$b\overline{b}$ MESONS (including possibly non-$q\overline{q}$ 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	$\times 10^{-6}$	CL=90%	–
$Z_c(3900)^{\pm}$ anything, $Z_c \to J/\psi(1S)\pi^{\pm}$	$<$	1.3	$\times 10^{-5}$	CL=90%	–
$Z_c(4200)^{\pm}$ anything, $Z_c \to J/\psi(1S)\pi^{\pm}$	$<$	6.0	$\times 10^{-5}$	CL=90%	–
$Z_c(4430)^{\pm}$ anything, $Z_c \to J/\psi(1S)\pi^{\pm}$	$<$	4.9	$\times 10^{-5}$	CL=90%	–
$X_{cs}^{\pm}$ 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 $\pm$0.35)	$\times 10^{-4}$		–
$\chi_{c1}(1P)X_{tetra}$	$<$	3.78	$\times 10^{-5}$	CL=90%	–
χ_{c2} anything	(	2.8 $\pm$0.8)	$\times 10^{-4}$		–
$\psi(2S)$ anything	(	1.23 $\pm$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%	–
$X(4050)^{\pm}$ anything, $X \to \psi(2S)\pi^{\pm}$	$<$	8.8	$\times 10^{-5}$	CL=90%	–
$Z_c(4430)^{\pm}$ anything, $Z_c \to \psi(2S)\pi^{\pm}$	$<$	6.7	$\times 10^{-5}$	CL=90%	–
$\chi_{c1}(3872)$ anything	$<$	2.5	$\times 10^{-4}$	CL=90%	–
$Z_c(4200)^+ Z_c(4200)^-$	$<$	2.23	$\times 10^{-5}$	CL=90%	–
$Z_c(3900)^{\pm} Z_c(4200)^{\mp}$	$<$	8.1	$\times 10^{-6}$	CL=90%	–
$Z_c(3900)^+ Z_c(3900)^-$	$<$	1.8	$\times 10^{-6}$	CL=90%	–
$X(4050)^+ X(4050)^-$	$<$	1.58	$\times 10^{-5}$	CL=90%	–
$X(4250)^+ X(4250)^-$	$<$	2.66	$\times 10^{-5}$	CL=90%	–

$X(4050)^{\pm} X(4250)^{\mp}$		$<$ 4.42		$\times 10^{-5}$	CL=90%	–
$Z_c(4430)^{+} Z_c(4430)^{-}$		$<$ 2.03		$\times 10^{-5}$	CL=90%	–
$X(4055)^{\pm} X(4055)^{\mp}$		$<$ 2.33		$\times 10^{-5}$	CL=90%	–
$X(4055)^{\pm} Z_c(4430)^{\mp}$		$<$ 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
ϕK^+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	$\pm$0.13)	$\times 10^{-5}$		4704
$\gamma p\overline{p}$	[b]	$<$ 6		$\times 10^{-6}$	CL=90%	4636
$\gamma 2h^+2h^-$		(7.0	$\pm$1.5)	$\times 10^{-4}$		4720
$\gamma 3h^+3h^-$		(5.4	$\pm$2.0)	$\times 10^{-4}$		4703
$\gamma 4h^+4h^-$		(7.4	$\pm$3.5)	$\times 10^{-4}$		4679
$\gamma\pi^+\pi^- K^+K^-$		(2.9	$\pm$0.9)	$\times 10^{-4}$		4686
$\gamma 2\pi^+2\pi^-$		(2.5	$\pm$0.9)	$\times 10^{-4}$		4720
$\gamma 3\pi^+3\pi^-$		(2.5	$\pm$1.2)	$\times 10^{-4}$		4703
$\gamma 2\pi^+2\pi^- K^+K^-$		(2.4	$\pm$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%	4571
$\gamma f_0(1710) \to \gamma K^+ K^-$		(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%	–
$\gamma X \to \gamma +\geq 4$ 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) %			–

$\chi_{b0}(1P)$ [h]

$I^G(J^{PC}) = 0^+(0^{++})$
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^0X	< 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
$2\pi^+\pi^-K^-K^0_S2\pi^0$	< 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%	–

$\chi_{b1}(1P)$ [h]

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

Mass $m = 9892.78 \pm 0.26 \pm 0.31$ MeV

$\chi_{b1}(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\gamma\Upsilon(1S)$	(35.2 ±2.0) %		423
D^0X	(12.6 ±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 ± 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)	p (MeV/c)
$\eta_b(1S)\gamma$	(52^{+6}_{-5}) %	488

