BOTTOM, STRANGE MESONS ($B = \pm1$, $S = \mp1$)

$B^0_s = s\overline{b}$, $\overline{B}^0_s = \overline{s}\,b$, similarly for B^*_s's

B^0_s

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

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

Mass $m_{B^0_s} = 5366.79 \pm 0.23$ MeV
$m_{B^0_s} - m_B = 87.33 \pm 0.23$ MeV
Mean life $\tau = (1.510 \pm 0.005) \times 10^{-12}$ s
$c\tau = 452.7$ μm
$\Delta\Gamma_{B^0_s} = \Gamma_{B^0_{sL}} - \Gamma_{B^0_{sH}} = (0.082 \pm 0.007) \times 10^{12}$ s^{-1}

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

$\Delta m_{B^0_s} = m_{B^0_{sH}} - m_{B^0_{sL}} = (17.757 \pm 0.021) \times 10^{12}$ $\hbar$ s^{-1}
$= (1.1688 \pm 0.0014) \times 10^{-8}$ MeV
$x_s = \Delta m_{B^0_s}/\Gamma_{B^0_s} = 26.81 \pm 0.10$
$\chi_s = 0.499308 \pm 0.000005$

CP violation parameters in B^0_s

$\text{Re}(\epsilon_{B^0_s}) \,/\, (1 + |\epsilon_{B^0_s}|^2) = (-1.9 \pm 1.0) \times 10^{-3}$
$C_{KK}(B^0_s \to K^+K^-) = 0.14 \pm 0.11$
$S_{KK}(B^0_s \to K^+K^-) = 0.30 \pm 0.13$
$\gamma(B^0_s \to D^\pm_s K^\mp) = (115^{+28}_{-40})^\circ$
$\delta_B(B^0_s \to D^\pm_s K^\mp) = (3 \pm 20)^\circ$
$r_B(B^0_s \to D^\mp_s K^\pm) = 0.53 \pm 0.17$
CP Violation phase $\beta_s = (0.6 \pm 1.9) \times 10^{-2}$ rad
$|\lambda|$ $(B^0_s \to J/\psi(1S)\phi) = 0.964 \pm 0.020$
$|\lambda| = 1.02 \pm 0.07$
$\boldsymbol{A_{CP}(B_s \to \pi^+K^-)} = 0.263 \pm 0.035$
$A_{CP}(B^0_s \to [K^+K^-]_D \overline{K}^*(892)^0) = -0.04 \pm 0.07$
$A_{CP}(B^0_s \to [\pi^+K^-]_D K^*(892)^0) = -0.01 \pm 0.04$
$A_{CP}(B^0_s \to [\pi^+\pi^-]_D K^*(892)^0) = 0.06 \pm 0.13$

These branching fractions all scale with $B(\overline{b} \to B^0_s)$.

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

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

B^0_s DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
D^-_s anything		(93 ±25) %		–
$\ell \nu_\ell X$		(9.6 ± 0.8) %		–
$e^+ \nu X^-$		(9.1 ± 0.8) %		–
$\mu^+ \nu X^-$		(10.2 ± 1.0) %		–
$D^-_s \ell^+ \nu_\ell$ anything	[a]	(7.9 ± 2.4) %		–
$D_{s1}(2536)^- \mu^+ \nu_\mu$, $D^-_{s1} \to D^{*-} K^0_S$		(2.5 ± 0.7) $\times 10^{-3}$		–
$D_{s1}(2536)^- X \mu^+ \nu$, $D^-_{s1} \to \overline{D}^0 K^+$		(4.3 ± 1.7) $\times 10^{-3}$		–
$D_{s2}(2573)^- X \mu^+ \nu$, $D^-_{s2} \to \overline{D}^0 K^+$		(2.6 ± 1.2) $\times 10^{-3}$		–
$D^-_s \pi^+$		(3.04± 0.23) $\times 10^{-3}$		2320
$D^-_s \rho^+$		(7.0 ± 1.5) $\times 10^{-3}$		2249
$D^-_s \pi^+ \pi^+ \pi^-$		(6.3 ± 1.1) $\times 10^{-3}$		2301
$D_{s1}(2536)^- \pi^+$, $D^-_{s1} \to D^-_s \pi^+ \pi^-$		(2.5 ± 0.8) $\times 10^{-5}$		–
$D^\mp_s K^\pm$		(2.03± 0.28) $\times 10^{-4}$	S=1.3	2293
$D^-_s K^+ \pi^+ \pi^-$		(3.3 ± 0.7) $\times 10^{-4}$		2249
$D^+_s D^-_s$		(4.4 ± 0.5) $\times 10^{-3}$		1824
$D^-_s D^+$		(2.8 ± 0.5) $\times 10^{-4}$		1875
$D^+ D^-$		(2.2 ± 0.6) $\times 10^{-4}$		1925
$D^0 \overline{D}^0$		(1.9 ± 0.5) $\times 10^{-4}$		1929
$D^{*-}_s \pi^+$		(2.0 ± 0.5) $\times 10^{-3}$		2265
$D^{*-}_s \rho^+$		(9.7 ± 2.2) $\times 10^{-3}$		2191
$D^{*+}_s D^-_s + D^{*-}_s D^+_s$		(1.29± 0.22) %	S=1.1	1742
$D^{*+}_s D^{*-}_s$		(1.86± 0.30) %		1655
$D^{(*)+}_s D^{(*)-}_s$		(4.5 ± 1.4) %		–
$\overline{D}^0 K^- \pi^+$		(9.9 ± 1.5) $\times 10^{-4}$		2312
$\overline{D}^0 \overline{K}^*(892)^0$		(4.4 ± 0.6) $\times 10^{-4}$		2264

