$b\bar{b}$ MESONS (including possibly non-$q\bar{q}$ states)

$\eta_b(1S)$

$I^G(J^{PC}) = 0^+(0^{-+})$

Mass $m = 9398.7 \pm 2.0$ MeV (S = 1.5)
Full width $\Gamma = 10^{+5}_{-4}$ MeV

$\eta_b(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
hadrons	seen		–
$3h^+3h^-$	not seen		4672
$2h^+2h^-$	not seen		4689
$4h^+4h^-$	not seen		4648
$\gamma\gamma$	not seen		4699
$\mu^+\mu^-$	$<9\times10^{-3}$	90%	4698
$\tau^+\tau^-$	<8 %	90%	4350

$\Upsilon(1S)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 9460.40 \pm 0.10$ MeV
Full width $\Gamma = 54.02 \pm 1.25$ keV

$\Upsilon(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\tau^+\tau^-$	(2.60 ±0.10) %		4384
e^+e^-	(2.39 ±0.08) %		4730
$\mu^+\mu^-$	(2.48 ±0.04) %		4729
Hadronic decays			
ggg	(81.7 ±0.7) %		–
γgg	(2.2 ±0.6) %		–
$\eta'(958)$ anything	(2.94 ±0.24) %		–
$J/\psi(1S)$ anything	(5.4 ±0.4) $\times10^{-4}$	S=1.4	4223
$J/\psi(1S)\eta_c$	< 2.2	$\times10^{-6}$ CL=90%	3623
$J/\psi(1S)\chi_{c0}$	< 3.4	$\times10^{-6}$ CL=90%	3429
$J/\psi(1S)\chi_{c1}$	(3.9 ±1.2) $\times10^{-6}$		3382
$J/\psi(1S)\chi_{c2}$	< 1.4	$\times10^{-6}$ CL=90%	3359
$J/\psi(1S)\eta_c(2S)$	< 2.2	$\times10^{-6}$ CL=90%	3317
$J/\psi(1S)X(3940)$	< 5.4	$\times10^{-6}$ CL=90%	3148
$J/\psi(1S)X(4160)$	< 5.4	$\times10^{-6}$ CL=90%	3020
$X(4350)$ anything, $X \to J/\psi(1S)\phi$	< 8.1	$\times10^{-6}$ CL=90%	–

$T_{c\overline{c}1}(3900)^{\pm}$ anything, $T_{c\overline{c}1} \to J/\psi(1S)\pi^{\pm}$	$<$	1.3		$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}1}(4200)^{\pm}$ anything, $Z_c \to J/\psi(1S)\pi^{\pm}$	$<$	6.0		$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}1}(4430)^{\pm}$ anything, $T_{c\overline{c}1} \to J/\psi(1S)\pi^{\pm}$	$<$	4.9		$\times 10^{-5}$	CL=90%	–
$P_{c\overline{c}s}(4459)/\overline{P}_{c\overline{c}s}(4459)$ anything	(	3.5	± 2.0)	$\times 10^{-6}$		–
$P_{c\overline{c}s}(4338)/\overline{P}_{c\overline{c}s}(4338)$ anything	$<$	1.8		$\times 10^{-6}$	CL=90%	–
$P_c(4312)$ anything, $P_c(4312) \to pJ/\psi(1S)$	$<$	5.7		$\times 10^{-6}$	CL=90%	–
$P_c(4440)$ anything, $P_c(4440) \to pJ/\psi(1S)$	$<$	1.00		$\times 10^{-5}$	CL=90%	–
$P_c(4457)$ anything, $P_c(4457) \to pJ/\psi(1S)$	$<$	7.6		$\times 10^{-6}$	CL=90%	–
$p/\overline{p}J/\psi(1S)$ anything	(	8.1	± 0.8)	$\times 10^{-5}$		–
$J/\psi(1S)\Lambda/\overline{\Lambda}$ anything	(	3.7	± 0.6)	$\times 10^{-5}$		–
$X_{cs}^{\pm}$ anything, $X \to J/\psi K^{\pm}$	$<$	5.7		$\times 10^{-6}$	CL=90%	–
$\psi(4230)$ anything, $\psi \to J/\psi(1S)\pi^+\pi^-$	$<$	3.8		$\times 10^{-5}$	CL=90%	–
$\psi(4230)$ anything, $\psi \to J/\psi(1S)K^+K^-$	$<$	7.5		$\times 10^{-6}$	CL=90%	–
$\chi_{c1}(4140)$ anything, $\chi_{c1} \to J/\psi(1S)\phi$	$<$	5.2		$\times 10^{-6}$	CL=90%	–
χ_{c0} anything	$<$	4		$\times 10^{-3}$	CL=90%	–
χ_{c1} anything	(	1.90	± 0.35)	$\times 10^{-4}$		–
$\chi_{c1}(1P)X_{tetra}$	$<$	3.78		$\times 10^{-5}$	CL=90%	–
χ_{c2} anything	(	2.8	± 0.8)	$\times 10^{-4}$		–
$\psi(2S)$ anything	(	1.23	± 0.20)	$\times 10^{-4}$		–
$\psi(2S)\eta_c$	$<$	3.6		$\times 10^{-6}$	CL=90%	3345
$\psi(2S)\chi_{c0}$	$<$	6.5		$\times 10^{-6}$	CL=90%	3124
$\psi(2S)\chi_{c1}$	$<$	4.5		$\times 10^{-6}$	CL=90%	3070
$\psi(2S)\chi_{c2}$	$<$	2.1		$\times 10^{-6}$	CL=90%	3043
$\psi(2S)\eta_c(2S)$	$<$	3.2		$\times 10^{-6}$	CL=90%	2994
$\psi(2S)X(3940)$	$<$	2.9		$\times 10^{-6}$	CL=90%	2797
$\psi(2S)X(4160)$	$<$	2.9		$\times 10^{-6}$	CL=90%	2645
$\psi(4230)$ anything, $\psi \to \psi(2S)\pi^+\pi^-$	$<$	7.9		$\times 10^{-5}$	CL=90%	–
$\psi(4360)$ anything, $\psi \to \psi(2S)\pi^+\pi^-$	$<$	5.2		$\times 10^{-5}$	CL=90%	–
$\psi(4660)$ anything, $\psi \to \psi(2S)\pi^+\pi^-$	$<$	2.2		$\times 10^{-5}$	CL=90%	–

