

BOTTOM, STRANGE MESONS

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

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

B_s^0

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

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

$$\text{Mass } m_{B_s^0} = 5366.3 \pm 0.6 \text{ MeV}$$

$$\text{Mean life } \tau = (1.470_{-0.027}^{+0.026}) \times 10^{-12} \text{ s}$$

$$c\tau = 441 \text{ } \mu\text{m}$$

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

$$\begin{aligned} \Delta m_{B_s^0} &= m_{B_{sH}^0} - m_{B_{sL}^0} = (17.77 \pm 0.12) \times 10^{12} \text{ } \hbar \text{ s}^{-1} \\ &= (117.0 \pm 0.8) \times 10^{-10} \text{ MeV} \end{aligned}$$

$$x_s = \Delta m_{B_s^0} / \Gamma_{B_s^0} = 26.1 \pm 0.5$$

$$\chi_s = 0.49927 \pm 0.00003$$

CP violation parameters in B_s^0

$$\text{Re}(\epsilon_{B_s^0}) / (1 + |\epsilon_{B_s^0}|^2) = (-0.75 \pm 2.52) \times 10^{-3}$$

$$\text{CP Violation phase } \beta_s \text{ in the } B_s^0 \text{ System} = 0.35_{-0.24}^{+0.20}$$

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

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

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

B_s^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
D_s^- anything	(93 ± 25) %		–
$D_s^- \ell^+ \nu_\ell$ anything	[a] (7.9 ± 2.4) %		–
$D_s^- \pi^+$	(3.2 ± 0.9) × 10 ⁻³	S=1.3	2320
$D_s^- \pi^+ \pi^+ \pi^-$	(8.4 ± 3.3) × 10 ⁻³		2301
$D_s^-(*) + D_s^-(*)^-$	(4.9 ^{+2.9} / _{-2.5}) %	S=1.2	–
$D_s^+ D_s^-$	(1.1 ± 0.4) %		1823
$D_s^{*+} D_s^-$	< 12.1 %	CL=90%	1742
$D_s^{*+} D_s^{*-}$	< 25.7 %	CL=90%	1655
$J/\psi(1S) \phi$	(9.3 ± 3.3) × 10 ⁻⁴		1587
$J/\psi(1S) \pi^0$	< 1.2 × 10 ⁻³	CL=90%	1786
$J/\psi(1S) \eta$	< 3.8 × 10 ⁻³	CL=90%	1733
$\psi(2S) \phi$	(4.8 ± 2.2) × 10 ⁻⁴		1119
$\pi^+ \pi^-$	< 1.7 × 10 ⁻⁶	CL=90%	2680
$\pi^0 \pi^0$	< 2.1 × 10 ⁻⁴	CL=90%	2680
$\eta \pi^0$	< 1.0 × 10 ⁻³	CL=90%	2653
$\eta \eta$	< 1.5 × 10 ⁻³	CL=90%	2627
$\rho^0 \rho^0$	< 3.20 × 10 ⁻⁴	CL=90%	2569
$\phi \rho^0$	< 6.17 × 10 ⁻⁴	CL=90%	2526
$\phi \phi$	(1.4 ± 0.8) × 10 ⁻⁵		2482
$\pi^+ K^-$	< 5.6 × 10 ⁻⁶	CL=90%	2659
$K^+ K^-$	(3.3 ± 0.9) × 10 ⁻⁵		2637
$\bar{K}^*(892)^0 \rho^0$	< 7.67 × 10 ⁻⁴	CL=90%	2550
$\bar{K}^*(892)^0 K^*(892)^0$	< 1.681 × 10 ⁻³	CL=90%	2531
$\phi K^*(892)^0$	< 1.013 × 10 ⁻³	CL=90%	2507
$p \bar{p}$	< 5.9 × 10 ⁻⁵	CL=90%	2514
$\gamma \gamma$	< 5.3 × 10 ⁻⁵	CL=90%	2683
$\phi \gamma$	< 1.2 × 10 ⁻⁴	CL=90%	2586

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

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

B_s^*

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

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

$$\text{Mass } m = 5412.8 \pm 1.3 \text{ MeV} \quad (S = 1.2)$$

$$m_{B_s^*} - m_{B_s} = 46.5 \pm 1.2 \text{ MeV} \quad (S = 1.1)$$

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

$B_{s1}(5830)^0$

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

I, J, P need confirmation.

$$\text{Mass } m = 5829.4 \pm 0.7 \text{ MeV}$$

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

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

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

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

I, J, P need confirmation.

$$\text{Mass } m = 5839.7 \pm 0.6 \text{ MeV}$$

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

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

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.