$\overline{D}^0\,\overline{K}^*(1410)$	$(3.9 \pm 3.5) \times 10^{-4}$		2117
$\overline{D}^0\,\overline{K}^*_0(1430)$	$(3.0 \pm 0.7) \times 10^{-4}$		2113
$\overline{D}^0\,\overline{K}^*_2(1430)$	$(1.1 \pm 0.4) \times 10^{-4}$		2113
$\overline{D}^0\,\overline{K}^*(1680)$	$< 7.8 \times 10^{-5}$	CL=90%	1997
$\overline{D}^0\,\overline{K}^*_0(1950)$	$< 1.1 \times 10^{-4}$	CL=90%	1890
$\overline{D}^0\,\overline{K}^*_3(1780)$	$< 2.6 \times 10^{-5}$	CL=90%	1971
$\overline{D}^0\,\overline{K}^*_4(2045)$	$< 3.1 \times 10^{-5}$	CL=90%	1837
$\overline{D}^0\,K^-\pi^+$ (non-resonant)	$(2.1 \pm 0.8) \times 10^{-4}$		2312
$D^*_{s2}(2573)^-\pi^+$, $D^*_{s2} \to \overline{D}^0 K^-$	$(2.6 \pm 0.4) \times 10^{-4}$		–
$D^*_{s1}(2700)^-\pi^+$, $D^*_{s1} \to \overline{D}^0 K^-$	$(1.6 \pm 0.8) \times 10^{-5}$		–
$D^*_{s1}(2860)^-\pi^+$, $D^*_{s1} \to \overline{D}^0 K^-$	$(5 \pm 4) \times 10^{-5}$		–
$D^*_{s3}(2860)^-\pi^+$, $D^*_{s3} \to \overline{D}^0 K^-$	$(2.2 \pm 0.6) \times 10^{-5}$		–
$\overline{D}^0\,K^+K^-$	$(4.2 \pm 1.9) \times 10^{-5}$		2242
$\overline{D}^0\,\phi$	$(3.0 \pm 0.8) \times 10^{-5}$		2235
$D^{*\mp}\pi^\pm$	$< 6.1 \times 10^{-6}$	CL=90%	–
$J/\psi(1S)\phi$	$(1.08 \pm 0.09) \times 10^{-3}$		1588
$J/\psi(1S)\pi^0$	$< 1.2 \times 10^{-3}$	CL=90%	1786
$J/\psi(1S)\eta$	$(3.9 \pm 0.7) \times 10^{-4}$	S=1.4	1733
$J/\psi(1S)K^0_S$	$(1.87 \pm 0.17) \times 10^{-5}$		1743
$J/\psi(1S)K^*(892)^0$	$(4.4 \pm 0.9) \times 10^{-5}$		1637
$J/\psi(1S)\eta'$	$(3.3 \pm 0.4) \times 10^{-4}$		1612
$J/\psi(1S)\pi^+\pi^-$	$(2.14 \pm 0.19) \times 10^{-4}$		1775
$J/\psi(1S)f_0(500)$, $f_0 \to \pi^+\pi^-$	$< 1.7 \times 10^{-6}$	CL=90%	–
$J/\psi(1S)\rho$, $\rho \to \pi^+\pi^-$	$< 1.2 \times 10^{-6}$	CL=90%	–
$J/\psi(1S)f_0(980)$, $f_0 \to \pi^+\pi^-$	$(1.35 \pm 0.16) \times 10^{-4}$		–
$J/\psi(1S)f_0(980)_0$, $f_0 \to \pi^+\pi^-$	$(5.1 \pm 0.9) \times 10^{-5}$		–
$J/\psi(1S)f_2(1270)_0$, $f_2 \to \pi^+\pi^-$	$(2.6 \pm 0.7) \times 10^{-7}$		–
$J/\psi(1S)f_2(1270)_\parallel$, $f_2 \to \pi^+\pi^-$	$(3.8 \pm 1.3) \times 10^{-7}$		–
$J/\psi(1S)f_2(1270)_\perp$, $f_2 \to \pi^+\pi^-$	$(4.6 \pm 2.8) \times 10^{-7}$		–
$J/\psi(1S)f_0(1500)$, $f_0 \to \pi^+\pi^-$	$(7.4 {}^{+1.6}_{-1.4}) \times 10^{-6}$		–

