2\pm0.4)\times10^{-4}$		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

$\chi_{b2}(2P)$ [kkkk]

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

Mass $m = 10.26865 \pm 0.00022 \pm 0.00050$ GeV
$m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)} = 13.5 \pm 0.6$ 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
$\gamma \Upsilon(2S)$	(16.2 ± 2.4) %		242
$\gamma \Upsilon(1S)$	(7.1 ± 1.0) %		777
$\pi\pi \chi_{b2}(1P)$	$(6.0 \pm 2.1) \times 10^{-3}$		229
$D^0 X$	< 2.4 %	90%	–
$\pi^+ \pi^- K^+ K^- \pi^0$	$< 1.1 \times 10^{-4}$	90%	5082
$2\pi^+ \pi^- K^- K^0_S$	$< 9 \times 10^{-5}$	90%	5082
$2\pi^+ \pi^- K^- K^0_S 2\pi^0$	$< 7 \times 10^{-4}$	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
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	$< 4 \times 10^{-4}$	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 $m = 10.3552 \pm 0.0005$ GeV
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
$\Upsilon(2S)\pi^+\pi^-$	$(\ 2.45 \pm 0.23)\ \%$	S=1.1	177
$\Upsilon(2S)\pi^0\pi^0$	$(\ 1.85 \pm 0.14)\ \%$		190
$\Upsilon(2S)\gamma\gamma$	$(\ 5.0 \pm 0.7\ )\ \%$		327
$\Upsilon(2S)\pi^0$	$<\ 5.1 \qquad \times 10^{-4}$	CL=90%	298
$\Upsilon(1S)\pi^+\pi^-$	$(\ 4.40 \pm 0.10)\ \%$		813
$\Upsilon(1S)\pi^0\pi^0$	$(\ 2.20 \pm 0.13)\ \%$		816
$\Upsilon(1S)\eta$	$<\ 1.8 \qquad \times 10^{-4}$	CL=90%	677
$\Upsilon(1S)\pi^0$	$<\ 7 \qquad \times 10^{-5}$	CL=90%	846
$\tau^+\tau^-$	$(\ 2.29 \pm 0.30)\ \%$		4863
$\mu^+\mu^-$	$(\ 2.18 \pm 0.21)\ \%$	S=2.1	5177
e^+e^-	seen		5178

Radiative decays

$\gamma\chi_{b2}(2P)$	$(13.1 \pm 1.6\ )\ \%$	S=3.4	86
$\gamma\chi_{b1}(2P)$	$(12.6 \pm 1.2\ )\ \%$	S=2.4	99
$\gamma\chi_{b0}(2P)$	$(\ 5.9 \pm 0.6\ )\ \%$	S=1.4	122
$\gamma\chi_{b2}(1P)$	$<\ 1.9 \qquad \%$	CL=90%	434
$\gamma\chi_{b1}(1P)$	$<\ 1.7 \qquad \times 10^{-3}$	CL=90%	452
$\gamma\chi_{b0}(1P)$	$(\ 3.0 \pm 1.1\ ) \times 10^{-3}$		484
$\gamma\eta_b(2S)$	$<\ 6.2 \qquad \times 10^{-4}$	CL=90%	–
$\gamma\eta_b(1S)$	$(\ 4.8 \pm 1.3\ ) \times 10^{-4}$		921
$\gamma X \to\ \gamma + \geq 4$ prongs	$[mmmm] <\ 2.2 \qquad \times 10^{-4}$	CL=95%	–

Lepton Flavor (*LF*) violating decays

$\mu^\pm\tau^\mp$	LF	$<\ 2.03 \qquad \times 10^{-5}$	CL=95%	5025

$\Upsilon(4S)$ or $\Upsilon(10580)$

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

Mass $m = 10.5794 \pm 0.0012$ GeV

Full width $\Gamma = 20.5 \pm 2.5$ MeV

$\Gamma_{ee} = 0.272 \pm 0.029$ keV $\quad$ (S = 1.5)

