

BOTTOM BARYONS

($B = -1$)

$$\Lambda_b^0 = udb, \Xi_b^0 = usb, \Xi_b^- = dsb, \Omega_b^- = ssb$$

 Λ_b^0

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

$I(J^P)$ not yet measured; $0(\frac{1}{2}^+)$ is the quark model prediction.

$$\text{Mass } m = 5619.60 \pm 0.17 \text{ MeV}$$

$$m_{\Lambda_b^0} - m_{B^0} = 339.2 \pm 1.4 \text{ MeV}$$

$$m_{\Lambda_b^0} - m_{B^+} = 339.72 \pm 0.28 \text{ MeV}$$

$$\text{Mean life } \tau = (1.471 \pm 0.009) \times 10^{-12} \text{ s}$$

$$c\tau = 441.0 \text{ } \mu\text{m}$$

$$A_{CP}(\Lambda_b \rightarrow p\pi^-) = -0.025 \pm 0.029 \quad (S = 1.2)$$

$$A_{CP}(\Lambda_b \rightarrow pK^-) = -0.025 \pm 0.022$$

$$\Delta A_{CP}(pK^-/\pi^-) \equiv A_{CP}(pK^-) - A_{CP}(p\pi^-) = 0.014 \pm 0.024$$

$$A_{CP}(\Lambda_b \rightarrow p\bar{K}^0\pi^-) = 0.22 \pm 0.13$$

$$\Delta A_{CP}(J/\psi p\pi^-/K^-) \equiv A_{CP}(J/\psi p\pi^-) - A_{CP}(J/\psi pK^-) = (5.7 \pm 2.7) \times 10^{-2}$$

$$A_{CP}(\Lambda_b \rightarrow \Lambda K^+\pi^-) = -0.53 \pm 0.25$$

$$A_{CP}(\Lambda_b \rightarrow \Lambda K^+K^-) = -0.28 \pm 0.12$$

$$\Delta A_{CP}(\Lambda_b^0 \rightarrow pK^-\mu^+\mu^-) \equiv A_{CP}(pK^-\mu^+\mu^-) - A_{CP}(pK^-J/\psi) = (-4 \pm 5) \times 10^{-2}$$

$$A_{FB}^\ell(\mu\mu) \text{ in } \Lambda_b \rightarrow \Lambda\mu^+\mu^- = -0.39 \pm 0.04$$

$$\Delta(A_{FB}^\ell(\mu\mu)) \text{ in } \Lambda_b \rightarrow \Lambda\mu^+\mu^- = -0.05 \pm 0.09$$

$$A_{FB}^h(p\pi) \text{ in } \Lambda_b \rightarrow \Lambda(p\pi)\mu^+\mu^- = -0.30 \pm 0.05$$

$$A_{FB}^{\ell h} \text{ in } \Lambda_b \rightarrow \Lambda\mu^+\mu^- = 0.25 \pm 0.04$$

The branching fractions $B(b\text{-baryon} \rightarrow \Lambda\ell^-\bar{\nu}_\ell \text{ anything})$ and $B(\Lambda_b^0 \rightarrow \Lambda_c^+\ell^-\bar{\nu}_\ell \text{ anything})$ are not pure measurements because the underlying measured products of these with $B(b \rightarrow b\text{-baryon})$ were used to determine $B(b \rightarrow b\text{-baryon})$, as described in the note "Production and Decay of b -Flavored Hadrons."

For inclusive branching fractions, e.g., $\Lambda_b \rightarrow \bar{\Lambda}_c \text{ anything}$, the values usually are multiplicities, not branching fractions. They can be greater than one.