$T_{c\overline{c}}(4050)^{\pm}$ anything, $X \to \psi(2S)\pi^{\pm}$	$<$	8.8	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}1}(4430)^{\pm}$ anything, $T_{c\overline{c}1} \to \psi(2S)\pi^{\pm}$	$<$	6.7	$\times 10^{-5}$	CL=90%	–
$\chi_{c1}(3872)$ anything	$<$	2.2	$\times 10^{-4}$	CL=90%	–
$T_{c\overline{c}1}(4200)^{+}\,T_{c\overline{c}1}(4200)^{-}$	$<$	2.23	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}1}(3900)^{\pm}\,T_{c\overline{c}1}(4200)^{\mp}$	$<$	8.1	$\times 10^{-6}$	CL=90%	–
$T_{c\overline{c}1}(3900)^{+}\,T_{c\overline{c}1}(3900)^{-}$	$<$	1.8	$\times 10^{-6}$	CL=90%	–
$T_{c\overline{c}}(4050)^{+}\,T_{c\overline{c}}(4050)^{-}$	$<$	1.58	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}}(4250)^{+}\,T_{c\overline{c}}(4250)^{-}$	$<$	2.66	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}}(4050)^{\pm}\,T_{c\overline{c}}(4250)^{\mp}$	$<$	4.42	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}1}(4430)^{+}\,T_{c\overline{c}1}(4430)^{-}$	$<$	2.03	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}}(4055)^{\pm}\,T_{c\overline{c}}(4055)^{\mp}$	$<$	2.33	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}}(4055)^{\pm}\,T_{c\overline{c}1}(4430)^{\mp}$	$<$	4.55	$\times 10^{-5}$	CL=90%	–
$\rho\pi$	$<$	3.68	$\times 10^{-6}$	CL=90%	4697
$\omega\pi^{0}$	$<$	3.90	$\times 10^{-6}$	CL=90%	4697
$\pi^{+}\pi^{-}$	$<$	5	$\times 10^{-4}$	CL=90%	4728
$K^{+}K^{-}$	$<$	5	$\times 10^{-4}$	CL=90%	4704
$p\overline{p}$	$<$	5	$\times 10^{-4}$	CL=90%	4636
$\pi^{+}\pi^{-}\pi^{0}$	(	2.1 $\pm$0.8)	$\times 10^{-6}$		4725
$\phi K^{+}K^{-}$	(	2.4 $\pm$0.5)	$\times 10^{-6}$		4623
$\omega\pi^{+}\pi^{-}$	(	4.5 $\pm$1.0)	$\times 10^{-6}$		4694
$K^{*}(892)^{0}K^{-}\pi^{+}$ + c.c.	(	4.4 $\pm$0.8)	$\times 10^{-6}$		4667
$\phi f_{2}'(1525)$	$<$	1.63	$\times 10^{-6}$	CL=90%	4551
$\omega f_{2}(1270)$	$<$	1.79	$\times 10^{-6}$	CL=90%	4611
$\rho(770)a_{2}(1320)$	$<$	2.24	$\times 10^{-6}$	CL=90%	4605
$K^{*}(892)^{0}\overline{K}_{2}^{*}(1430)^{0}$ + c.c.	(	3.0 $\pm$0.8)	$\times 10^{-6}$		4579
$K_{1}(1270)^{\pm}K^{\mp}$	$<$	2.41	$\times 10^{-6}$	CL=90%	4634
$K_{1}(1400)^{\pm}K^{\mp}$	(	1.0 $\pm$0.4)	$\times 10^{-6}$		4613
$b_{1}(1235)^{\pm}\pi^{\mp}$	$<$	1.25	$\times 10^{-6}$	CL=90%	4649
$\pi^{+}\pi^{-}\pi^{0}\pi^{0}$	(	1.28 $\pm$0.30)	$\times 10^{-5}$		4720
$K_{S}^{0}K^{+}\pi^{-}$ + c.c.	(	1.6 $\pm$0.4)	$\times 10^{-6}$		4696
$K^{*}(892)^{0}\overline{K}^{0}$ + c.c.	(	2.9 $\pm$0.9)	$\times 10^{-6}$		4675
$K^{*}(892)^{-}K^{+}$ + c.c.	$<$	1.11	$\times 10^{-6}$	CL=90%	4675
$f_{1}(1285)$ anything	(	4.6 $\pm$3.1)	$\times 10^{-3}$		–
$D^{*}(2010)^{\pm}$ anything	(	2.52 $\pm$0.20)	%		–
$f_{1}(1285)X_{tetra}$	$<$	6.24	$\times 10^{-5}$	CL=90%	–
$\overline{^{2}H}$ anything	(	2.85 $\pm$0.25)	$\times 10^{-5}$		–
Sum of 100 exclusive modes	(	1.200$\pm$0.017)	%		–

Radiative decays

$\gamma\pi^{+}\pi^{-}$	(	6.3 $\pm$1.8)	$\times 10^{-5}$		4728
$\gamma\pi^{0}\pi^{0}$	(	1.7 $\pm$0.7)	$\times 10^{-5}$		4728
$\gamma\pi\pi$(S-wave)	(	4.6 $\pm$0.7)	$\times 10^{-5}$		4728

$\gamma\pi^0\eta$		$<$	2.4		$\times 10^{-6}$	CL=90%	4713
γK^+K^-	[a]	(	1.14	± 0.13)	$\times 10^{-5}$		4704
$\gamma p\overline{p}$	[b]	$<$	6		$\times 10^{-6}$	CL=90%	4636
$\gamma 2h^+2h^-$		(	7.0	± 1.5)	$\times 10^{-4}$		4720
$\gamma 3h^+3h^-$		(	5.4	± 2.0)	$\times 10^{-4}$		4703
$\gamma 4h^+4h^-$		(	7.4	± 3.5)	$\times 10^{-4}$		4679
$\gamma\pi^+\pi^-K^+K^-$		(	2.9	± 0.9)	$\times 10^{-4}$		4686
$\gamma 2\pi^+2\pi^-$		(	2.5	± 0.9)	$\times 10^{-4}$		4720
$\gamma 3\pi^+3\pi^-$		(	2.5	± 1.2)	$\times 10^{-4}$		4703
$\gamma 2\pi^+2\pi^-K^+K^-$		(	2.4	± 1.2)	$\times 10^{-4}$		4659
$\gamma\pi^+\pi^-p\overline{p}$		(	1.5	± 0.6)	$\times 10^{-4}$		4604
$\gamma 2\pi^+2\pi^-p\overline{p}$		(	4	± 6)	$\times 10^{-5}$		4563
$\gamma 2K^+2K^-$		(	2.0	± 2.0)	$\times 10^{-5}$		4601
$\gamma\eta'(958)$		$<$	1.9		$\times 10^{-6}$	CL=90%	4682
$\gamma\eta$		$<$	1.0		$\times 10^{-6}$	CL=90%	4714
$\gamma f_0(980)$		$<$	3		$\times 10^{-5}$	CL=90%	4678
$\gamma f_2'(1525)$		(	2.9	± 0.6)	$\times 10^{-5}$		4609
$\gamma f_2(1270)$		(	1.01	± 0.06)	$\times 10^{-4}$		4644
$\gamma\eta(1405)$		$<$	8.2		$\times 10^{-5}$	CL=90%	4625
$\gamma f_0(1500)$		$<$	1.5		$\times 10^{-5}$	CL=90%	4608
$\gamma f_0(1500) \to \gamma K^+K^-$		(	1.0	± 0.4)	$\times 10^{-5}$		–
$\gamma f_0(1710)$		$<$	2.6		$\times 10^{-4}$	CL=90%	4573
$\gamma f_0(1710) \to \gamma K^+K^-$		(	1.01	± 0.32)	$\times 10^{-5}$		–
$\gamma f_0(1710) \to \gamma\pi^+\pi^-$		(	5.3	± 2.0)	$\times 10^{-6}$		–
$\gamma f_0(1710) \to \gamma\pi^0\pi^0$		$<$	1.4		$\times 10^{-6}$	CL=90%	–
$\gamma f_0(1710) \to \gamma\eta\eta$		$<$	1.8		$\times 10^{-6}$	CL=90%	–
$\gamma f_4(2050)$		$<$	5.3		$\times 10^{-5}$	CL=90%	4515
$\gamma f_0(2200) \to \gamma K^+K^-$		$<$	2		$\times 10^{-4}$	CL=90%	4475
$\gamma f_J(2220) \to \gamma K^+K^-$		$<$	8		$\times 10^{-7}$	CL=90%	4469
$\gamma f_J(2220) \to \gamma\pi^+\pi^-$		$<$	6		$\times 10^{-7}$	CL=90%	–
$\gamma f_J(2220) \to \gamma p\overline{p}$		$<$	1.1		$\times 10^{-6}$	CL=90%	–
$\gamma\eta(2225) \to \gamma\phi\phi$		$<$	3		$\times 10^{-3}$	CL=90%	4469
$\gamma\eta_c(1S)$		$<$	2.9		$\times 10^{-5}$	CL=90%	4260
$\gamma\eta_c(2S)$		$<$	4		$\times 10^{-4}$	CL=90%	4031
$\gamma\chi_{c0}$		$<$	6.6		$\times 10^{-5}$	CL=90%	4114
$\gamma\chi_{c1}$		(	4.7	$^{+2.4}_{-1.9}$)	$\times 10^{-5}$		4079
$\gamma\chi_{c2}$		$<$	7.6		$\times 10^{-6}$	CL=90%	4062
$\gamma\chi_{c1}(3872)$		$<$	4		$\times 10^{-5}$	CL=90%	3938
$\gamma\chi_{c1}(3872),\ \chi_{c1} \to \pi^+\pi^-\pi^0 J/\psi$		$<$	2.8		$\times 10^{-6}$	CL=90%	–
$\gamma\chi_{c0}(3915) \to \omega J/\psi$		$<$	3.0		$\times 10^{-6}$	CL=90%	–
$\gamma\chi_{c1}(4140) \to \phi J/\psi$		$<$	2.2		$\times 10^{-6}$	CL=90%	–
$\gamma X\overline{X}(m_X < 3.1$ GeV)	[c]	$<$	1		$\times 10^{-3}$	CL=90%	–