$\Upsilon(4S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$B\overline{B}$	> 96 %	95%	328
$B^+ B^-$	$(51.6 \pm 0.6$) %		334
D_s^+ anything + c.c.	$(18.2 \pm 2.5$) %		−
$B^0 \overline{B}^0$	$(48.4 \pm 0.6$) %		328
$J/\psi K_S^0 (J/\psi, \eta_c) K_S^0$	$< 4 \times 10^{-7}$	90%	−
non-$B\overline{B}$	< 4 %	95%	−
$e^+ e^-$	$(1.57 \pm 0.08) \times 10^{-5}$		5290
$\rho^+ \rho^-$	$< 5.7 \times 10^{-6}$	90%	5233
$J/\psi(1S)$ anything	$< 1.9 \times 10^{-4}$	95%	−
D^{*+} anything + c.c.	< 7.4 %	90%	5099
ϕ anything	$(7.1 \pm 0.6$) %		5240
$\phi \eta$	$< 2.5 \times 10^{-6}$	90%	5226
$\Upsilon(1S)$ anything	$< 4 \times 10^{-3}$	90%	1053
$\Upsilon(1S)\pi^+ \pi^-$	$(8.0 \pm 0.7$) $\times 10^{-5}$		1026
$\Upsilon(1S)\eta$	$(1.96 \pm 0.11) \times 10^{-4}$		924
$\Upsilon(2S)\pi^+ \pi^-$	$(8.6 \pm 1.3$) $\times 10^{-5}$		468
$\overline{d}$ anything	$< 1.3 \times 10^{-5}$	90%	−

$\Upsilon(10860)$

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

Mass $m = 10.865 \pm 0.008$ GeV   (S = 1.1)
Full width $\Gamma = 110 \pm 13$ 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)
$e^+ e^-$	$(2.8 \pm 0.7$) $\times 10^{-6}$		5432
$B\overline{B}X$	$(59 \pm 14$) %		−
$B\overline{B}$	< 13.8 %	90%	1280
$B\overline{B}^* + $ c.c.	$(14 \pm 6$) %		−
$B^* \overline{B}^*$	$(44 \pm 11$) %		−
$B\overline{B}^{(*)}\pi$	< 19.7 %	90%	−
$B\overline{B}\pi\pi$	< 8.9 %	90%	442
$B_s^{(*)} \overline{B}_s^{(*)}(X)$	$(19.3 \pm 2.9$) %		−
$\Upsilon(1S)\pi^+ \pi^-$	$(5.3 \pm 0.6$) $\times 10^{-3}$		1288
$\Upsilon(2S)\pi^+ \pi^-$	$(7.8 \pm 1.3$) $\times 10^{-3}$		763
$\Upsilon(3S)\pi^+ \pi^-$	$(4.8 ^{+ 1.9}_{- 1.7}$) $\times 10^{-3}$		416
$\Upsilon(1S)K^+ K^-$	$(6.1 \pm 1.8$) $\times 10^{-4}$		933

Inclusive Decays.

These decay modes are submodes of one or more of the decay modes above.

ϕ anything	($13.8 \begin{smallmatrix} +2.4 \\ -1.7 \end{smallmatrix}$) %	–
D^0 anything + c.c.	(108 $\pm$ 8) %	–
D_s anything + c.c.	(46 $\pm$ 6) %	–
J/ψ anything	(2.06$\pm$ 0.21) %	–

$\Upsilon(11020)$

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

Mass $m = 11.019 \pm 0.008$ GeV
Full width $\Gamma = 79 \pm 16$ MeV
$\Gamma_{ee} = 0.130 \pm 0.030$ keV

$\Upsilon(11020)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$e^+ e^-$	$(1.6\pm0.5) \times 10^{-6}$	5510

NOTES

[a] See the "Note on $\pi^\pm \rightarrow \ell^\pm \nu \gamma$ and $K^\pm \rightarrow \ell^\pm \nu \gamma$ Form Factors" in the $\pi^\pm$ Particle Listings 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 $[\Gamma(e^+ \nu_e) + \Gamma(\mu^+ \nu_\mu)]/\Gamma_{total} = 100\%$.