Λ_b^0 DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$J/\psi(1S)\Lambda \times B(b \rightarrow \Lambda_b^0)$	$(5.8 \pm 0.8) \times 10^{-5}$		1740
$pD^0\pi^-$	$(6.3 \pm 0.7) \times 10^{-4}$		2370
pD^0K^-	$(4.6 \pm 0.8) \times 10^{-5}$		2269
$pJ/\psi\pi^-$	$(2.6^{+0.5}_{-0.4}) \times 10^{-5}$		1755
$p\pi^- J/\psi, J/\psi \rightarrow \mu^+\mu^-$	$(1.6 \pm 0.8) \times 10^{-6}$		–
$pJ/\psi K^-$	$(3.2^{+0.6}_{-0.5}) \times 10^{-4}$		1589
$P_c(4380)^+ K^-, P_c \rightarrow pJ/\psi$	[a] $(2.7 \pm 1.4) \times 10^{-5}$		–
$P_c(4450)^+ K^-, P_c \rightarrow pJ/\psi$	[a] $(1.3 \pm 0.4) \times 10^{-5}$		–
$\chi_{c1}(1P)pK^-$	$(7.6^{+1.5}_{-1.3}) \times 10^{-5}$		1242
$\chi_{c2}(1P)pK^-$	$(7.9^{+1.6}_{-1.4}) \times 10^{-5}$		1198
$pJ/\psi(1S)\pi^+\pi^-K^-$	$(6.6^{+1.3}_{-1.1}) \times 10^{-5}$		1410
$p\psi(2S)K^-$	$(6.6^{+1.2}_{-1.0}) \times 10^{-5}$		1063
$\psi(2S)p\pi^-$	$(7.5^{+1.6}_{-1.4}) \times 10^{-6}$		1320
$p\bar{K}^0\pi^-$	$(1.3 \pm 0.4) \times 10^{-5}$		2693
pK^0K^-	$< 3.5 \times 10^{-6}$	CL=90%	2639
$\Lambda_c^+\pi^-$	$(4.9 \pm 0.4) \times 10^{-3}$	S=1.2	2342
$\Lambda_c^+K^-$	$(3.59 \pm 0.30) \times 10^{-4}$	S=1.2	2314
$\Lambda_c^+ a_1(1260)^-$	seen		2153
$\Lambda_c^+ D^-$	$(4.6 \pm 0.6) \times 10^{-4}$		1886
$\Lambda_c^+ D_s^-$	$(1.10 \pm 0.10) \%$		1833
$\Lambda_c^+ \pi^+ \pi^- \pi^-$	$(7.7 \pm 1.1) \times 10^{-3}$	S=1.1	2323
$\Lambda_c(2595)^+ \pi^-$	$(3.4 \pm 1.5) \times 10^{-4}$		2210
$\Lambda_c(2595)^+ \rightarrow \Lambda_c^+ \pi^+ \pi^-$			
$\Lambda_c(2625)^+ \pi^-$	$(3.3 \pm 1.3) \times 10^{-4}$		2193
$\Lambda_c(2625)^+ \rightarrow \Lambda_c^+ \pi^+ \pi^-$			
$\Sigma_c(2455)^0 \pi^+ \pi^-, \Sigma_c^0 \rightarrow \Lambda_c^+ \pi^-$	$(5.7 \pm 2.2) \times 10^{-4}$		2265
$\Sigma_c(2455)^{++} \pi^- \pi^-, \Sigma_c^{++} \rightarrow \Lambda_c^+ \pi^+$	$(3.2 \pm 1.6) \times 10^{-4}$		2265
$\Lambda_c^+ p \bar{p} \pi^-$	$(2.65 \pm 0.29) \times 10^{-4}$		1805
$\Sigma_c(2455)^0 p \bar{p}, \Sigma_c(2455)^0 \rightarrow \Lambda_c^+ \pi^-$	$(2.4 \pm 0.5) \times 10^{-5}$		–

$\Sigma_c(2520)^0 p \bar{p}, \Sigma_c(2520)^0 \Lambda_c^+ \pi^-$	$(3.2 \pm 0.7) \times 10^{-5}$		–
$\Lambda_c^+ \ell^- \bar{\nu}_\ell$ anything	[b] $(10.4 \pm 2.2) \%$		–
$\Lambda_c^+ \ell^- \bar{\nu}_\ell$	$(6.2^{+1.4}_{-1.3}) \%$		2345
$\Lambda_c^+ \pi^+ \pi^- \ell^- \bar{\nu}_\ell$	$(5.6 \pm 3.1) \%$		2335
$\Lambda_c(2595)^+ \ell^- \bar{\nu}_\ell$	$(7.9^{+4.0}_{-3.5}) \times 10^{-3}$		2212
$\Lambda_c(2625)^+ \ell^- \bar{\nu}_\ell$	$(1.3^{+0.6}_{-0.5}) \%$		2195
$p h^-$	[c] $< 2.3 \times 10^{-5}$	CL=90%	2730
$p \pi^-$	$(4.3 \pm 0.8) \times 10^{-6}$		2730
$p K^-$	$(5.1 \pm 0.9) \times 10^{-6}$		2709
$p D_s^-$	$< 4.8 \times 10^{-4}$	CL=90%	2364
$p \mu^- \bar{\nu}_\mu$	$(4.1 \pm 1.0) \times 10^{-4}$		2730
$\Lambda \mu^+ \mu^-$	$(1.08 \pm 0.28) \times 10^{-6}$		2695
$p \pi^- \mu^+ \mu^-$	$(6.9 \pm 2.5) \times 10^{-8}$		2720
$\Lambda \gamma$	$< 1.3 \times 10^{-3}$	CL=90%	2699
$\Lambda \eta$	$(9^{+7}_{-5}) \times 10^{-6}$		2670
$\Lambda \eta'(958)$	$< 3.1 \times 10^{-6}$	CL=90%	2611
$\Lambda \pi^+ \pi^-$	$(4.7 \pm 1.9) \times 10^{-6}$		2692
$\Lambda K^+ \pi^-$	$(5.7 \pm 1.3) \times 10^{-6}$		2660
$\Lambda K^+ K^-$	$(1.62 \pm 0.23) \times 10^{-5}$		2605
$\Lambda \phi$	$(9.3 \pm 2.5) \times 10^{-6}$		2599
$p \pi^- \pi^+ \pi^-$	$(2.11 \pm 0.23) \times 10^{-5}$		2715
$p K^- K^+ \pi^-$	$(4.1 \pm 0.6) \times 10^{-6}$		2612
$p K^- \pi^+ \pi^-$	$(5.1 \pm 0.5) \times 10^{-5}$		2675
$p K^- K^+ K^-$	$(1.27 \pm 0.14) \times 10^{-5}$		2524