$\gamma X \overline{X}(m_X < 4.5$ GeV)	[d]	< 2.4	$\times 10^{-4}$	CL=90%	–
$\gamma X \to \gamma +$ ≥ 4 prongs	[e]	< 1.78	$\times 10^{-4}$	CL=95%	–
$\gamma A^0 \to \gamma \mu^+ \mu^-$	[f]	< 9	$\times 10^{-6}$	CL=90%	–
$\gamma A^0 \to \gamma \tau^+ \tau^-$	[a]	< 1.30	$\times 10^{-4}$	CL=90%	–
$\gamma A^0 \to \gamma g g$	[g]	< 1	%	CL=90%	–
$\gamma A^0 \to \gamma s \overline{s}$	[g]	< 1	$\times 10^{-3}$	CL=90%	–

Lepton Family number (*LF*) violating modes

$e^\pm \mu^\mp$	*LF*	< 3.9	$\times 10^{-7}$	CL=90%	4730
$\mu^\pm \tau^\mp$	*LF*	< 2.7	$\times 10^{-6}$	CL=90%	4563
$e^\pm \tau^\mp$	*LF*	< 2.7	$\times 10^{-6}$	CL=90%	4563
$\gamma e^\pm \mu^\mp$	*LF*	< 4.2	$\times 10^{-7}$	CL=90%	4730
$\gamma \mu^\pm \tau^\mp$	*LF*	< 6.1	$\times 10^{-6}$	CL=90%	4563
$\gamma e^\pm \tau^\mp$	*LF*	< 6.5	$\times 10^{-6}$	CL=90%	4563

Other decays

invisible		< 3.0	$\times 10^{-4}$	CL=90%	–
hadrons		(96 ±4) %			–

$\chi_{b0}(1P)$

$I^G(J^{PC}) = 0^+(0^{++})$
J needs confirmation.

Mass $m = 9859.44 \pm 0.42 \pm 0.31$ MeV

$\chi_{b0}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma \Upsilon(1S)$	(1.94±0.27) %		391
$D^0 X$	< 10.4 %	90%	–
$\pi^+ \pi^- K^+ K^- \pi^0$	< 1.6 $\times 10^{-4}$	90%	4875
$2\pi^+ \pi^- K^- K^0_S$	< 5 $\times 10^{-5}$	90%	4875
$2\pi^+ \pi^- K^- K^0_S 2\pi^0$	< 5 $\times 10^{-4}$	90%	4846
$2\pi^+ 2\pi^- 2\pi^0$	< 2.1 $\times 10^{-4}$	90%	4905
$2\pi^+ 2\pi^- K^+ K^-$	(1.1 ±0.6) $\times 10^{-4}$		4861
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.7 $\times 10^{-4}$	90%	4846
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 5 $\times 10^{-4}$	90%	4828
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	< 1.6 $\times 10^{-4}$	90%	4827
$3\pi^+ 3\pi^-$	< 8 $\times 10^{-5}$	90%	4904
$3\pi^+ 3\pi^- 2\pi^0$	< 6 $\times 10^{-4}$	90%	4881
$3\pi^+ 3\pi^- K^+ K^-$	(2.4 ±1.2) $\times 10^{-4}$		4827
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 1.0 $\times 10^{-3}$	90%	4808
$4\pi^+ 4\pi^-$	< 8 $\times 10^{-5}$	90%	4880
$4\pi^+ 4\pi^- 2\pi^0$	< 2.1 $\times 10^{-3}$	90%	4850
$J/\psi J/\psi$	< 7 $\times 10^{-5}$	90%	3836
$J/\psi \psi(2S)$	< 1.2 $\times 10^{-4}$	90%	3571
$\psi(2S) \psi(2S)$	< 3.1 $\times 10^{-5}$	90%	3273

$J/\psi(1S)$ anything	$<$ 2.3	$\times 10^{-3}$	90%	–

$\chi_{b1}(1P)$

$I^G(J^{PC}) = 0^+(1^{++})$
J needs confirmation.

Mass $m = 9892.78 \pm 0.26 \pm 0.31$ MeV
$m_{\chi_{b1}(1P)} - m_{\Upsilon(1S)} = 432.10 \pm 0.28$ MeV

$\chi_{b1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma\,\Upsilon(1S)$	(35.2 $\pm$2.0) %		423
$D^0 X$	(12.6 $\pm$2.2) %		–
$\pi^+\pi^- K^+ K^- \pi^0$	(2.0 $\pm$0.6) $\times 10^{-4}$		4892
$2\pi^+\pi^- K^- K^0_S$	(1.3 $\pm$0.5) $\times 10^{-4}$		4892
$2\pi^+\pi^- K^- K^0_S 2\pi^0$	$<$ 6 $\times 10^{-4}$	90%	4863
$2\pi^+ 2\pi^- 2\pi^0$	(8.0 $\pm$2.5) $\times 10^{-4}$		4921
$2\pi^+ 2\pi^- K^+ K^-$	(1.5 $\pm$0.5) $\times 10^{-4}$		4878
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	(3.5 $\pm$1.2) $\times 10^{-4}$		4863
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(8.6 $\pm$3.2) $\times 10^{-4}$		4845
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	(9.3 $\pm$3.3) $\times 10^{-4}$		4844
$3\pi^+ 3\pi^-$	(1.9 $\pm$0.6) $\times 10^{-4}$		4921
$3\pi^+ 3\pi^- 2\pi^0$	(1.7 $\pm$0.5) $\times 10^{-3}$		4898
$3\pi^+ 3\pi^- K^+ K^-$	(2.6 $\pm$0.8) $\times 10^{-4}$		4844
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	(7.5 $\pm$2.6) $\times 10^{-4}$		4825
$4\pi^+ 4\pi^-$	(2.6 $\pm$0.9) $\times 10^{-4}$		4897
$4\pi^+ 4\pi^- 2\pi^0$	(1.4 $\pm$0.6) $\times 10^{-3}$		4867
ω anything	(4.9 $\pm$1.4) %		–
ωX_{tetra}	$<$ 4.44 $\times 10^{-4}$	90%	–
$J/\psi\,J/\psi$	$<$ 2.7 $\times 10^{-5}$	90%	3857
$J/\psi\,\psi(2S)$	$<$ 1.7 $\times 10^{-5}$	90%	3594
$\psi(2S)\psi(2S)$	$<$ 6 $\times 10^{-5}$	90%	3298
$J/\psi(1S)$ anything	$<$ 1.1 $\times 10^{-3}$	90%	–
$J/\psi(1S) X_{tetra}$	$<$ 2.27 $\times 10^{-4}$	90%	–

