

# BOTTOM, STRANGE MESONS

## ( $B = \pm 1, S = \mp 1$ )

$$B_s^0 = s\bar{b}, \bar{B}_s^0 = \bar{s}b, \quad \text{similarly for } B_s^{*'}s$$

$B_s^0$

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

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

$$\text{Mass } m_{B_s^0} = 5366.92 \pm 0.10 \text{ MeV}$$

$$m_{B_s^0} - m_B = 87.42 \pm 0.14 \text{ MeV}$$

$$\text{Mean life } \tau = (1.520 \pm 0.005) \times 10^{-12} \text{ s}$$

$$c\tau = 455.7 \text{ } \mu\text{m}$$

$$\Delta\Gamma_{B_s^0} = \Gamma_{B_{sL}^0} - \Gamma_{B_{sH}^0} = (0.084 \pm 0.005) \times 10^{12} \text{ s}^{-1} \quad (S = 1.7)$$

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

$$\Delta m_{B_s^0} = m_{B_{sH}^0} - m_{B_{sL}^0} = (17.765 \pm 0.006) \times 10^{12} \hbar \text{ s}^{-1}$$

$$= (1.1693 \pm 0.0004) \times 10^{-8} \text{ MeV}$$

$$x_s = \Delta m_{B_s^0} / \Gamma_{B_s^0} = 27.01 \pm 0.10$$

$$\chi_s (B_s^0\text{-}\bar{B}_s^0 \text{ mixing parameter}) = 0.499318 \pm 0.000005$$

### CP violation parameters in $B_s^0$

$$\text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2) = (-0.15 \pm 0.70) \times 10^{-3}$$

$$C_{KK}(B_s^0 \rightarrow K^+ K^-) = 0.162 \pm 0.035$$

$$S_{KK}(B_s^0 \rightarrow K^+ K^-) = 0.14 \pm 0.05 \quad (S = 1.3)$$

$$r_B(B_s^0 \rightarrow D_s^\mp K^\pm) = 0.37_{-0.09}^{+0.10}$$

$$r_B(B_s^0 \rightarrow D_s^\mp K^\pm \pi^\pm \pi^\mp) = 0.47 \pm 0.08$$

$$\delta_B(B_s^0 \rightarrow D_s^\pm K^\mp) = (358 \pm 14)^\circ$$

$$\delta_B(B_s^0 \rightarrow D_s^\pm K^\mp \pi^\pm \pi^\mp) = (-6_{-13}^{+10})^\circ$$

$$\text{CP Violation phase } \beta_s = (2.5 \pm 1.0) \times 10^{-2} \text{ rad}$$

$$|\lambda| (B_s^0 \rightarrow J/\psi(1S)\phi) = 1.001 \pm 0.018 \quad (S = 1.2)$$

$$|\lambda| = 0.999 \pm 0.017$$

$$A, \text{ CP violation parameter} = -0.79 \pm 0.08$$

$$C, \text{ CP violation parameter} = 0.19 \pm 0.06$$

$$S, \text{ CP violation parameter} = 0.17 \pm 0.06$$

$$A_{CP}^L(B_s \rightarrow J/\psi \bar{K}^*(892)^0) = -0.05 \pm 0.06$$

$$A_{CP}^{\parallel}(B_s \rightarrow J/\psi \bar{K}^*(892)^0) = 0.17 \pm 0.15$$

$$\begin{aligned}
 A_{CP}^\perp(B_s \rightarrow J/\psi \bar{K}^*(892)^0) &= -0.05 \pm 0.10 \\
 \mathbf{A}_{CP}(B_s \rightarrow \pi^+ K^-) &= 0.224 \pm 0.012 \\
 A_{CP}(B_s^0 \rightarrow [K^+ K^-]_D \bar{K}^*(892)^0) &= -0.04 \pm 0.07 \\
 A_{CP}(B_s^0 \rightarrow [\pi^+ K^-]_D K^*(892)^0) &= -0.01 \pm 0.04 \\
 A_{CP}(B_s^0 \rightarrow [\pi^+ \pi^-]_D K^*(892)^0) &= 0.06 \pm 0.13 \\
 S(B_s^0 \rightarrow \phi \gamma) &= 0.43 \pm 0.32 \\
 C(B_s^0 \rightarrow \phi \gamma) &= 0.11 \pm 0.31 \\
 A^\Delta(B_s^0 \rightarrow \phi \gamma) &= -0.7 \pm 0.4 \\
 \Delta a_\perp &< 1.2 \times 10^{-12} \text{ GeV, CL} = 95\% \\
 \Delta a_\parallel &= (-0.9 \pm 1.5) \times 10^{-14} \text{ GeV} \\
 \Delta a_\chi &= (1.0 \pm 2.2) \times 10^{-14} \text{ GeV} \\
 \Delta a_\gamma &= (-3.8 \pm 2.2) \times 10^{-14} \text{ GeV} \\
 \text{Re}(\xi) &= -0.022 \pm 0.033 \\
 \text{Im}(\xi) &= 0.004 \pm 0.011
 \end{aligned}$$