$\Lambda_b(5912)^0$

$$J^P = \frac{1}{2}^-$$

Mass $m = 5912.20 \pm 0.21$ MeV

Full width $\Gamma < 0.66$ MeV, CL = 90%

$\Lambda_b(5912)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_b^0 \pi^+ \pi^-$	seen	86

$\Lambda_b(5920)^0$

$$J^P = \frac{3}{2}^-$$

Mass $m = 5919.92 \pm 0.19$ MeV (S = 1.1)

Full width $\Gamma < 0.63$ MeV, CL = 90%

$\Lambda_b(5920)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_b^0 \pi^+ \pi^-$	seen	108

Σ_b

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

I, J, P need confirmation.

Mass $m(\Sigma_b^+) = 5810.56 \pm 0.25$ MeV

Mass $m(\Sigma_b^-) = 5815.64 \pm 0.27$ MeV

$m_{\Sigma_b^+} - m_{\Sigma_b^-} = -5.06 \pm 0.18$ MeV

$\Gamma(\Sigma_b^+) = 5.0 \pm 0.5$ MeV

$\Gamma(\Sigma_b^-) = 5.3 \pm 0.5$ MeV

Σ_b DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_b^0 \pi$	dominant	133

Σ_b^*

$$I(J^P) = 1(\frac{3}{2}^+)$$

I, J, P need confirmation.

Mass $m(\Sigma_b^{*+}) = 5830.32 \pm 0.27$ MeV

Mass $m(\Sigma_b^{*-}) = 5834.74 \pm 0.30$ MeV

$m_{\Sigma_b^{*+}} - m_{\Sigma_b^{*-}} = -4.37 \pm 0.33$ MeV ($S = 1.6$)

$m_{\Sigma_b^{*+}} - m_{\Sigma_b^+} = 19.73 \pm 0.18$

$m_{\Sigma_b^{*-}} - m_{\Sigma_b^-} = 19.09 \pm 0.22$

$\Gamma(\Sigma_b^{*+}) = 9.4 \pm 0.5$ MeV

$\Gamma(\Sigma_b^{*-}) = 10.4 \pm 0.8$ MeV ($S = 1.3$)

$m_{\Sigma_b^*} - m_{\Sigma_b} = 21.2 \pm 2.0$ MeV

Σ_b^* DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_b^0 \pi$	dominant	159

$\Sigma_b(6097)^+$

$$J^P = ??$$

Mass $m = 6095.8 \pm 1.7$ MeV

Full width $\Gamma = 31 \pm 6$ MeV

$\Sigma_b(6097)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_b \pi^+ \times B(b \rightarrow \Sigma_b(6097)^+)$	seen	—

$\Sigma_b(6097)^-$

$$J^P = ??$$

Mass $m = 6098.0 \pm 1.8$ MeV

Full width $\Gamma = 29 \pm 4$ MeV

$\Sigma_b(6097)^-$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Lambda_b \pi^- \times B(b \rightarrow \Sigma_b(6097)^-)$	seen	—

 Ξ_b^0, Ξ_b^-

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

 I, J, P need confirmation.