$\chi_{b2}(1P)$ [h]

$I^G(J^{PC}) = 0^+(2^{++})$
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) $\times 10^{-5}$		4902
$2\pi^+\pi^- K^- K^0_S$	$< 1.0 \times 10^{-4}$	90%	4901
$2\pi^+\pi^- K^- K^0_S 2\pi^0$	$(5.3\pm2.4) \times 10^{-4}$		4873
$2\pi^+ 2\pi^- 2\pi^0$	$(3.5\pm1.4) \times 10^{-4}$		4931

$2\pi^+2\pi^-K^+K^-$	$(\ 1.1\pm0.4)\times10^{-4}$		4888
$2\pi^+2\pi^-K^+K^-\pi^0$	$(\ 2.1\pm0.9)\times10^{-4}$		4872
$2\pi^+2\pi^-K^+K^-2\pi^0$	$(\ 3.9\pm1.8)\times10^{-4}$		4855
$3\pi^+2\pi^-K^-K^0_S\pi^0$	$<\ 5\ \times10^{-4}$	90%	4854
$3\pi^+3\pi^-$	$(\ 7.0\pm3.1)\times10^{-5}$		4931
$3\pi^+3\pi^-2\pi^0$	$(\ 1.0\pm0.4)\times10^{-3}$		4908
$3\pi^+3\pi^-K^+K^-$	$<\ 8\ \times10^{-5}$	90%	4854
$3\pi^+3\pi^-K^+K^-\pi^0$	$(\ 3.6\pm1.5)\times10^{-4}$		4835
$4\pi^+4\pi^-$	$(\ 8\ \pm4\ )\times10^{-5}$		4907
$4\pi^+4\pi^-2\pi^0$	$(\ 1.8\pm0.7)\times10^{-3}$		4877
$J/\psi\,J/\psi$	$<\ 4\ \times10^{-5}$	90%	3869
$J/\psi\psi(2S)$	$<\ 5\ \times10^{-5}$	90%	3608
$\psi(2S)\psi(2S)$	$<\ 1.6\ \times10^{-5}$	90%	3313
$J/\psi(1S)$ anything	$(\ 1.5\pm0.4)\times10^{-3}$		–