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

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

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

$B_s^0$ DECAY MODES	Fraction ( $\Gamma_i/\Gamma$ )	Scale factor/ Confidence level	$p$ (MeV/c)
$D_s^-$ anything	(62 ± 6 ) %		—
$\ell \nu_\ell X$	( 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] ( 8.1 ± 1.3 ) %		—
$D_s^{*-} \ell^+ \nu_\ell$ anything	( 5.4 ± 1.1 ) %		—
$D_s^- \mu^+ \nu_\mu$	( 2.44 ± 0.23 ) %		2321
$D_s^{*-} \mu^+ \nu_\mu$	( 5.3 ± 0.5 ) %		2266
$D_{s1}(2536)^- \mu^+ \nu_\mu, D_{s1}^- \rightarrow D_s^{*-} K_S^0$	( 2.7 ± 0.7 ) × 10 <sup>-3</sup>		—
$D_{s1}(2536)^- X \mu^+ \nu, D_{s1}^- \rightarrow \bar{D}^0 K^+$	( 4.4 ± 1.3 ) × 10 <sup>-3</sup>		—
$D_{s2}(2573)^- X \mu^+ \nu, D_{s2}^- \rightarrow \bar{D}^0 K^+$	( 2.7 ± 1.0 ) × 10 <sup>-3</sup>		—
$K^- \mu^+ \nu_\mu$	( 1.06 ± 0.09 ) × 10 <sup>-4</sup>		2660
$D_s^- \pi^+$	( 2.98 ± 0.14 ) × 10 <sup>-3</sup>		2320