$h_b(1P)$

$I^G(J^{PC}) = 0^-(1^{+-})$

Mass $m = 9899.3 \pm 0.8$ MeV

$h_b(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\eta_b(1S)\gamma$	(52 $^{+6}_{-5}$) %		488
$\Upsilon(1S)\pi^0$	$<$ 1.8 $\times 10^{-3}$	90%	408

$\chi_{b2}(1P)$

$I^G(J^{PC}) = 0^+(2^{++})$
J needs confirmation.

Mass $m = 9912.21 \pm 0.26 \pm 0.31$ MeV

$\chi_{b2}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma\,\Upsilon(1S)$	(18.0±1.0) %		442
$D^0 X$	< 7.9 %	90%	–
$\pi^+\pi^- K^+ K^- \pi^0$	(8 ±5) × 10^{-5}		4902
$2\pi^+\pi^- K^- K^0_S$	< 1.0 × 10^{-4}	90%	4901
$2\pi^+\pi^- K^- K^0_S 2\pi^0$	(5.3±2.4) × 10^{-4}		4873
$2\pi^+ 2\pi^- 2\pi^0$	(3.5±1.4) × 10^{-4}		4931
$2\pi^+ 2\pi^- K^+ K^-$	(1.1±0.4) × 10^{-4}		4888
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	(2.1±0.9) × 10^{-4}		4872
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(3.9±1.8) × 10^{-4}		4855
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	< 5 × 10^{-4}	90%	4854
$3\pi^+ 3\pi^-$	(7.0±3.1) × 10^{-5}		4931
$3\pi^+ 3\pi^- 2\pi^0$	(1.0±0.4) × 10^{-3}		4908
$3\pi^+ 3\pi^- K^+ K^-$	< 8 × 10^{-5}	90%	4854
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	(3.6±1.5) × 10^{-4}		4835
$4\pi^+ 4\pi^-$	(8 ±4) × 10^{-5}		4907
$4\pi^+ 4\pi^- 2\pi^0$	(1.8±0.7) × 10^{-3}		4877
$J/\psi\,J/\psi$	< 4 × 10^{-5}	90%	3869
$J/\psi\,\psi(2S)$	< 5 × 10^{-5}	90%	3608
$\psi(2S)\,\psi(2S)$	< 1.6 × 10^{-5}	90%	3313
$J/\psi(1S)$ anything	(1.5±0.4) × 10^{-3}		–

$\Upsilon(2S)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 10023.4 \pm 0.5$ MeV
$m_{\Upsilon(2S)} - m_{\Upsilon(1S)} = 562.81 \pm 0.11$ MeV
Full width $\Gamma = 31.98 \pm 2.63$ keV

$\Upsilon(2S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\Upsilon(1S)\pi^+\pi^-$	(17.85± 0.26) %		475
$\Upsilon(1S)\pi^0\pi^0$	(8.6 ± 0.4) %		480
$\tau^+\tau^-$	(2.00± 0.21) %		4686
$\mu^+\mu^-$	(1.93± 0.17) %	S=2.2	5011
e^+e^-	(1.91± 0.16) %		5012
$\Upsilon(1S)\pi^0$	< 4 × 10^{-5}	CL=90%	531
$\Upsilon(1S)\eta$	(2.9 ± 0.4) × 10^{-4}	S=2.0	126
$J/\psi(1S)$ anything	< 6 × 10^{-3}	CL=90%	4533
$J/\psi(1S)\eta_c$	< 5.4 × 10^{-6}	CL=90%	3984

$J/\psi(1S)\chi_{c0}$	$<$	3.4	$\times 10^{-6}$	CL=90%	3808
$J/\psi(1S)\chi_{c1}$	$<$	1.2	$\times 10^{-6}$	CL=90%	3765
$J/\psi(1S)\chi_{c2}$	$<$	2.0	$\times 10^{-6}$	CL=90%	3745
$J/\psi(1S)\eta_c(2S)$	$<$	2.5	$\times 10^{-6}$	CL=90%	3706
$J/\psi(1S)X(3940)$	$<$	2.0	$\times 10^{-6}$	CL=90%	3555
$J/\psi(1S)X(4160)$	$<$	2.0	$\times 10^{-6}$	CL=90%	3442
χ_{c1} anything	(2.2	± 0.5)	$\times 10^{-4}$		–
$\chi_{c1}(1P)^0 X_{tetra}$	$<$	3.67	$\times 10^{-5}$	CL=90%	–
χ_{c2} anything	(2.3	± 0.8)	$\times 10^{-4}$		–
$\psi(2S)\eta_c$	$<$	5.1	$\times 10^{-6}$	CL=90%	3732
$\psi(2S)\chi_{c0}$	$<$	4.7	$\times 10^{-6}$	CL=90%	3536
$\psi(2S)\chi_{c1}$	$<$	2.5	$\times 10^{-6}$	CL=90%	3488
$\psi(2S)\chi_{c2}$	$<$	1.9	$\times 10^{-6}$	CL=90%	3464
$\psi(2S)\eta_c(2S)$	$<$	3.3	$\times 10^{-6}$	CL=90%	3422
$\psi(2S)X(3940)$	$<$	3.9	$\times 10^{-6}$	CL=90%	3250
$\psi(2S)X(4160)$	$<$	3.9	$\times 10^{-6}$	CL=90%	3120
$T_{c\overline{c}1}(3900)^+ T_{c\overline{c}1}(3900)^-$	$<$	1.0	$\times 10^{-6}$	CL=90%	–
$T_{c\overline{c}1}(4200)^+ T_{c\overline{c}1}(4200)^-$	$<$	1.67	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}1}(3900)^\pm T_{c\overline{c}1}(4200)^\mp$	$<$	7.3	$\times 10^{-6}$	CL=90%	–
$T_{c\overline{c}}(4050)^+ T_{c\overline{c}}(4050)^-$	$<$	1.35	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}}(4250)^+ T_{c\overline{c}}(4250)^-$	$<$	2.67	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}}(4050)^\pm T_{c\overline{c}}(4250)^\mp$	$<$	2.72	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}1}(4430)^+ T_{c\overline{c}1}(4430)^-$	$<$	2.03	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}}(4055)^\pm T_{c\overline{c}}(4055)^\mp$	$<$	1.11	$\times 10^{-5}$	CL=90%	–
$T_{c\overline{c}}(4055)^\pm T_{c\overline{c}1}(4430)^\mp$	$<$	2.11	$\times 10^{-5}$	CL=90%	–
$P_{c\overline{c}s}(4459)/\overline{P}_{c\overline{c}s}(4459)$ anything	(2.9	± 1.7)	$\times 10^{-6}$		–
$P_{c\overline{c}s}(4338)/\overline{P}_{c\overline{c}s}(4338)$ anything	$<$	1.6	$\times 10^{-6}$	CL=90%	–
$P_c(4457)$ anything, $P_c(4457) \to\ p J/\psi(1S)$	$<$	4.6	$\times 10^{-6}$	CL=90%	–
$P_c(4440)$ anything, $P_c(4440) \to\ p J/\psi(1S)$	$<$	1.18	$\times 10^{-5}$	CL=90%	–
$P_c(4312)$ anything, $P_c(4312) \to\ p J/\psi(1S)$	$<$	7.2	$\times 10^{-6}$	CL=90%	–
$p/\overline{p}J/\psi(1S)$ anything	(4.3	± 0.6)	$\times 10^{-5}$		–
$J/\psi(1S)\Lambda/\overline{\Lambda}$ anything	(2.2	± 0.6)	$\times 10^{-5}$		–
$\overline{^2H}$ anything	($2.78^{+\ 0.30}_{-\ 0.26}$	)	$\times 10^{-5}$	S=1.2	–
hadrons	(94	±11)	%		–
$g\,g\,g$	(58.8	± 1.2)	%		–
$\gamma\,g\,g$	(1.87	± 0.28)	%		–
$\phi K^+ K^-$	(1.6	± 0.4)	$\times 10^{-6}$		4910
$\omega\pi^+\pi^-$	$<$	2.58	$\times 10^{-6}$	CL=90%	4977