[c] See the $\pi^\pm$ 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}; see the π^0 Particle Listings.

[f] Due to a new measurement in the average, this is 0.45 MeV larger than the mass we gave in our 2002 edition, 547.30 ± 0.12 MeV.

[g] Due to removing an old measurement from the average, this is 0.11 keV larger than the width we gave in our 2002 edition, 1.18 ± 0.11 keV. See the $\Gamma(2\gamma)$ data block in the Data Listings.

[h] C parity forbids this to occur as a single-photon process.

[i] See the "Note on scalar mesons" in the $f_0(1370)$ Particle Listings . The interpretation of this entry as a particle is controversial.

[j] See the "Note on $\rho(770)$" in the $\rho(770)$ Particle Listings .

[k] The $\omega\rho$ interference is then due to $\omega\rho$ mixing only, and is expected to be small. If $e\mu$ universality holds, $\Gamma(\rho^0 \rightarrow \mu^+\mu^-) = \Gamma(\rho^0 \rightarrow e^+e^-) \times 0.99785$.

[l] See the "Note on scalar mesons" in the $f_0(1370)$ Particle Listings .

[m] See the "Note on $a_1(1260)$" in the $a_1(1260)$ Particle Listings in PDG 06, Journal of Physics, G **33** 1 (2006).

[n] This is only an educated guess; the error given is larger than the error on the average of the published values. See the Particle Listings for details.

[o] See the "Note on non-$q\overline{q}$ mesons" in the Particle Listings in PDG 06, Journal of Physics, G **33** 1 (2006).

[p] See the "Note on the $\eta(1405)$" in the $\eta(1405)$ Particle Listings.

[q] See the "Note on the $f_1(1420)$" in the $\eta(1405)$ Particle Listings.

[r] See also the $\omega(1650)$ Particle Listings.

[s] See the "Note on the $\rho(1450)$ and the $\rho(1700)$" in the $\rho(1700)$ Particle Listings.

[t] See also the $\omega(1420)$ Particle Listings.

[u] See the "Note on $f_0(1710)$" in the $f_0(1710)$ Particle Listings in 2004 edition of *Review of Particle Physics*.

[v] See the note in the $K^\pm$ Particle Listings.

[w] The definition of the slope parameter g 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):
$$|M|^2 = 1 + g(s_3 - s_0)/m_{\pi^+}^2 + \cdots .$$

[x] For more details and definitions of parameters see the Particle Listings.

[y] Most of this radiative mode, the low-momentum γ part, is also included in the parent mode listed without γ's.

[z] See the $K^\pm$ Particle Listings for the energy limits used in this measurement.

[aa] Structure-dependent part.

[bb] Direct-emission branching fraction.

[cc] Violates angular-momentum conservation.

[dd] 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."

[ee] 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):

$$\eta_{+-} = \left|\eta_{+-}\right|e^{i\phi_{+-}} = \frac{A(K_L^0 \to \pi^+\pi^-)}{A(K_S^0 \to \pi^+\pi^-)} = \epsilon + \epsilon'$$

$$\eta_{00} = \left|\eta_{00}\right|e^{i\phi_{00}} = \frac{A(K_L^0 \to \pi^0\pi^0)}{A(K_S^0 \to \pi^0\pi^0)} = \epsilon - 2\epsilon'$$

$$\delta = \frac{\Gamma(K_L^0 \to \pi^-\ell^+\nu) - \Gamma(K_L^0 \to \pi^+\ell^-\nu)}{\Gamma(K_L^0 \to \pi^-\ell^+\nu) + \Gamma(K_L^0 \to \pi^+\ell^-\nu)},$$