$$m(\Xi_b^-) = 5797.0 \pm 0.9$$
 MeV ($S = 1.8$)

$$m(\Xi_b^0) = 5791.9 \pm 0.5$$
 MeV

$$m_{\Xi_b^-} - m_{\Lambda_b^0} = 177.5 \pm 0.5$$
 MeV ($S = 1.6$)

$$m_{\Xi_b^0} - m_{\Lambda_b^0} = 172.5 \pm 0.4$$
 MeV

$$m_{\Xi_b^-} - m_{\Xi_b^0} = 5.9 \pm 0.6$$
 MeV

Mean life $\tau_{\Xi_b^-} = (1.572 \pm 0.040) \times 10^{-12}$ s

Mean life $\tau_{\Xi_b^0} = (1.480 \pm 0.030) \times 10^{-12}$ s

Ξ_b DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\Xi^- \ell^- \bar{\nu}_\ell X \times B(\bar{b} \rightarrow \Xi_b)$	$(3.9 \pm 1.2) \times 10^{-4}$	S=1.4	—
$J/\psi \Xi^- \times B(b \rightarrow \Xi_b^-)$	$(1.02^{+0.26}_{-0.21}) \times 10^{-5}$		1782
$J/\psi \Lambda K^- \times B(b \rightarrow \Xi_b^-)$	$(2.5 \pm 0.4) \times 10^{-6}$		1631
$p D^0 K^- \times B(\bar{b} \rightarrow \Xi_b)$	$(1.8 \pm 0.6) \times 10^{-6}$		2374
$p \bar{K}^0 \pi^- \times B(\bar{b} \rightarrow \Xi_b)/B(\bar{b} \rightarrow B^0)$	$< 1.6 \times 10^{-6}$	CL=90%	2783
$p K^0 K^- \times B(\bar{b} \rightarrow \Xi_b)/B(\bar{b} \rightarrow B^0)$	$< 1.1 \times 10^{-6}$	CL=90%	2730
$p K^- K^- \times B(\bar{b} \rightarrow \Xi_b)$	$(3.6 \pm 0.8) \times 10^{-8}$		2731
$\Lambda \pi^+ \pi^- \times B(b \rightarrow \Xi_b^0)/B(b \rightarrow \Lambda_b^0)$	$< 1.7 \times 10^{-6}$	CL=90%	2781
$\Lambda K^- \pi^+ \times B(b \rightarrow \Xi_b^0)/B(b \rightarrow \Lambda_b^0)$	$< 8 \times 10^{-7}$	CL=90%	2751
$\Lambda K^+ K^- \times B(b \rightarrow \Xi_b^0)/B(b \rightarrow \Lambda_b^0)$	$< 3 \times 10^{-7}$	CL=90%	2698
$\Lambda_c^+ K^- \times B(\bar{b} \rightarrow \Xi_b)$	$(6 \pm 4) \times 10^{-7}$		2416
$\Lambda_b^0 \pi^- \times B(b \rightarrow \Xi_b^-)/B(b \rightarrow \Lambda_b^0)$	$(5.7 \pm 2.0) \times 10^{-4}$		99

$pK^- \pi^+ \pi^- \times B(b \rightarrow \Xi_b^0)/B(b \rightarrow \Lambda_b^0)$	$(1.9 \pm 0.4) \times 10^{-6}$	2766
$pK^- K^- \pi^+ \times B(b \rightarrow \Xi_b^0)/B(b \rightarrow \Lambda_b^0)$	$(1.73 \pm 0.32) \times 10^{-6}$	2704
$pK^- K^+ K^- \times B(b \rightarrow \Xi_b^0)/B(b \rightarrow \Lambda_b^0)$	$(1.8 \pm 1.0) \times 10^{-7}$	2620

 $\Xi_b'(5935)^-$

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

Mass $m = 5935.02 \pm 0.05$ MeV

$$m_{\Xi_b'(5935)^-} - m_{\Xi_b^0} - m_{\pi^-} = 3.653 \pm 0.019 \text{ MeV}$$

Full width $\Gamma < 0.08$ MeV, CL = 95%

$\Xi_b'(5935)^-$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Xi_b^0 \pi^- \times B(\bar{b} \rightarrow \Xi_b'(5935)^-)/B(\bar{b} \rightarrow \Xi_b^0)$	$(11.8 \pm 1.8) \%$	31

 $\Xi_b(5945)^0$

$$J^P = \frac{3}{2}^+$$

Mass $m = 5952.3 \pm 0.9$ MeVFull width $\Gamma = 0.90 \pm 0.18$ MeV

$\Xi_b(5945)^0$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Xi_b^- \pi^+$	seen	78