$D_s^- \rho^+$	$( 6.8 \pm 1.4 ) \times 10^{-3}$		2249
$D_s^- \pi^+ \pi^+ \pi^-$	$( 6.1 \pm 1.0 ) \times 10^{-3}$		2301
$D_{s1}(2536)^- \pi^+, D_{s1}^- \rightarrow$ $D_s^- \pi^+ \pi^-$	$( 2.4 \pm 0.8 ) \times 10^{-5}$		—
$D_s^\mp K^\pm$	$( 2.25 \pm 0.12 ) \times 10^{-4}$		2293
$D_s^- K^+ \pi^+ \pi^-$	$( 3.2 \pm 0.6 ) \times 10^{-4}$		2249
$D_s^+ D_s^-$	$( 4.4 \pm 0.5 ) \times 10^{-3}$		1824
$D_s^- D^+$	$( 2.8 \pm 0.5 ) \times 10^{-4}$		1875
$D^+ D^-$	$( 2.2 \pm 0.6 ) \times 10^{-4}$		1925
$D^0 \bar{D}^0$	$( 1.9 \pm 0.5 ) \times 10^{-4}$		1930
$D_s^{*-} \pi^+$	$( 1.9 \begin{smallmatrix} + 0.5 \\ - 0.4 \end{smallmatrix} ) \times 10^{-3}$		2265
$D_s^{*\mp} K^\pm$	$( 1.32 \begin{smallmatrix} + 0.40 \\ - 0.32 \end{smallmatrix} ) \times 10^{-4}$		—
$D_s^{*-} \rho^+$	$( 9.5 \pm 2.0 ) \times 10^{-3}$		2191
$D_s^{*+} D_s^- + D_s^{*-} D_s^+$	$( 1.39 \pm 0.17 ) \%$		1742
$D_s^{*+} D_s^{*-}$	$( 1.44 \pm 0.21 ) \%$	S=1.1	1655
$D_s^{(*)+} D_s^{(*)-}$	$( 4.5 \pm 1.4 ) \%$		—
$D_s^{*-} D^+$	$( 3.9 \pm 0.8 ) \times 10^{-4}$		1801
$\bar{D}^{*0} \bar{K}^0$	$( 2.8 \pm 1.1 ) \times 10^{-4}$		2278
$\bar{D}^0 \bar{K}^0$	$( 4.3 \pm 0.9 ) \times 10^{-4}$		2330
$\bar{D}^0 K^- \pi^+$	$( 1.04 \pm 0.13 ) \times 10^{-3}$		2312
$\bar{D}^0 \bar{K}^*(892)^0$	$( 4.4 \pm 0.6 ) \times 10^{-4}$		2264
$\bar{D}^0 \bar{K}^*(1410)$	$( 3.9 \pm 3.5 ) \times 10^{-4}$		2117
$\bar{D}^0 \bar{K}_0^*(1430)$	$( 3.0 \pm 0.7 ) \times 10^{-4}$		2113
$\bar{D}^0 \bar{K}_2^*(1430)$	$( 1.1 \pm 0.4 ) \times 10^{-4}$		2112
$\bar{D}^0 \bar{K}^*(1680)$	$< 7.8 \times 10^{-5}$	CL=90%	1997
$\bar{D}^0 \bar{K}_0^*(1950)$	$< 1.1 \times 10^{-4}$	CL=90%	1890
$\bar{D}^0 \bar{K}_3^*(1780)$	$< 2.6 \times 10^{-5}$	CL=90%	1970
$\bar{D}^0 \bar{K}_4^*(2045)$	$< 3.1 \times 10^{-5}$	CL=90%	1835
$\bar{D}^0 K^- \pi^+ (\text{non-resonant})$	$( 2.1 \pm 0.8 ) \times 10^{-4}$		2312
$D_{s2}^*(2573)^- \pi^+, D_{s2}^* \rightarrow$ $\bar{D}^0 K^-$	$( 2.6 \pm 0.4 ) \times 10^{-4}$		—
$D_{s1}^*(2700)^- \pi^+, D_{s1}^* \rightarrow$ $\bar{D}^0 K^-$	$( 1.6 \pm 0.8 ) \times 10^{-5}$		—
$D_{s1}^*(2860)^- \pi^+, D_{s1}^* \rightarrow$ $\bar{D}^0 K^-$	$( 5 \pm 4 ) \times 10^{-5}$		—
$D_{s3}^*(2860)^- \pi^+, D_{s3}^* \rightarrow$ $\bar{D}^0 K^-$	$( 2.2 \pm 0.6 ) \times 10^{-5}$		—
$\bar{D}^0 K^+ K^-$	$( 5.6 \pm 0.9 ) \times 10^{-5}$		2243
$\bar{D}^0 f_0(980)$	$< 3.1 \times 10^{-6}$	CL=90%	2242
$\bar{D}^0 \phi$	$( 3.0 \pm 0.5 ) \times 10^{-5}$		2235
$\bar{D}^{*0} \phi$	$( 3.7 \pm 0.6 ) \times 10^{-5}$		2178