$K^*(892)^0 K^- \pi^+ +$ c.c.	(2.3 ± 0.7) $\times 10^{-6}$			4952
$\phi f_2'(1525)$	< 1.33	$\times 10^{-6}$	CL=90%	4843
$\omega f_2(1270)$	< 5.7	$\times 10^{-7}$	CL=90%	4899
$\rho(770) a_2(1320)$	< 8.8	$\times 10^{-7}$	CL=90%	4894
$K^*(892)^0 \overline{K}_2^*(1430)^0 +$ c.c.	(1.5 ± 0.6) $\times 10^{-6}$			4869
$K_1(1270)^\pm K^\mp$	< 3.22	$\times 10^{-6}$	CL=90%	4920
$K_1(1400)^\pm K^\mp$	< 8.3	$\times 10^{-7}$	CL=90%	4901
$b_1(1235)^\pm \pi^\mp$	< 4.0	$\times 10^{-7}$	CL=90%	4935
$\rho\pi$	< 1.16	$\times 10^{-6}$	CL=90%	4981
$\pi^+\pi^-\pi^0$	< 8.0	$\times 10^{-7}$	CL=90%	5007
$\omega\pi^0$	< 1.63	$\times 10^{-6}$	CL=90%	4980
$\pi^+\pi^-\pi^0\pi^0$	(1.30± 0.28) $\times 10^{-5}$			5002
$K_S^0 K^+\pi^- +$ c.c.	(1.14± 0.33) $\times 10^{-6}$			4979
$K^*(892)^0 \overline{K}^0 +$ c.c.	< 4.22	$\times 10^{-6}$	CL=90%	4959
$K^*(892)^- K^+ +$ c.c.	< 1.45	$\times 10^{-6}$	CL=90%	4960
$f_1(1285)$ anything	(2.2 ± 1.6) $\times 10^{-3}$			–
$f_1(1285) X_{tetra}$	< 6.47	$\times 10^{-5}$	CL=90%	–
$D_s^+ D_{s1}(2536)^-$, $D_{s1}^- \to K^- D^*(2007)^0$	(1.6 ± 0.4) $\times 10^{-5}$			–
$D_s^+ D_{s1}(2536)^-$, $D_{s1}^- \to K_S^0 D^*(2010)^-$	(8.4 ± 2.3) $\times 10^{-6}$			–
$D_s^{*+} D_{s1}(2536)^-$, $D_{s1}^- \to K^- D^*(2007)^0$	(1.4 ± 0.4) $\times 10^{-5}$			–
$D_s^{*+} D_{s1}(2536)^-$, $D_{s1}^- \to K_S^0 D^*(2010)^-$	(8.2 ± 3.1) $\times 10^{-6}$			–
$D_s^+ D_{s2}^*(2573)^-$, $D_{s2}^{*-} \to K^- D^0$	(1.4 ± 0.4) $\times 10^{-5}$			–
$D_s^+ D_{s2}^*(2573)^-$, $D_{s2}^{*-} \to K_S^0 D^-$	(6.9 ± 3.0) $\times 10^{-6}$			–
$D_s^{*+} D_{s2}^*(2573)^-$, $D_{s2}^{*-} \to K^- D^0$	(9 ± 5) $\times 10^{-6}$			–
$D_s^{*+} D_{s2}^*(2573)^-$, $D_{s2}^{*-} \to K_S^0 D^-$	(5 ± 6) $\times 10^{-6}$			–
Sum of 100 exclusive modes	(2.90± 0.30) $\times 10^{-3}$			–

Radiative decays

$\gamma\chi_{b1}(1P)$	(6.9 ± 0.4) %			130
$\gamma\chi_{b2}(1P)$	(7.15± 0.35) %			111
$\gamma\chi_{b0}(1P)$	(3.8 ± 0.4) %			163
$\gamma f_0(1710)$	< 5.9	$\times 10^{-4}$	CL=90%	4864
$\gamma f_2'(1525)$	< 5.3	$\times 10^{-4}$	CL=90%	4897
$\gamma f_2(1270)$	< 2.41	$\times 10^{-4}$	CL=90%	4931
$\gamma\eta_c(1S)$	< 2.7	$\times 10^{-5}$	CL=90%	4567

$\gamma\chi_{c0}$		$<$	1.0	$\times 10^{-4}$	CL=90%	4430
$\gamma\chi_{c1}$		$<$	3.6	$\times 10^{-6}$	CL=90%	4397
$\gamma\chi_{c2}$		$<$	1.5	$\times 10^{-5}$	CL=90%	4381
$\gamma\chi_{c1}(3872)$		$<$	1.8	$\times 10^{-5}$	CL=90%	4264
$\gamma\chi_{c1}(3872)$, $\chi_{c1} \to \pi^+\pi^-\pi^0 J/\psi$		$<$	2.4	$\times 10^{-6}$	CL=90%	–
$\gamma\chi_{c0}(3915) \to \omega J/\psi$		$<$	2.8	$\times 10^{-6}$	CL=90%	–
$\gamma\chi_{c1}(4140) \to \phi J/\psi$		$<$	1.2	$\times 10^{-6}$	CL=90%	–
$\gamma X(4350) \to \phi J/\psi$		$<$	1.3	$\times 10^{-6}$	CL=90%	–
$\gamma\eta_b(1S)$			$(\ 5.5\ ^{+\ 1.1}_{-\ 0.9}\ ) \times 10^{-4}$		S=1.2	605
$\gamma\eta_b(1S) \to \gamma$ Sum of 26 exclusive modes		$<$	3.7	$\times 10^{-6}$	CL=90%	–
$\gamma X_{b\overline{b}} \to \gamma$ Sum of 26 exclusive modes		$<$	4.9	$\times 10^{-6}$	CL=90%	–
$\gamma X \to \gamma +\geq 4$ prongs	[*h*]	$<$	1.95	$\times 10^{-4}$	CL=95%	–
$\gamma A^0 \to \gamma$ hadrons		$<$	8	$\times 10^{-5}$	CL=90%	–
$\gamma A^0 \to \gamma\mu^+\mu^-$		$<$	8.3	$\times 10^{-6}$	CL=90%	–