$\Upsilon(2S)$

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

Mass $m = 10023.4 \pm 0.5$ MeV
$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.50 \pm 0.13$ 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
$\Upsilon(1S)\pi^0$	$<\ 4\ \times10^{-5}$	CL=90%	531
$\Upsilon(1S)\eta$	$(\ 2.9\ \pm\ 0.4\ )\times10^{-4}$	S=2.0	126
$J/\psi(1S)$ anything	$<\ 6\ \times10^{-3}$	CL=90%	4533
$J/\psi(1S)\eta_c$	$<\ 5.4\ \times10^{-6}$	CL=90%	3984
$J/\psi(1S)\chi_{c0}$	$<\ 3.4\ \times10^{-6}$	CL=90%	3808
$J/\psi(1S)\chi_{c1}$	$<\ 1.2\ \times10^{-6}$	CL=90%	3765
$J/\psi(1S)\chi_{c2}$	$<\ 2.0\ \times10^{-6}$	CL=90%	3745
$J/\psi(1S)\eta_c(2S)$	$<\ 2.5\ \times10^{-6}$	CL=90%	3707
$J/\psi(1S)X(3940)$	$<\ 2.0\ \times10^{-6}$	CL=90%	3555
$J/\psi(1S)X(4160)$	$<\ 2.0\ \times10^{-6}$	CL=90%	3442
χ_{c1} anything	$(\ 2.2\ \pm\ 0.5\ )\times10^{-4}$		–
$\chi_{c1}(1P)^0X_{tetra}$	$<\ 3.67\ \times10^{-5}$	CL=90%	–
χ_{c2} anything	$(\ 2.3\ \pm\ 0.8\ )\times10^{-4}$		–
$\psi(2S)\eta_c$	$<\ 5.1\ \times10^{-6}$	CL=90%	3732
$\psi(2S)\chi_{c0}$	$<\ 4.7\ \times10^{-6}$	CL=90%	3536
$\psi(2S)\chi_{c1}$	$<\ 2.5\ \times10^{-6}$	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
$Z_c(3900)^+ Z_c(3900)^-$	$<$ 1.0	$\times 10^{-6}$	CL=90%	–
$Z_c(4200)^+ Z_c(4200)^-$	$<$ 1.67	$\times 10^{-5}$	CL=90%	–
$Z_c(3900)^\pm Z_c(4200)^\mp$	$<$ 7.3	$\times 10^{-6}$	CL=90%	–
$X(4050)^+ X(4050)^-$	$<$ 1.35	$\times 10^{-5}$	CL=90%	–
$X(4250)^+ X(4250)^-$	$<$ 2.67	$\times 10^{-5}$	CL=90%	–
$X(4050)^\pm X(4250)^\mp$	$<$ 2.72	$\times 10^{-5}$	CL=90%	–
$Z_c(4430)^+ Z_c(4430)^-$	$<$ 2.03	$\times 10^{-5}$	CL=90%	–
$X(4055)^\pm X(4055)^\mp$	$<$ 1.11	$\times 10^{-5}$	CL=90%	–
$X(4055)^\pm Z_c(4430)^\mp$	$<$ 2.11	$\times 10^{-5}$	CL=90%	–
$\overline{^2H}$ anything	$(\ 2.78^{+\ 0.30}_{-\ 0.26}) \times 10^{-5}$		S=1.2	–
hadrons	(94 $\pm$11) %			–
$g\,g\,g$	(58.8 $\pm$ 1.2) %			–
$\gamma\,g\,g$	(1.87$\pm$ 0.28) %			–
$\phi K^+ K^-$	(1.6 $\pm$ 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 $\pm$ 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 $\pm$ 0.6) $\times 10^{-6}$			4869
$K_1(1270)^\pm K^\mp$	$<$ 3.22	$\times 10^{-6}$	CL=90%	4921
$K_1(1400)^\pm K^\mp$	$<$ 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$\pm$ 0.28) $\times 10^{-5}$			5002
$K_S^0 K^+\pi^- +$ c.c.	(1.14$\pm$ 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 $\pm$ 1.6) $\times 10^{-3}$			–
$f_1(1285)X_{tetra}$	$<$ 6.47	$\times 10^{-5}$	CL=90%	–
Sum of 100 exclusive modes	(2.90$\pm$ 0.30) $\times 10^{-3}$			–

Radiative decays

$\gamma\chi_{b1}(1P)$	(6.9 $\pm$ 0.4) %			130
$\gamma\chi_{b2}(1P)$	(7.15$\pm$ 0.35) %			111
$\gamma\chi_{b0}(1P)$	(3.8 $\pm$ 0.4) %			163
$\gamma f_0(1710)$	$<$ 5.9	$\times 10^{-4}$	CL=90%	4862
$\gamma f_2'(1525)$	$<$ 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%	4568
$\gamma \chi_{c0}$	$<$	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
$\gamma \chi_{c1}(3872)$	$<$	2.1	$\times 10^{-5}$	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	[i] $<$	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*	$<$ 3.2	$\times 10^{-6}$	CL=90%	4854
$\mu^\pm \tau^\mp$	*LF*	$<$ 3.3	$\times 10^{-6}$	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
$\pi^+\pi^-\,\Upsilon(1S)$	$(6.6\pm1.6) \times 10^{-3}$	623

$\chi_{b0}(2P)$ [h]

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

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
$\gamma\,\Upsilon(1S)$	$(3.8 \ \pm1.7 \ ) \times 10^{-3}$		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

$\chi_{b1}(2P)$ [h]

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

$\chi_{b1}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega\,\Upsilon(1S)$	$(1.63^{+0.40}_{-0.34})$ %	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)	p (MeV/c)
hadrons	not seen	–
$\eta_b(1S)\gamma$	(22± 5) %	825
$\eta_b(2S)\gamma$	(48±13) %	257

$\chi_{b2}(2P)$ [h]

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

Mass $m = 10268.65 \pm 0.22 \pm 0.50$ MeV
$m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)} = 13.10 \pm 0.24$ MeV

