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

$B_s^0 = s\overline{b}$, $\overline{B}_s^0 = \overline{s}\,b$, 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 $m_{B_s^0} = 5366.77 \pm 0.24$ MeV

$m_{B_s^0} - m_B = 87.35 \pm 0.23$ MeV

Mean life $\tau = (1.512 \pm 0.007) \times 10^{-12}$ s

$c\tau = 453.3\ \mu$m

$\Delta\Gamma_{B_s^0} = \Gamma_{B_{sL}^0} - \Gamma_{B_{sH}^0} = (0.091 \pm 0.008) \times 10^{12}\ \text{s}^{-1}$

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

$\Delta m_{B_s^0} = m_{B_{sH}^0} - m_{B_{sL}^0} = (17.761 \pm 0.022) \times 10^{12}\ \hbar\ \text{s}^{-1}$

$= (1.1691 \pm 0.0014) \times 10^{-8}$ MeV

$x_s = \Delta m_{B_s^0}/\Gamma_{B_s^0} = 26.85 \pm 0.13$

$\chi_s = 0.499311 \pm 0.000007$

CP violation parameters in B_s^0

$\text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2) = (-1.9 \pm 1.0) \times 10^{-3}$

$C_{KK}(B_s^0 \to K^+K^-) = 0.14 \pm 0.11$

$S_{KK}(B_s^0 \to K^+K^-) = 0.30 \pm 0.13$

CP Violation phase $\beta_s = (0.0 \pm 3.5) \times 10^{-2}$

$A_{CP}(B_s \to \pi^+K^-) = 0.28 \pm 0.04$

$A_{CP}(B_s^0 \to [K^+K^-]_D \overline{K}^*(892)^0) = 0.04 \pm 0.16$

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

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

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_s^0 DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
D_s^- anything		(93 ±25) %		–
$\ell \nu_\ell X$		(10.5 ± 0.8) %		–
$D_s^- \ell^+ \nu_\ell$ anything	[a]	(7.9 ± 2.4) %		–
$D_{s1}(2536)^- \mu^+ \nu_\mu$, $D_{s1}^- \rightarrow D^{*-} K_S^0$		(2.5 ± 0.7) × 10^{-3}		–
$D_{s1}(2536)^- X \mu^+ \nu$, $D_{s1}^- \rightarrow \overline{D}^0 K^+$		(4.3 ± 1.7) × 10^{-3}		–
$D_{s2}(2573)^- X \mu^+ \nu$, $D_{s2}^- \rightarrow \overline{D}^0 K^+$		(2.6 ± 1.2) × 10^{-3}		–
$D_s^- \pi^+$		(3.04± 0.23) × 10^{-3}		2320
$D_s^- \rho^+$		(7.0 ± 1.5) × 10^{-3}		2249
$D_s^- \pi^+ \pi^+ \pi^-$		(6.3 ± 1.1) × 10^{-3}		2301
$D_{s1}(2536)^- \pi^+$, $D_{s1}^- \rightarrow D_s^- \pi^+ \pi^-$		(2.5 ± 0.8) × 10^{-5}		–
$D_s^\mp K^\pm$		(2.03± 0.28) × 10^{-4}	S=1.3	2293
$D_s^- K^+ \pi^+ \pi^-$		(3.3 ± 0.7) × 10^{-4}		2249
$D_s^+ D_s^-$		(4.4 ± 0.5) × 10^{-3}		1824
$D_s^- D^+$		(3.6 ± 0.8) × 10^{-4}		1875
$D^+ D^-$		(2.2 ± 0.6) × 10^{-4}		1925
$D^0 \overline{D}^0$		(1.9 ± 0.5) × 10^{-4}		1929
$D_s^{*-} \pi^+$		(2.0 ± 0.5) × 10^{-3}		2265
$D_s^{*-} \rho^+$		(9.7 ± 2.2) × 10^{-3}		2191
$D_s^{*+} D_s^- + D_s^{*-} D_s^+$		(1.28± 0.23) %	S=1.2	1742
$D_s^{*+} D_s^{*-}$		(1.85± 0.30) %		1655
$D_s^{(*)+} D_s^{(*)-}$		(4.5 ± 1.4) %		–
$\overline{D}^0 K^- \pi^+$		(9.9 ± 1.5) × 10^{-4}		2312
$\overline{D}^0 \overline{K}^*(892)^0$		(3.5 ± 0.6) × 10^{-4}		2264
$\overline{D}^0 K^+ K^-$		(4.2 ± 1.9) × 10^{-5}		2242
$\overline{D}^0 \phi$		(2.4 ± 0.7) × 10^{-5}		2235