$D^*\mp\pi^\pm$	$< 6.1 \times 10^{-6}$	CL=90%	—
$\eta_c\phi$	$(5.0 \pm 0.9) \times 10^{-4}$		1663
$\eta_c\pi^+\pi^-$	$(1.8 \pm 0.7) \times 10^{-4}$		1840
$J/\psi(1S)\phi$	$(1.04 \pm 0.04) \times 10^{-3}$		1588
$J/\psi(1S)\phi\phi$	$(1.20_{-0.16}^{+0.14}) \times 10^{-5}$		764
$J/\psi(1S)\pi^0$	$< 1.2 \times 10^{-3}$	CL=90%	1787
$J/\psi(1S)\eta$	$(4.0 \pm 0.7) \times 10^{-4}$	S=1.4	1733
$J/\psi(1S)K_S^0$	$(1.92 \pm 0.14) \times 10^{-5}$		1743
$J/\psi(1S)\bar{K}^*(892)^0$	$(4.1 \pm 0.4) \times 10^{-5}$		1637
$J/\psi(1S)\eta'$	$(3.3 \pm 0.4) \times 10^{-4}$		1612
$J/\psi(1S)\pi^+\pi^-$	$(2.02 \pm 0.17) \times 10^{-4}$	S=1.7	1775
$J/\psi(1S)f_0(500), f_0 \rightarrow \pi^+\pi^-$	$< 4 \times 10^{-6}$	CL=90%	—
$J/\psi(1S)\rho, \rho \rightarrow \pi^+\pi^-$	$< 3.4 \times 10^{-6}$	CL=90%	—
$J/\psi(1S)f_0(980), f_0 \rightarrow \pi^+\pi^-$	$(1.24 \pm 0.15) \times 10^{-4}$	S=2.1	—
$J/\psi(1S)f_2(1270), f_2 \rightarrow \pi^+\pi^-$	$(1.0 \pm 0.4) \times 10^{-6}$		—
$J/\psi(1S)f_2(1270)_0, f_2 \rightarrow \pi^+\pi^-$	$(7.3 \pm 1.7) \times 10^{-7}$		—
$J/\psi(1S)f_2(1270)_\parallel, f_2 \rightarrow \pi^+\pi^-$	$(1.05 \pm 0.33) \times 10^{-6}$		—
$J/\psi(1S)f_2(1270)_\perp, f_2 \rightarrow \pi^+\pi^-$	$(1.3 \pm 0.7) \times 10^{-6}$		—
$J/\psi(1S)f_0(1370), f_0 \rightarrow \pi^+\pi^-$	$(4.4_{-4.0}^{+0.6}) \times 10^{-5}$		—
$J/\psi(1S)f_0(1500), f_0 \rightarrow \pi^+\pi^-$	$(2.04_{-0.24}^{+0.32}) \times 10^{-5}$		—
$J/\psi(1S)f_2'(1525)_0, f_2' \rightarrow \pi^+\pi^-$	$(1.03 \pm 0.22) \times 10^{-6}$		—
$J/\psi(1S)f_2'(1525)_\parallel, f_2' \rightarrow \pi^+\pi^-$	$(1.2_{-0.8}^{+2.6}) \times 10^{-7}$		—
$J/\psi(1S)f_2'(1525)_\perp, f_2' \rightarrow \pi^+\pi^-$	$(5 \pm 4) \times 10^{-7}$		—
$J/\psi(1S)f_0(1790), f_0 \rightarrow \pi^+\pi^-$	$(4.9_{-1.0}^{+10.0}) \times 10^{-6}$		—
$J/\psi(1S)\pi^+\pi^-$ (nonresonant)	$(1.74_{-0.34}^{+1.10}) \times 10^{-5}$		1775
$J/\psi(1S)\bar{K}^0\pi^+\pi^-$	$< 4.4 \times 10^{-5}$	CL=90%	1675
$J/\psi(1S)K^+K^-$	$(7.9 \pm 0.7) \times 10^{-4}$		1601
$J/\psi(1S)K^0K^-\pi^+ + \text{c.c.}$	$(9.5 \pm 1.3) \times 10^{-4}$		1538
$J/\psi(1S)\bar{K}^0K^+K^-$	$< 1.2 \times 10^{-5}$	CL=90%	1333
$J/\psi K^*(892)^0\bar{K}^*(892)^0$	$(1.10 \pm 0.09) \times 10^{-4}$		1083
$J/\psi(1S)f_2'(1525)$	$(2.6 \pm 0.6) \times 10^{-4}$		1310