Lepton Family number (*LF*) violating modes

$e^\pm\tau^\mp$	*LF*	$<$	1.12	$\times 10^{-6}$	CL=90%	4854
$\mu^\pm\tau^\mp$	*LF*	$<$	2.3	$\times 10^{-7}$	CL=90%	4854

$\Upsilon_2(1D)$

$I^G(J^{PC}) = 0^-(2^{--})$

was $\Upsilon(1D)$

Mass $m = 10163.7 \pm 1.4$ MeV (S = 1.7)

$\Upsilon_2(1D)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\gamma\gamma\,\Upsilon(1S)$	seen	679
$\gamma\chi_{bJ}(1P)$	seen	300
$\eta\,\Upsilon(1S)$	not seen	426
$\pi^+\pi^-\,\Upsilon(1S)$	$(6.6\pm1.6)\times10^{-3}$	623

$\chi_{b0}(2P)$

$I^G(J^{PC}) = 0^+(0^{++})$
J needs confirmation.

Mass $m = 10232.5 \pm 0.4 \pm 0.5$ MeV

$\chi_{b0}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma\,\Upsilon(2S)$	(1.38 ± 0.30) %		207
$\omega\,\Upsilon(1S)$	$(5.5\ \pm2.0\ )\times10^{-3}$		†
$\gamma\,\Upsilon(1S)$	$(3.8\ \pm1.7\ )\times10^{-3}$		743

$D^0 X$	< 8.2	%	90%	–
$\pi^+\pi^- K^+ K^- \pi^0$	< 3.4	$\times 10^{-5}$	90%	5064
$2\pi^+\pi^- K^- K^0_S$	< 5	$\times 10^{-5}$	90%	5063
$2\pi^+\pi^- K^- K^0_S 2\pi^0$	< 2.2	$\times 10^{-4}$	90%	5036
$2\pi^+ 2\pi^- 2\pi^0$	< 2.4	$\times 10^{-4}$	90%	5092
$2\pi^+ 2\pi^- K^+ K^-$	< 1.5	$\times 10^{-4}$	90%	5050
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.2	$\times 10^{-4}$	90%	5035
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 1.1	$\times 10^{-3}$	90%	5019
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	< 7	$\times 10^{-4}$	90%	5018
$3\pi^+ 3\pi^-$	< 7	$\times 10^{-5}$	90%	5091
$3\pi^+ 3\pi^- 2\pi^0$	< 1.2	$\times 10^{-3}$	90%	5070
$3\pi^+ 3\pi^- K^+ K^-$	< 1.5	$\times 10^{-4}$	90%	5017
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 7	$\times 10^{-4}$	90%	4999
$4\pi^+ 4\pi^-$	< 1.7	$\times 10^{-4}$	90%	5069
$4\pi^+ 4\pi^- 2\pi^0$	< 6	$\times 10^{-4}$	90%	5039

$\chi_{b1}(2P)$

$I^G(J^{PC}) = 0^+(1^{++})$
J needs confirmation.

Mass $m = 10255.46 \pm 0.22 \pm 0.50$ MeV
$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)} = 23.5 \pm 1.0$ MeV
$m_{\chi_{b1}(2P)} - m_{\Upsilon(1S)} = 793.6 \pm 0.8$ MeV

$\chi_{b1}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$\omega\,\Upsilon(1S)$	(2.1±0.4) %	1.6	134
$\gamma\,\Upsilon(2S)$	(18.1±1.9) %		229
$\gamma\,\Upsilon(1S)$	(9.9±1.0) %		764
$\pi\pi\,\chi_{b1}(1P)$	(9.1±1.3) $\times 10^{-3}$		238
$D^0 X$	(8.8±1.7) %		–
$\pi^+\pi^- K^+ K^- \pi^0$	(3.1±1.0) $\times 10^{-4}$		5075
$2\pi^+\pi^- K^- K^0_S$	(1.1±0.5) $\times 10^{-4}$		5075
$2\pi^+\pi^- K^- K^0_S 2\pi^0$	(7.7±3.2) $\times 10^{-4}$		5047
$2\pi^+ 2\pi^- 2\pi^0$	(5.9±2.0) $\times 10^{-4}$		5104
$2\pi^+ 2\pi^- K^+ K^-$	(10 ±4) $\times 10^{-5}$		5062
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	(5.5±1.8) $\times 10^{-4}$		5047
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(10 ±4) $\times 10^{-4}$		5030
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	(6.7±2.6) $\times 10^{-4}$		5029
$3\pi^+ 3\pi^-$	(1.2±0.4) $\times 10^{-4}$		5103
$3\pi^+ 3\pi^- 2\pi^0$	(1.2±0.4) $\times 10^{-3}$		5081
$3\pi^+ 3\pi^- K^+ K^-$	(2.0±0.8) $\times 10^{-4}$		5029
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	(6.1±2.2) $\times 10^{-4}$		5011
$4\pi^+ 4\pi^-$	(1.7±0.6) $\times 10^{-4}$		5080
$4\pi^+ 4\pi^- 2\pi^0$	(1.9±0.7) $\times 10^{-3}$		5051

$h_b(2P)$

$I^G(J^{PC}) = 0^-(1^{+-})$

Mass $m = 10259.8 \pm 1.2$ MeV

$h_b(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
hadrons	not seen		–
$\eta_b(1S)\gamma$	(22 ± 5) %		825
$\eta_b(2S)\gamma$	(48 ±13) %		257
$\Upsilon(1S)\eta$	$(7.1^{+\ 4.0}_{-\ 3.3}) \times 10^{-3}$		559
$\Upsilon(1S)\pi^0$	$< 1.8 \times 10^{-3}$	90%	757
$\gamma\chi_{b0}(1P)$	< 27 %	90%	393
$\gamma\chi_{b1}(1P)$	$< 5.4 \times 10^{-3}$	90%	360
$\gamma\chi_{b2}(1P)$	< 1.3 %	90%	342

$\chi_{b2}(2P)$

$I^G(J^{PC}) = 0^+(2^{++})$
J needs confirmation.

Mass $m = 10268.65 \pm 0.22 \pm 0.50$ MeV
$m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)} = 13.2 \pm 0.4$ MeV (S = 1.8)