$J/\psi(1S) f'_2(1525)_0$, $f'_2 \to \pi^+\pi^-$	$(3.7 \pm 1.0) \times 10^{-7}$		–
$J/\psi(1S) f'_2(1525)_{\parallel}$, $f'_2 \to \pi^+\pi^-$	$(4.4 ^{+10.0}_{-3.1}) \times 10^{-8}$		–
$J/\psi(1S) f'_2(1525)_{\perp}$, $f'_2 \to \pi^+\pi^-$	$(1.9 \pm 1.4) \times 10^{-7}$		–
$J/\psi(1S) f_0(1790)$, $f_0 \to \pi^+\pi^-$	$(1.7 ^{+4.0}_{-0.4}) \times 10^{-6}$		–
$J/\psi(1S) \overline{K}^0 \pi^+\pi^-$	$< 4.4 \times 10^{-5}$	CL=90%	1675
$J/\psi(1S) K^+ K^-$	$(7.9 \pm 0.7) \times 10^{-4}$		1601
$J/\psi(1S) K^0 K^- \pi^+ +$ c.c.	$(9.3 \pm 1.3) \times 10^{-4}$		1538
$J/\psi(1S) \overline{K}^0 K^+ K^-$	$< 1.2 \times 10^{-5}$	CL=90%	1333
$J/\psi(1S) f'_2(1525)$	$(2.6 \pm 0.6) \times 10^{-4}$		1304
$J/\psi(1S) p\overline{p}$	$< 4.8 \times 10^{-6}$	CL=90%	982
$J/\psi(1S) \pi^+\pi^-\pi^+\pi^-$	$(8.0 \pm 0.9) \times 10^{-5}$		1731
$J/\psi(1S) f_1(1285)$	$(7.1 \pm 1.4) \times 10^{-5}$		1460
$\psi(2S)\eta$	$(3.3 \pm 0.9) \times 10^{-4}$		1338
$\psi(2S)\eta'$	$(1.29 \pm 0.35) \times 10^{-4}$		1158
$\psi(2S)\pi^+\pi^-$	$(7.3 \pm 1.3) \times 10^{-5}$		1397
$\psi(2S)\phi$	$(5.4 \pm 0.6) \times 10^{-4}$		1120
$\chi_{c1}\phi$	$(2.05 \pm 0.31) \times 10^{-4}$		1274
$\pi^+\pi^-$	$(7.6 \pm 1.9) \times 10^{-7}$	S=1.4	2680
$\pi^0\pi^0$	$< 2.1 \times 10^{-4}$	CL=90%	2680
$\eta\pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	2654
$\eta\eta$	$< 1.5 \times 10^{-3}$	CL=90%	2627
$\rho^0\rho^0$	$< 3.20 \times 10^{-4}$	CL=90%	2569
$\phi\rho^0$	$< 6.17 \times 10^{-4}$	CL=90%	2526
$\phi\phi$	$(1.93 \pm 0.31) \times 10^{-5}$		2482
$\pi^+ K^-$	$(5.5 \pm 0.6) \times 10^{-6}$		2659
$K^+ K^-$	$(2.50 \pm 0.17) \times 10^{-5}$		2638
$K^0 \overline{K}^0$	$< 6.6 \times 10^{-5}$	CL=90%	2637
$K^0 \pi^+\pi^-$	$(1.5 \pm 0.4) \times 10^{-5}$		2653
$K^0 K^\pm \pi^\mp$	$(7.7 \pm 1.0) \times 10^{-5}$		2622
$K^*(892)^- \pi^+$	$(3.3 \pm 1.2) \times 10^{-6}$		2607
$K^*(892)^\pm K^\mp$	$(1.25 \pm 0.26) \times 10^{-5}$		2585
$K^0 K^+ K^-$	$< 3.5 \times 10^{-6}$	CL=90%	2568
$\overline{K}^*(892)^0 \rho^0$	$< 7.67 \times 10^{-4}$	CL=90%	2550
$\overline{K}^*(892)^0 K^*(892)^0$	$(2.8 \pm 0.7) \times 10^{-5}$		2531
$\phi K^*(892)^0$	$(1.13 \pm 0.30) \times 10^{-6}$		2507
$p\overline{p}$	$(2.8 ^{+2.2}_{-1.7}) \times 10^{-8}$		2514
$\Lambda_c^- \Lambda \pi^+$	$(3.6 \pm 1.6) \times 10^{-4}$		–