$J/\psi(1S)\rho\bar{\rho}$	$(3.6 \pm 0.4) \times 10^{-6}$		982
$J/\psi(1S)\gamma$	$< 7.3 \times 10^{-6}$	CL=90%	1790
$J/\psi(1S)\pi^+\pi^-\pi^+\pi^-$	$(7.5 \pm 0.8) \times 10^{-5}$		1731
$J/\psi(1S)f_1(1285)$	$(7.2 \pm 1.4) \times 10^{-5}$		1460
$\psi(2S)\eta$	$(3.3 \pm 0.9) \times 10^{-4}$		1338
$\psi(2S)\eta'$	$(1.29 \pm 0.35) \times 10^{-4}$		1158
$\psi(2S)\pi^+\pi^-$	$(6.9 \pm 1.2) \times 10^{-5}$		1397
$\psi(2S)\phi$	$(5.2 \pm 0.4) \times 10^{-4}$		1120
$\psi(2S)K^-\pi^+$	$(3.1 \pm 0.4) \times 10^{-5}$		1310
$\psi(2S)\bar{K}^*(892)^0$	$(3.3 \pm 0.5) \times 10^{-5}$		1196
$\chi_{c1}\phi$	$(1.97 \pm 0.25) \times 10^{-4}$		1274
$\chi_{c1}(3872)\phi$	$(1.1 \pm 0.4) \times 10^{-4}$		936
$\chi_{c1}(3872)(K^+K^-)_{non-\phi}$	$(8.6 \pm 3.5) \times 10^{-5}$		961
$\pi^+\pi^-$	$(7.0 \pm 1.0) \times 10^{-7}$		2680
$\pi^0\pi^0$	$< 2.1 \times 10^{-4}$	CL=90%	2680
$\eta\pi^0$	$< 1.0 \times 10^{-3}$	CL=90%	2654
$\eta\eta$	$< 1.43 \times 10^{-4}$	CL=90%	2627
$\rho^0\rho^0$	$< 3.20 \times 10^{-4}$	CL=90%	2569
$\eta'\eta$	$< 6.5 \times 10^{-5}$	CL=90%	2568
$\eta'\eta'$	$(3.3 \pm 0.7) \times 10^{-5}$		2507
$\eta'\phi$	$< 8.2 \times 10^{-7}$	CL=90%	2495
$\phi f_0(980), f_0(980) \rightarrow \pi^+\pi^-$	$(1.12 \pm 0.21) \times 10^{-6}$		—
$\phi f_2(1270), f_2(1270) \rightarrow \pi^+\pi^-$	$(6.1 \pm 1.8) \times 10^{-7}$		—
$\phi\rho^0$	$(2.7 \pm 0.8) \times 10^{-7}$		2526
$\phi\pi^+\pi^-$	$(3.5 \pm 0.5) \times 10^{-6}$		2579
$\phi\phi$	$(1.85 \pm 0.14) \times 10^{-5}$		2482
$\phi\phi\phi$	$(2.2 \pm 0.6) \times 10^{-6}$		2165
$\pi^+K^-$	$(5.8 \pm 0.7) \times 10^{-6}$		2659
$K^+K^-$	$(2.66 \pm 0.22) \times 10^{-5}$		2638
$K^0\bar{K}^0$	$(1.76 \pm 0.31) \times 10^{-5}$		2637
$K^0\pi^+\pi^-$	$(9.5 \pm 2.1) \times 10^{-6}$		2653
$K^0K^\pm\pi^\mp$	$(8.4 \pm 0.9) \times 10^{-5}$		2622
$K^*(892)^-\pi^+$	$(2.9 \pm 1.1) \times 10^{-6}$		2607
$K^*(892)^\pm K^\mp$	$(1.9 \pm 0.5) \times 10^{-5}$		2585
$K_0^*(1430)^\pm K^\mp$	$(3.1 \pm 2.5) \times 10^{-5}$		—
$K_2^*(1430)^\pm K^\mp$	$(1.0 \pm 1.7) \times 10^{-5}$		—
$K^*(892)^0\bar{K}^0 + c.c.$	$(2.0 \pm 0.6) \times 10^{-5}$		2585
$K_0^*(1430)\bar{K}^0 + c.c.$	$(3.3 \pm 1.0) \times 10^{-5}$		2468
$K_2^*(1430)^0\bar{K}^0 + c.c.$	$(1.7 \pm 2.2) \times 10^{-5}$		2467
$K_S^0\bar{K}^*(892)^0 + c.c.$	$(1.6 \pm 0.4) \times 10^{-5}$		2585
$K^0K^+K^-$	$(1.3 \pm 0.6) \times 10^{-6}$		2568
$\bar{K}^*(892)^0\rho^0$	$< 7.67 \times 10^{-4}$	CL=90%	2550
$\bar{K}^*(892)^0K^*(892)^0$	$(1.11 \pm 0.27) \times 10^{-5}$		2531

$\phi K^*(892)^0$		$(1.14 \pm 0.30) \times 10^{-6}$		2507
$p\bar{p}$		$< 1.5 \times 10^{-8}$	CL=90%	2514
$p\bar{p}K^+K^-$		$(4.5 \pm 0.5) \times 10^{-6}$		2231
$p\bar{p}K^+\pi^-$		$(1.39 \pm 0.26) \times 10^{-6}$		2355
$p\bar{p}\pi^+\pi^-$		$(4.3 \pm 2.0) \times 10^{-7}$		2454
$p\bar{\Lambda}K^- + \text{c.c.}$		$(5.5 \pm 1.0) \times 10^{-6}$		2358
$\Lambda_c^- \Lambda\pi^+$		$(3.6 \pm 1.6) \times 10^{-4}$		1979
$\Lambda_c^- \Lambda_c^+$		$< 8.0 \times 10^{-5}$	CL=95%	1405