$\chi_{b2}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\omega\,\Upsilon(1S)$	$(5.7\pm2.0) \times 10^{-3}$	S=1.5	194
$\gamma\,\Upsilon(2S)$	(8.9±1.2) %		242
$\gamma\,\Upsilon(1S)$	(6.6±0.8) %		776
$\pi\pi\chi_{b2}(1P)$	$(5.1\pm0.9) \times 10^{-3}$		229
D^0X	< 2.4 %	CL=90%	–
$\pi^+\pi^-K^+K^-\pi^0$	$< 1.1 \times 10^{-4}$	CL=90%	5082
$2\pi^+\pi^-K^-K^0_S$	$< 9 \times 10^{-5}$	CL=90%	5082
$2\pi^+\pi^-K^-K^0_S2\pi^0$	$< 7 \times 10^{-4}$	CL=90%	5054
$2\pi^+2\pi^-2\pi^0$	$(3.9\pm1.6) \times 10^{-4}$		5110
$2\pi^+2\pi^-K^+K^-$	$(9 \pm4) \times 10^{-5}$		5068
$2\pi^+2\pi^-K^+K^-\pi^0$	$(2.4\pm1.1) \times 10^{-4}$		5054
$2\pi^+2\pi^-K^+K^-2\pi^0$	$(4.7\pm2.3) \times 10^{-4}$		5037
$3\pi^+2\pi^-K^-K^0_S\pi^0$	$< 4 \times 10^{-4}$	CL=90%	5036
$3\pi^+3\pi^-$	$(9 \pm4) \times 10^{-5}$		5110
$3\pi^+3\pi^-2\pi^0$	$(1.2\pm0.4) \times 10^{-3}$		5088
$3\pi^+3\pi^-K^+K^-$	$(1.4\pm0.7) \times 10^{-4}$		5036
$3\pi^+3\pi^-K^+K^-\pi^0$	$(4.2\pm1.7) \times 10^{-4}$		5017
$4\pi^+4\pi^-$	$(9 \pm5) \times 10^{-5}$		5087
$4\pi^+4\pi^-2\pi^0$	$(1.3\pm0.5) \times 10^{-3}$		5058

$\Upsilon(3S)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 10355.1 \pm 0.5$ MeV
$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.82 \pm 0.08$ MeV (S = 1.9)
Full width $\Gamma = 20.32 \pm 1.85$ keV

$\Upsilon(3S)$ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\Upsilon(2S)$ anything		(10.6 ± 0.8) %		296
$\Upsilon(2S)\pi^+\pi^-$		(2.82± 0.18) %	S=1.6	176
$\Upsilon(2S)\pi^0\pi^0$		(1.85± 0.14) %		190
$\Upsilon(2S)\gamma\gamma$		(5.0 ± 0.7) %		326
$\Upsilon(2S)\pi^0$		$< 5.1 \times 10^{-4}$	CL=90%	298
$\Upsilon(1S)\pi^+\pi^-$		(4.37± 0.08) %		813
$\Upsilon(1S)\pi^0\pi^0$		(2.20± 0.13) %		816
$\Upsilon(1S)\eta$		$< 1 \times 10^{-4}$	CL=90%	677
$\Upsilon(1S)\pi^0$		$< 7 \times 10^{-5}$	CL=90%	846
$h_b(1P)\pi^0$		$< 1.2 \times 10^{-3}$	CL=90%	426
$h_b(1P)\pi^0 \to \gamma\eta_b(1S)\pi^0$		(4.3 ± 1.4) $\times 10^{-4}$		–
$h_b(1P)\pi^+\pi^-$		$< 1.2 \times 10^{-4}$	CL=90%	352
$\tau^+\tau^-$		(2.29± 0.30) %		4863
$\mu^+\mu^-$		(2.18± 0.21) %	S=2.1	5176
e^+e^-		(2.18± 0.20) %		5178
hadrons		(93 ±12) %		–
ggg		(35.7 ± 2.6) %		–
$\underline{\gamma gg}$		(9.7 ± 1.8) $\times 10^{-3}$		–
^2H anything		(2.33± 0.33) $\times 10^{-5}$		–
Radiative decays				
$\gamma\chi_{b2}(2P)$		(13.1 ± 1.6) %	S=3.4	86
$\gamma\chi_{b1}(2P)$		(12.6 ± 1.2) %	S=2.4	99
$\gamma\chi_{b0}(2P)$		(5.9 ± 0.6) %	S=1.4	122
$\gamma\chi_{b2}(1P)$		(10.0 ± 1.0) $\times 10^{-3}$	S=1.7	433
$\gamma\chi_{b1}(1P)$		(9 ± 5) $\times 10^{-4}$	S=1.8	452
$\gamma\chi_{b0}(1P)$		(2.7 ± 0.4) $\times 10^{-3}$		484
$\gamma\eta_b(2S)$		$< 6.2 \times 10^{-4}$	CL=90%	350
$\gamma\eta_b(1S)$		(5.1 ± 0.7) $\times 10^{-4}$		912
$\gamma A^0 \to \gamma$ hadrons		$< 8 \times 10^{-5}$	CL=90%	–
$\gamma X \to \gamma + \geq 4$ prongs	[i]	$< 2.2 \times 10^{-4}$	CL=95%	–
$\gamma A^0 \to \gamma\mu^+\mu^-$		$< 5.5 \times 10^{-6}$	CL=90%	–
$\gamma A^0 \to \gamma\tau^+\tau^-$	[j]	$< 1.6 \times 10^{-4}$	CL=90%	–
Lepton Family number (LF) violating modes				
$e^\pm\tau^\mp$	LF	$< 4.2 \times 10^{-6}$	CL=90%	5025
$e^\pm\mu^\mp$	LF	$< 3.6 \times 10^{-7}$	CL=90%	5177
$\mu^\pm\tau^\mp$	LF	$< 3.1 \times 10^{-6}$	CL=90%	5025

$\chi_{b1}(3P)$

$I^G(J^{PC}) = 0^+(1^{++})$
J needs confirmation.

Mass $m = 10513.4 \pm 0.7$ MeV

$\chi_{b1}(3P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Upsilon(1S)\gamma$	seen	1000
$\Upsilon(2S)\gamma$	seen	479
$\Upsilon(3S)\gamma$	seen	157

$\chi_{b2}(3P)$

$I^G(J^{PC}) = 0^+(2^{++})$
J needs confirmation.

Mass $m = 10524.0 \pm 0.8$ MeV

$\chi_{b2}(3P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Upsilon(3S)\gamma$	seen	168

$\Upsilon(4S)$

$I^G(J^{PC}) = 0^-(1^{--})$

also known as $\Upsilon(10580)$

Mass $m = 10579.4 \pm 1.2$ MeV
Full width $\Gamma = 20.5 \pm 2.5$ MeV

$\Upsilon(4S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$B\overline{B}$	> 96 %	95%	326
B^+B^-	$(51.1\ ^{+\ 0.7}_{-\ 1.1})$ %		331
D_s^+ anything + c.c.	(17.8 ± 2.6) %		–
$B^0\overline{B}^0$	(48.6 ± 0.8) %		326
$J/\psi K_S^0 + (J/\psi,\ \eta_c)K_S^0$	$< 4 \times 10^{-7}$	90%	–
non-$B\overline{B}$	$(2.64^{+13.00}_{-\ 0.20}) \times 10^{-3}$		–
e^+e^-	$(1.57 \pm 0.08) \times 10^{-5}$		5290
$\rho^+\rho^-$	$< 5.7 \times 10^{-6}$	90%	5233
$K^*(892)^0\overline{K}^0$	$< 2.0 \times 10^{-6}$	90%	5240
$J/\psi(1S)$ anything	$< 1.9 \times 10^{-4}$	95%	–
D^{*+} anything + c.c.	< 7.4 %	90%	5099
ϕ anything	(7.1 ± 0.6) %		5240
$\phi\eta$	$< 1.8 \times 10^{-6}$	90%	5226
$\phi\eta'$	$< 4.3 \times 10^{-6}$	90%	5196
$\rho\eta$	$< 1.3 \times 10^{-6}$	90%	5247