$D^{*\mp}\pi^{\pm}$		$<$ 6.1	$\times 10^{-6}$	CL=90%	–
$J/\psi(1S)\phi$		(1.07 $\pm$ 0.09)	$\times 10^{-3}$		1588
$J/\psi(1S)\pi^0$		$<$ 1.2	$\times 10^{-3}$	CL=90%	1786
$J/\psi(1S)\eta$		(4.0 $\pm$ 0.7)	$\times 10^{-4}$	S=1.3	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
$J/\psi(1S)\eta'$		(3.4 $\pm$ 0.5)	$\times 10^{-4}$		1612
$J/\psi(1S)\pi^+\pi^-$		(2.12 $\pm$ 0.19)	$\times 10^{-4}$		1775
$J/\psi(1S)f_0(980)$, $f_0 \to \pi^+\pi^-$		(1.39 $\pm$ 0.14)	$\times 10^{-4}$		–
$J/\psi(1S)f_0(1370)$, $f_0 \to \pi^+\pi^-$		(3.9 $^{+\ 0.8}_{-\ 1.8}$)	$\times 10^{-5}$		–
$J/\psi(1S)f_2(1270)$, $f_2 \to \pi^+\pi^-$		(1.1 $\pm$ 0.4)	$\times 10^{-6}$		–
$J/\psi(1S)\pi^+\pi^-$ (nonresonant)		(1.8 $^{+\ 1.1}_{-\ 0.4}$)	$\times 10^{-5}$		1775
$J/\psi(1S)K^+K^-$		(7.9 $\pm$ 0.7)	$\times 10^{-4}$		1601
$J/\psi(1S)f_2'(1525)$		(2.6 $\pm$ 0.6)	$\times 10^{-4}$		1304
$J/\psi(1S)p\overline{p}$		$<$ 4.8	$\times 10^{-6}$	CL=90%	982
$\psi(2S)\eta$		(3.3 $\pm$ 0.9)	$\times 10^{-4}$		1338
$\psi(2S)\pi^+\pi^-$		(7.2 $\pm$ 1.2)	$\times 10^{-5}$		1397
$\psi(2S)\phi$		(5.4 $\pm$ 0.6)	$\times 10^{-4}$		1120
$\chi_{c1}\phi$		(2.02 $\pm$ 0.30)	$\times 10^{-4}$		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
$\phi\phi$		(1.91 $\pm$ 0.31)	$\times 10^{-5}$		2482
π^+K^-		(5.5 $\pm$ 0.6)	$\times 10^{-6}$		2659
K^+K^-		(2.49 $\pm$ 0.17)	$\times 10^{-5}$		2638
$K^0\overline{K}^0$		$<$ 6.6	$\times 10^{-5}$	CL=90%	2637
$K^0\pi^+\pi^-$		(1.9 $\pm$ 0.5)	$\times 10^{-5}$		2653
$K^0K^{\pm}\pi^{\mp}$		(9.7 $\pm$ 1.7)	$\times 10^{-5}$		2622
$K^0K^+K^-$		$<$ 4	$\times 10^{-6}$	CL=90%	2568
$\overline{K}^*(892)^0\rho^0$		$<$ 7.67	$\times 10^{-4}$	CL=90%	2550
$\overline{K}^*(892)^0K^*(892)^0$		(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)	$\times 10^{-4}$		–
$\gamma\gamma$	*B1*	$<$ 8.7	$\times 10^{-6}$	CL=90%	2683
$\phi\gamma$		(3.6 $\pm$ 0.4)	$\times 10^{-5}$		2587

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

$\mu^+\mu^-$	*B1*		$(\ 3.1 \pm 0.7\ ) \times 10^{-9}$		2681
e^+e^-	*B1*	$<$	2.8×10^{-7}	CL=90%	2683
$e^\pm\mu^\mp$	*LF*	[*b*] $<$	1.1×10^{-8}	CL=90%	2682
$\mu^+\mu^-\mu^+\mu^-$		$<$	1.2×10^{-8}	CL=90%	2673
$SP,\ S \to \mu^+\mu^-,\ P \to \mu^+\mu^-$		[*c*] $<$	1.2×10^{-8}	CL=90%	–
$\phi(1020)\mu^+\mu^-$	*B1*		$(\ 7.6 \pm 1.5\ ) \times 10^{-7}$		2582
$\phi\nu\overline{\nu}$	*B1*	$<$	5.4×10^{-3}	CL=90%	2587

B_s^*

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

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

Mass $m = 5415.4^{+2.4}_{-2.1}$ MeV (S = 3.0)

$m_{B_s^*} - m_{B_s} = 48.7^{+2.3}_{-2.1}$ 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 $m = 5828.7 \pm 0.4$ MeV (S = 1.2)

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

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

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

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

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

Mass $m = 5839.96 \pm 0.20$ MeV

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

Full width $\Gamma = 1.6 \pm 0.5$ 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_s^0 Decay Modes.

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

[*c*] 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.