 $\Xi_b(5955)^-$

$$J^P = \frac{3}{2}^+$$

Mass $m = 5955.33 \pm 0.13$ MeV

$$m_{\Xi_b(5955)^-} - m_{\Xi_b^0} - m_{\pi^-} = 23.96 \pm 0.13 \text{ MeV}$$

Full width $\Gamma = 1.65 \pm 0.33$ MeV

$\Xi_b(5955)^-$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Xi_b^0 \pi^- \times B(\bar{b} \rightarrow \Xi_b^*(5955)^-)/B(\bar{b} \rightarrow \Xi_b^0)$	$(20.7 \pm 3.5) \%$	84

 $\Xi_b(6227)$

$$J^P = ??$$

Mass $m = 6226.9 \pm 2.0$ MeVFull width $\Gamma = 18 \pm 6$ MeV

$\Xi_b(6227)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	P (MeV/c)
$\Lambda_b^0 K^- \times B(b \rightarrow \Xi_b(6227))/B(b \rightarrow \Lambda_b^0)$	$(3.20 \pm 0.35) \times 10^{-3}$		336
$\Xi_b^0 \pi^- \times B(b \rightarrow \Xi_b(6227))/B(b \rightarrow \Xi_b^0)$	$(2.8 \pm 1.1) \%$	1.8	398

Ω_b^-

$I(J^P) = 0(\frac{1}{2}^+)$
 I, J, P need confirmation.

Mass $m = 6046.1 \pm 1.7$ MeV

$m_{\Omega_b^-} - m_{\Lambda_b^0} = 426.4 \pm 2.2$ MeV

$m_{\Omega_b^-} - m_{\Xi_b^-} = 247.3 \pm 3.2$ MeV

Mean life $\tau = (1.64^{+0.18}_{-0.17}) \times 10^{-12}$ s

$\tau(\Omega_b^-)/\tau(\Xi_b^-)$ mean life ratio = 1.11 ± 0.16

Ω_b^- DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$J/\psi \Omega^- \times B(b \rightarrow \Omega_b)$	$(2.9^{+1.1}_{-0.8}) \times 10^{-6}$		1806
$p K^- K^- \times B(\bar{b} \rightarrow \Omega_b)$	$< 2.5 \times 10^{-9}$	90%	2866
$p \pi^- \pi^- \times B(\bar{b} \rightarrow \Omega_b)$	$< 1.5 \times 10^{-8}$	90%	2943
$p K^- \pi^- \times B(\bar{b} \rightarrow \Omega_b)$	$< 7 \times 10^{-9}$	90%	2915

b -baryon ADMIXTURE ($\Lambda_b, \Xi_b, \Sigma_b, \Omega_b$)

These branching fractions are actually an average over weakly decaying b -baryons weighted by their production rates at the LHC, LEP, and Tevatron, branching ratios, and detection efficiencies. They scale with the b -baryon production fraction $B(b \rightarrow b\text{-baryon})$.

The branching fractions $B(b\text{-baryon} \rightarrow \Lambda \ell^- \bar{\nu}_\ell \text{ anything})$ and $B(\Lambda_b^0 \rightarrow \Lambda_c^+ \ell^- \bar{\nu}_\ell \text{ anything})$ are not pure measurements because the underlying measured products of these with $B(b \rightarrow b\text{-baryon})$ were used to determine $B(b \rightarrow b\text{-baryon})$, as described in the note "Production and Decay of b -Flavored Hadrons."

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*-baryon ADMIXTURE DECAY MODES**

$(\Lambda_b, \Xi_b, \Sigma_b, \Omega_b)$	Fraction (Γ_i/Γ)	p (MeV/c)
$p\mu^-\bar{\nu}$ anything	$(5.6^{+2.2}_{-1.9})\%$	—
$p\ell\bar{\nu}_\ell$ anything	$(5.4 \pm 1.2)\%$	—
p anything	$(67 \pm 21)\%$	—
$\Lambda\ell^-\bar{\nu}_\ell$ anything	$(3.6 \pm 0.6)\%$	—
$\Lambda\ell^+\nu_\ell$ anything	$(3.0 \pm 0.8)\%$	—
Λ anything	$(38 \pm 7)\%$	—
$\Xi^-\ell^-\bar{\nu}_\ell$ anything	$(6.3 \pm 1.6) \times 10^{-3}$	—

NOTES

[a] P_c^+ is a pentaquark-charmonium state.

[b] Not a pure measurement. See note at head of Λ_b^0 Decay Modes.

[c] Here h^- means π^- or K^- .