$\rho\eta'$	< 2.5	$\times 10^{-6}$	90%	5217
$\Upsilon(1S)$ anything	< 4	$\times 10^{-3}$	90%	1053
$\Upsilon(1S)\pi^+\pi^-$	(8.2 ± 0.4)	$\times 10^{-5}$		1026
$\Upsilon(1S)\eta$	(1.81 ± 0.18)	$\times 10^{-4}$		924
$\Upsilon(1S)\eta'$	(3.4 ± 0.9)	$\times 10^{-5}$		–
$\Upsilon(2S)\pi^+\pi^-$	(8.2 ± 0.8)	$\times 10^{-5}$		468
$h_b(1P)\pi^+\pi^-$	not seen			600
$h_b(1P)\eta$	(2.18 ± 0.21)	$\times 10^{-3}$		390
$\eta_b(1S)\omega$	< 1.8	$\times 10^{-4}$	90%	–
^2H anything	< 1.3	$\times 10^{-5}$	90%	–

Double Radiative Decays

$\gamma\gamma\,\Upsilon(\mathrm{D}) \to \gamma\gamma\eta\,\Upsilon(1S)$	< 2.3	$\times 10^{-5}$	90%	–

$\Upsilon(10753)$

$I^G(J^{PC}) = ?^?(1^{--})$

Mass $m = 10756.6 \pm 2.8$ MeV
Full width $\Gamma = 29 \pm 9$ MeV

$\Upsilon(10860)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 10885.2^{+2.6}_{-1.6}$ MeV
Full width $\Gamma = 37 \pm 4$ MeV

$\Upsilon(10860)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$B\overline{B}X$	$(73.5\ ^{+1.5}_{-2.8})$ %		–
$B\overline{B}$	(5.5 ± 1.0) %		1322
$B\overline{B}^* +$ c.c.	(13.7 ± 1.6) %		–
$B^*\overline{B}^*$	(38.1 ± 3.4) %		1127
$B\overline{B}^{(*)}\pi$	< 19.7 %	90%	1015
$B\overline{B}\pi$	(0.0 ± 1.2) %		1015
$B^*\overline{B}\pi + B\overline{B}^*\pi$	(7.3 ± 2.3) %		–
$B^*\overline{B}^*\pi$	(1.0 ± 1.4) %		739
$B\overline{B}\pi\pi$	< 8.9 %	90%	550
$B_s^{(*)}\overline{B}_s^{(*)}$	(21.3 ± 1.5) %		904
$B_s\overline{B}_s$	$(6 \pm 5)\times 10^{-3}$		904
$B_s\overline{B}_s^* +$ c.c.	(1.44 ± 0.28) %		–
$B_s^*\overline{B}_s^*$	(18.7 ± 1.3) %		543
no open-bottom	$(4.8\ ^{+4.0}_{-0.5})$ %		–
e^+e^-	$(8.3 \pm 2.1)\times 10^{-6}$		5443
$K^*(892)^0\overline{K}^0$	< 1.0 $\times 10^{-5}$	90%	5395

$\Upsilon(1S)\pi^+\pi^-$	(5.3 $\pm$0.6) $\times 10^{-3}$			1306
$\Upsilon(1S)\eta$	(8.5 $\pm$1.7) $\times 10^{-4}$			1229
$\Upsilon(1S)\eta'$	$<$ 6.9 $\times 10^{-5}$		90%	985
$\Upsilon(2S)\pi^+\pi^-$	(7.8 $\pm$1.3) $\times 10^{-3}$			783
$\Upsilon(2S)\eta$	(4.1 $\pm$0.6) $\times 10^{-3}$			639
$\Upsilon(3S)\pi^+\pi^-$	(4.8 $^{+1.9}_{-1.7}$) $\times 10^{-3}$			440
$\Upsilon(1S)K^+K^-$	(6.1 $\pm$1.8) $\times 10^{-4}$			959
$\eta\,\Upsilon_J(1D)$	(4.8 $\pm$1.1) $\times 10^{-3}$			–
$h_b(1P)\pi^+\pi^-$	(3.5 $^{+1.0}_{-1.3}$) $\times 10^{-3}$			903
$h_b(2P)\pi^+\pi^-$	(5.7 $^{+1.7}_{-2.1}$) $\times 10^{-3}$			544
$\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	(2.5 $\pm$2.3) $\times 10^{-3}$			894
$\chi_{b0}(1P)\pi^+\pi^-\pi^0$	$<$ 6.3 $\times 10^{-3}$		90%	894
$\chi_{b0}(1P)\omega$	$<$ 3.9 $\times 10^{-3}$		90%	631
$\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega}$	$<$ 4.8 $\times 10^{-3}$		90%	–
$\chi_{b1}(1P)\pi^+\pi^-\pi^0$	(1.85$\pm$0.33) $\times 10^{-3}$			861
$\chi_{b1}(1P)\omega$	(1.57$\pm$0.30) $\times 10^{-3}$			582
$\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega}$	(5.2 $\pm$1.9) $\times 10^{-4}$			–
$\chi_{b2}(1P)\pi^+\pi^-\pi^0$	(1.17$\pm$0.30) $\times 10^{-3}$			841
$\chi_{b2}(1P)\omega$	(6.0 $\pm$2.7) $\times 10^{-4}$			552
$\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega}$	(6 $\pm$4) $\times 10^{-4}$			–
$\gamma X_b \rightarrow\ \gamma\,\Upsilon(1S)\omega$	$<$ 3.8 $\times 10^{-5}$		90%	–
$\eta_b(1S)\omega$	$<$ 1.3 $\times 10^{-3}$		90%	1177
$\eta_b(2S)\omega$	$<$ 5.6 $\times 10^{-3}$		90%	399

Inclusive Decays.

These decay modes are submodes of one or more of the decay modes above.

ϕ anything	(13.8 $^{+2.4}_{-1.7}$) %		–
D^0 anything + c.c.	(112 $\pm$6) %		–
D_s anything + c.c.	(44.7 $\pm$2.6) %		–
J/ψ anything	(2.06$\pm$0.21) %		–
B^0 anything + c.c.	(77 $\pm$8) %		–
B^+ anything + c.c.	(72 $\pm$6) %		–

$\Upsilon(11020)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 11000 \pm 4$ MeV
Full width $\Gamma = 24^{+8}_{-6}$ MeV

$\Upsilon(11020)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$e^+ e^-$	$(5.4^{+1.9}_{-2.1}) \times 10^{-6}$	5500
$\chi_{bJ}(1P)\pi^+\pi^-\pi^0$	$(9\ ^{+9}_{-8}\ ) \times 10^{-3}$	1007
$\chi_{b1}(1P)\pi^+\pi^-\pi^0$	seen	975
$\chi_{b2}(1P)\pi^+\pi^-\pi^0$	seen	956

NOTES

[*a*] $2m_\tau < \mathrm{M}(\tau^+\tau^-) < 9.2$ GeV

[*b*] 2 GeV $< m_{K^+K^-} <$ 3 GeV

[*c*] $X\overline{X}$ = vectors with $m < 3.1$ GeV

[*d*] X and $\overline{X}$ = zero spin with $m < 4.5$ GeV

[*e*] 1.5 GeV $< m_X <$ 5.0 GeV

[*f*] 201 MeV $< \mathrm{M}(\mu^+\mu^-) <$ 3565 MeV

[*g*] 0.5 GeV $< m_X <$ 9.0 GeV, where m_X is the invariant mass of the hadronic final state.

[*h*] 1.5 GeV $< m_X <$ 5.0 GeV

[*i*] 1.5 GeV $< m_X <$ 5.0 GeV

[*j*] For $m_{\tau^+\tau^-}$ in the ranges 4.03–9.52 and 9.61–10.10 GeV.