$\Lambda_c^- \Lambda_c^+$		< 8.0	$\times 10^{-5}$	CL=95%	–
$\gamma\gamma$	B1	< 3.1	$\times 10^{-6}$	CL=90%	2683
$\phi\gamma$		(3.52 ± 0.34)	$\times 10^{-5}$		2587

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

$\mu^+ \mu^-$	B1	(3.1 ± 0.7)	$\times 10^{-9}$		2681
$e^+ e^-$	B1	< 2.8	$\times 10^{-7}$	CL=90%	2683
$\mu^+ \mu^- \mu^+ \mu^-$	B1	< 1.2	$\times 10^{-8}$	CL=90%	2673
$S P$, $S \to \mu^+ \mu^-$, $P \to \mu^+ \mu^-$	B1	[b] < 1.2	$\times 10^{-8}$	CL=90%	–
$\phi(1020) \mu^+ \mu^-$	B1	(7.7 ± 1.5)	$\times 10^{-7}$		2582
$\phi \nu \overline{\nu}$	B1	< 5.4	$\times 10^{-3}$	CL=90%	2587
$e^\pm \mu^\mp$	LF	[c] < 1.1	$\times 10^{-8}$	CL=90%	2682

B_s^*

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

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

Mass $m = 5415.4^{+1.8}_{-1.5}$ MeV (S = 3.0)
$m_{B_s^*} - m_{B_s} = 48.6^{+1.8}_{-1.6}$ MeV (S = 2.8)

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

$B_{s1}(5830)^0$

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

Mass $m = 5828.78 \pm 0.35$ MeV (S = 1.2)
$m_{B_{s1}^0} - m_{B^{*+}} = 503.95 \pm 0.23$ MeV (S = 1.3)
Full width $\Gamma = 0.5 \pm 0.4$ MeV

$B_{s1}(5830)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^{*+} K^-$	dominant	97

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

$I(J^P) = 0(2^+)$
I, J, P need confirmation.

Mass $m = 5839.83 \pm 0.19$ MeV (S = 1.2)
$m_{B_{s2}^{*0}} - m_{B_{s1}^0}$
$m_{B_{s2}^{*0}} - m_{B^+} = 560.54 \pm 0.19$ MeV (S = 1.2)
Full width $\Gamma = 1.47 \pm 0.33$ MeV

$B^*_{s2}(5840)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$B^+ K^-$	dominant	253

NOTES

[*a*] Not a pure measurement. See note at head of B^0_s Decay Modes.

[*b*] Here S and P are the hypothetical scalar and pseudoscalar particles with masses of 2.5 GeV/c^2 and 214.3 MeV/c^2, respectively.

[*c*] The value is for the sum of the charge states or particle/antiparticle states indicated.