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

$\gamma\gamma$	<i>B1</i>	$< 3.1 \times 10^{-6}$	CL=90%	2683
$\phi\gamma$	<i>B1</i>	$(3.4 \pm 0.4) \times 10^{-5}$		2587
$\mu^+\mu^-$	<i>B1</i>	$(3.01 \pm 0.35) \times 10^{-9}$		2681
$e^+e^-$	<i>B1</i>	$< 9.4 \times 10^{-9}$	CL=90%	2683
$\tau^+\tau^-$	<i>B1</i>	$< 6.8 \times 10^{-3}$	CL=95%	2011
$\mu^+\mu^-\mu^+\mu^-$	<i>B1</i>	$< 2.5 \times 10^{-9}$	CL=95%	2673
$SP, S \rightarrow \mu^+\mu^-,$ $P \rightarrow \mu^+\mu^-$	<i>B1</i>	[b] $< 2.2 \times 10^{-9}$	CL=95%	—
$\phi(1020)\mu^+\mu^-$	<i>B1</i>	$(8.4 \pm 0.4) \times 10^{-7}$		2582
$f_2'(1525)\mu^+\mu^-$		$(1.62 \pm 0.22) \times 10^{-7}$		2464
$\bar{K}^*(892)^0\mu^+\mu^-$	<i>B1</i>	$(2.9 \pm 1.1) \times 10^{-8}$		2605
$\pi^+\pi^-\mu^+\mu^-$	<i>B1</i>	$(8.4 \pm 1.7) \times 10^{-8}$		2670
$\phi\nu\bar{\nu}$	<i>B1</i>	$< 5.4 \times 10^{-3}$	CL=90%	2587
$e^\pm\mu^\mp$	<i>LF</i>	[c] $< 5.4 \times 10^{-9}$	CL=90%	2682
$\mu^\pm\tau^\mp$	<i>LF</i>	$< 4.2 \times 10^{-5}$	CL=95%	2388



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

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

$$\text{Mass } m = 5415.4^{+1.8}_{-1.5} \text{ MeV} \quad (S = 2.9)$$

$$m_{B_s^*} - m_{B_s} = 48.5^{+1.8}_{-1.5} \text{ MeV} \quad (S = 2.9)$$

<b><math>B_s^*</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$B_s\gamma$	seen	48

**$B_{s1}(5830)^0$**  $I(J^P) = 0(1^+)$   
 $I, J, P$  need confirmation.Mass  $m = 5828.70 \pm 0.20$  MeV $m_{B_{s1}^0} - m_{B^{*+}} = 503.99 \pm 0.17$  MeVFull width  $\Gamma = 0.5 \pm 0.4$  MeV

<b><math>B_{s1}(5830)^0</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$B^{*+} K^-$	seen	97

 **$B_{s2}^*(5840)^0$**  $I(J^P) = 0(2^+)$   
 $I, J, P$  need confirmation.Mass  $m = 5839.86 \pm 0.12$  MeV $m_{B_{s2}^{*0}} - m_{B^+} = 560.52 \pm 0.14$  MeVFull width  $\Gamma = 1.49 \pm 0.27$  MeVBranching fractions are given relative to the one **DEFINED AS 1**.

<b><math>B_{s2}^*(5840)^0</math> DECAY MODES</b>	Fraction ( $\Gamma_i/\Gamma$ )	$p$ (MeV/c)
$B^+ K^-$	<b>DEFINED AS 1</b>	252
$B^{*+} K^-$	$0.093 \pm 0.018$	141
$B^0 K_S^0$	$0.43 \pm 0.11$	245
$B^{*0} K_S^0$	$0.04 \pm 0.04$	—

## NOTES

- [a] Not a pure measurement. See note at head of  $B_s^0$  Decay Modes.
- [b] Here  $S$  and  $P$  are the hypothetical scalar and pseudoscalar particles with masses of  $2.5 \text{ GeV}/c^2$  and  $214.3 \text{ MeV}/c^2$ , respectively.
- [c] The value is for the sum of the charge states or particle/antiparticle states indicated.