$\chi_{b2}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\omega\,\Upsilon(1S)$	$(1.10^{+0.34}_{-0.30})$ %		194
$\gamma\,\Upsilon(2S)$	(8.9 ±1.2) %		242
$\gamma\,\Upsilon(1S)$	(6.6 ±0.8) %		776
$\pi\pi\,\chi_{b2}(1P)$	(5.1 ±0.9) $\times 10^{-3}$		229
$D^0 X$	< 2.4 %	90%	–
$\pi^+\pi^- K^+ K^- \pi^0$	< 1.1 $\times 10^{-4}$	90%	5082
$2\pi^+\pi^- K^- K^0_S$	< 9 $\times 10^{-5}$	90%	5082
$2\pi^+\pi^- K^- K^0_S 2\pi^0$	< 7 $\times 10^{-4}$	90%	5054
$2\pi^+ 2\pi^- 2\pi^0$	(3.9 ±1.6) $\times 10^{-4}$		5110
$2\pi^+ 2\pi^- K^+ K^-$	(9 ±4) $\times 10^{-5}$		5068
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	(2.4 ±1.1) $\times 10^{-4}$		5054
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(4.7 ±2.3) $\times 10^{-4}$		5037
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	< 4 $\times 10^{-4}$	90%	5036
$3\pi^+ 3\pi^-$	(9 ±4) $\times 10^{-5}$		5110
$3\pi^+ 3\pi^- 2\pi^0$	(1.2 ±0.4) $\times 10^{-3}$		5088
$3\pi^+ 3\pi^- K^+ K^-$	(1.4 ±0.7) $\times 10^{-4}$		5036
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	(4.2 ±1.7) $\times 10^{-4}$		5017
$4\pi^+ 4\pi^-$	(9 ±5) $\times 10^{-5}$		5087
$4\pi^+ 4\pi^- 2\pi^0$	(1.3 ±0.5) $\times 10^{-3}$		5058

$\Upsilon(3S)$

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

Mass $m = 10355.1 \pm 0.5$ MeV
$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.50 \pm 0.13$ MeV
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	[j] < 2.2 $\times 10^{-4}$	CL=95%	–
$\gamma A^0 \to \gamma\mu^+\mu^-$	< 5.5 $\times 10^{-6}$	CL=90%	–
$\gamma A^0 \to \gamma\tau^+\tau^-$	[k] < 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

$\chi_{b1}(3P)$ [h]

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

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

$\chi_{b2}(3P)$ [h]

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

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^-	(51.4 $\pm$0.6) %		331
D_s^+ anything + c.c.	(17.8 $\pm$2.6) %		–
$B^0\overline{B}^0$	(48.6 $\pm$0.6) %		326
$J/\psi K_S^0 + (J/\psi,\ \eta_c)K_S^0$	$< 4 \times 10^{-7}$	90%	–
non-$B\overline{B}$	< 4 %	95%	–
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 $\pm$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 $\pm$0.4)	$\times 10^{-5}$		1026
$\Upsilon(1S)\eta$	(1.81$\pm$0.18)	$\times 10^{-4}$		924
$\Upsilon(1S)\eta'$	(3.4 $\pm$0.9)	$\times 10^{-5}$		–
$\Upsilon(2S)\pi^+\pi^-$	(8.2 $\pm$0.8)	$\times 10^{-5}$		468
$h_b(1P)\pi^+\pi^-$	not seen			600
$h_b(1P)\eta$	(2.18$\pm$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%	–

$\Upsilon(10860)$

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

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)
$B\overline{B}X$	(76.2 $^{+2.7}_{-4.0}$) %		–
$B\overline{B}$	(5.5 $\pm$1.0) %		1322
$B\overline{B}^* +$ c.c.	(13.7 $\pm$1.6) %		–
$B^*\overline{B}^*$	(38.1 $\pm$3.4) %		1127
$B\overline{B}^{(*)}\pi$	$<$ 19.7 %	90%	1015
$B\overline{B}\pi$	(0.0 $\pm$1.2) %		1015
$B^*\overline{B}\pi + B\overline{B}^*\pi$	(7.3 $\pm$2.3) %		–
$B^*\overline{B}^*\pi$	(1.0 $\pm$1.4) %		739
$B\overline{B}\pi\pi$	$<$ 8.9 %	90%	551
$B_s^{(*)}\overline{B}_s^{(*)}$	(20.1 $\pm$3.1) %		905
$B_s\overline{B}_s$	(5 $\pm$5) $\times 10^{-3}$		905
$B_s\overline{B}_s^* +$ c.c.	(1.35$\pm$0.32) %		–
$B_s^*\overline{B}_s^*$	(17.6 $\pm$2.7) %		543
no open-bottom	(3.8 $^{+5.0}_{-0.5}$) %		–
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.	(108 $\pm$8) %	–
D_s anything + c.c.	(46 $\pm$6) %	–
J/ψ anything	(2.06$\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*] Spectroscopic labeling for these states is theoretical, pending experimental information.

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

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

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