$$\mathrm{Im}(\eta_{+-0})^2 = \frac{\Gamma(K_S^0 \to \pi^+\pi^-\pi^0)^{CP\ \mathrm{viol.}}}{\Gamma(K_L^0 \to \pi^+\pi^-\pi^0)},$$

$$\mathrm{Im}(\eta_{000})^2 = \frac{\Gamma(K_S^0 \to \pi^0\pi^0\pi^0)}{\Gamma(K_L^0 \to \pi^0\pi^0\pi^0)}.$$

where for the last two relations *CPT* is assumed valid, *i.e.*, $\mathrm{Re}(\eta_{+-0}) \simeq 0$ and $\mathrm{Re}(\eta_{000}) \simeq 0$.

[ff] See the K_S^0 Particle Listings for the energy limits used in this measurement.

[gg] The value is for the sum of the charge states or particle/antiparticle states indicated.

[hh] $\mathrm{Re}(\epsilon'/\epsilon) = \epsilon'/\epsilon$ to a very good approximation provided the phases satisfy *CPT* invariance.

[ii] This mode includes gammas from inner bremsstrahlung but not the direct emission mode $K_L^0 \to \pi^+\pi^-\gamma(\mathrm{DE})$.

[jj] See the K_L^0 Particle Listings for the energy limits used in this measurement.

[kk] Allowed by higher-order electroweak interactions.

[ll] Violates *CP* in leading order. Test of direct *CP* violation since the indirect *CP*-violating and *CP*-conserving contributions are expected to be suppressed.

[mm] See the "Note on $f_0(1370)$" in the $f_0(1370)$ Particle Listings and in the 1994 edition.

[nn] 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 .

[oo] See the "Note on $K_2(1770)$ and the $K_2(1820)$" in the $K_2(1770)$ Particle Listings .

[pp] This result applies to $Z^0 \to c\bar{c}$ decays only. Here ℓ^+ is an average (not a sum) of e^+ and μ^+ decays.

[*qq*] 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.

[*rr*] These subfractions of the $K^- \pi^+ \pi^+$ mode are uncertain: see the Particle Listings.

[*ss*] The two experiments measuring this fraction are in serious disagreement. See the Particle Listings.

[*tt*] This is *not* a test for the $\Delta C = 1$ weak neutral current, but leads to the $\pi^+ e^+ e^-$ final state.

[*uu*] This mode is not a useful test for a $\Delta C = 1$ weak neutral current because both quarks must change flavor in this decay.

[*vv*] This value is obtained by subtracting the branching fractions for 2-, 4- and 6-prongs from unity.

[*ww*] This is the sum of our $K^- \pi^+ \pi^+ \pi^-$, $K^- \pi^+ \pi^+ \pi^- \pi^0$, $\overline{K}^0 2\pi^+ 2\pi^-$, $2\pi^+ 2\pi^-$, $2\pi^+ 2\pi^- \pi^0$, $K^+ K^- \pi^+ \pi^-$, and $K^+ K^- \pi^+ \pi^- \pi^0$, branching fractions.

[*xx*] 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 6.27 ± 0.17 %.

[*yy*] This is a doubly Cabibbo-suppressed mode.

[*zz*] This branching fraction includes all the decay modes of the resonance in the final state.

[*aaa*] The experiments on the division of this charge mode amongst its submodes disagree, and the submode branching fractions here add up to considerably more than the charged-mode fraction.

[*bbb*] However, these upper limits are in serious disagreement with values obtained in another experiment.

[*ccc*] See the Particle Listings for the (complicated) definition of this quantity.

[*ddd*] This fraction includes η from η' decays.

[*eee*] For now, we average together measurements of the $X e^+ \nu_e$ and $X \mu^+ \nu_\mu$ branching fractions. This is the *average*, not the *sum*.

[*fff*] We decouple the $D_s^+ \to \phi \pi^+$ branching fraction obtained from mass projections (and used to get some of the other branching fractions) from the $D_s^+ \to \phi \pi^+$, $\phi \to K^+ K^-$ branching fraction obtained from the Dalitz-plot analysis of $D_s^+ \to K^+ K^- \pi^+$. That is, the ratio of these two branching fractions is not exactly the $\phi \to K^+ K^-$ branching fraction 0.491.

[*ggg*] This branching fraction includes all the decay modes of the final-state resonance.

[hhh] This comes from a K-matrix parametrization of the $\pi^+\pi^-$ S-wave and is a sum over the $f_0(980)$, $f_0(1300)$, $f_0(1200–1600)$, $f_0(1500)$, and $f_0(1750)$. Not all of these correspond to particles in our Tables.

[iii] An ℓ indicates an e or a μ mode, not a sum over these modes.

[jjj] An $CP(\pm1)$ indicates the $CP=+1$ and $CP=-1$ eigenstates of the D^0-$\overline{D}^0$ system.

[kkk] D denotes D^0 or $\overline{D}^0$.

[lll] D_{CP+}^{*0} decays into $D^0\pi^0$ with the D^0 reconstructed in CP-even eigenstates K^+K^- and $\pi^+\pi^-$.

[mmm] $\overline{D}^{**}$ represents an excited state with mass $2.2 < \mathrm{M} < 2.8$ GeV/c^2.

[nnn] $X(3872)^+$ is a hypothetical charged partner of the $X(3872)$.

[ooo] $\Theta(1710)^{++}$ is a possible narrow pentaquark state and $G(2220)$ is a possible glueball resonance.

[ppp] $(\overline{\Lambda}_c^- p)_s$ denotes a low-mass enhancement near 3.35 GeV/c^2.

[qqq] Stands for the possible candidates of $K^*(1410)$, $K_0^*(1430)$ and $K_2^*(1430)$.

[rrr] B^0 and B_s^0 contributions not separated. Limit is on weighted average of the two decay rates.

[sss] 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/c^2.

[ttt] $\Theta(1540)^+$ denotes a possible narrow pentaquark state.

[uuu] These values are model dependent.

[vvv] Here "anything" means at least one particle observed.

[www] 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.

[xxx] $D^{(*)}\overline{D}^{(*)}$ stands for the sum of $D^*\overline{D}^*$, $D^*\overline{D}$, $D\overline{D}^*$, and $D\overline{D}$.

[yyy] $X(3945)$ denotes a near-threshold enhancement in the $\omega J/\psi$ mass spectrum.

[zzz] Inclusive branching fractions have a multiplicity definition and can be greater than 100%.

[aaaa] D_j represents an unresolved mixture of pseudoscalar and tensor D^{**} (P-wave) states.

[bbbb] Not a pure measurement. See note at head of B_s^0 Decay Modes.

[cccc] Includes $p\overline{p}\pi^+\pi^-\gamma$ and excludes $p\overline{p}\eta$, $p\overline{p}\omega$, $p\overline{p}\eta'$.

[dddd] 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.

[*eeee*] See COAN 06 for details.

[*ffff*] $2m_\tau < \mathrm{M}(\tau^+\tau^-) < 7500$ MeV.

[*gggg*] $2 < m_{K^+K^-} < 3$ GeV.

[*hhhh*] $X =$ pseudoscalar with $m < 7.2$ GeV

[*iiii*] $X\overline{X} =$ vectors with $m < 3.1$ GeV

[*jjjj*] 1.5 GeV $< m_X < 5.0$ GeV

[*kkkk*] Spectroscopic labeling for these states is theoretical, pending experimental information.

[*llll*] 1.5 GeV $< m_X < 5.0$ GeV

[*mmmm*] 1.5 GeV $< m_X < 5.0$ GeV