$b\overline{b}$ MESONS

$\Upsilon(1S)$

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

Mass $m = 9460.30 \pm 0.26$ MeV (S = 3.3)
Full width $\Gamma = 54.02 \pm 1.25$ keV
$\Gamma_{ee} = 1.340 \pm 0.018$ keV

$\Upsilon(1S)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\tau^+\tau^-$	(2.60 ±0.10) %		4384
e^+e^-	(2.38 ±0.11) %		4730
$\mu^+\mu^-$	(2.48 ±0.05) %		4729
Hadronic decays			
ggg	(81.7 ±0.7) %		–
γgg	(2.2 ±0.6) %		–
$\eta'(958)$ anything	(2.94 ±0.24) %		–
$J/\psi(1S)$ anything	(6.5 ±0.7) $\times 10^{-4}$		4223
χ_{c0} anything	$< 5 \times 10^{-3}$	90%	–
χ_{c1} anything	(2.3 ±0.7) $\times 10^{-4}$		–
χ_{c2} anything	(3.4 ±1.0) $\times 10^{-4}$		–
$\psi(2S)$ anything	(2.7 ±0.9) $\times 10^{-4}$		–
$\rho\pi$	$< 2 \times 10^{-4}$	90%	4697
$\pi^+\pi^-$	$< 5 \times 10^{-4}$	90%	4728
K^+K^-	$< 5 \times 10^{-4}$	90%	4704
$p\overline{p}$	$< 5 \times 10^{-4}$	90%	4636
$\pi^0\pi^+\pi^-$	$< 1.84 \times 10^{-5}$	90%	4725
$D^*(2010)^\pm$ anything	(2.52 ±0.20) %		–
$\overline{d}$ anything	(2.86 ±0.28) $\times 10^{-5}$		–
Sum of 100 exclusive modes	(1.200±0.017) %		–
Radiative decays			
$\gamma\pi^+\pi^-$	(6.3 ±1.8) $\times 10^{-5}$		4728
$\gamma\pi^0\pi^0$	(1.7 ±0.7) $\times 10^{-5}$		4728
$\gamma\pi^0\eta$	$< 2.4 \times 10^{-6}$	90%	4713
γK^+K^-	[a] (1.14 ±0.13) $\times 10^{-5}$		4704
$\gamma p\overline{p}$	[b] $< 6 \times 10^{-6}$	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)	$\times 10^{-4}$		4658
$\gamma \pi^+ \pi^- p\overline{p}$		(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		$\times 10^{-6}$	90%	4682
$\gamma \eta$		$<$ 1.0		$\times 10^{-6}$	90%	4714
$\gamma f_0(980)$		$<$ 3		$\times 10^{-5}$	90%	4678
$\gamma f_2'(1525)$		(3.8	± 0.9)	$\times 10^{-5}$		4607
$\gamma f_2(1270)$		(1.01	± 0.09)	$\times 10^{-4}$		4644
$\gamma \eta(1405)$		$<$ 8.2		$\times 10^{-5}$	90%	4625
$\gamma f_0(1500)$		$<$ 1.5		$\times 10^{-5}$	90%	4610
$\gamma f_0(1710)$		$<$ 2.6		$\times 10^{-4}$	90%	4574
$\gamma f_0(1710) \to \gamma K^+ K^-$		$<$ 7		$\times 10^{-6}$	90%	–
$\gamma f_0(1710) \to \gamma \pi^0 \pi^0$		$<$ 1.4		$\times 10^{-6}$	90%	–
$\gamma f_0(1710) \to \gamma \eta \eta$		$<$ 1.8		$\times 10^{-6}$	90%	–
$\gamma f_4(2050)$		$<$ 5.3		$\times 10^{-5}$	90%	4515
$\gamma f_0(2200) \to \gamma K^+ K^-$		$<$ 2		$\times 10^{-4}$	90%	4475
$\gamma f_J(2220) \to \gamma K^+ K^-$		$<$ 8		$\times 10^{-7}$	90%	4469
$\gamma f_J(2220) \to \gamma \pi^+ \pi^-$		$<$ 6		$\times 10^{-7}$	90%	–
$\gamma f_J(2220) \to \gamma p\overline{p}$		$<$ 1.1		$\times 10^{-6}$	90%	–
$\gamma \eta(2225) \to \gamma \phi \phi$		$<$ 3		$\times 10^{-3}$	90%	4469
$\gamma \eta_c(1S)$		$<$ 5.7		$\times 10^{-5}$	90%	4260
$\gamma \chi_{c0}$		$<$ 6.5		$\times 10^{-4}$	90%	4114
$\gamma \chi_{c1}$		$<$ 2.3		$\times 10^{-5}$	90%	4079
$\gamma \chi_{c2}$		$<$ 7.6		$\times 10^{-6}$	90%	4062
$\gamma X(3872) \to \pi^+ \pi^- J/\psi$		$<$ 1.6		$\times 10^{-6}$	90%	–
$\gamma X(3872) \to \pi^+ \pi^- \pi^0 J/\psi$		$<$ 2.8		$\times 10^{-6}$	90%	–
$\gamma X(3915) \to \omega J/\psi$		$<$ 3.0		$\times 10^{-6}$	90%	–
$\gamma X(4140) \to \phi J/\psi$		$<$ 2.2		$\times 10^{-6}$	90%	–
γX	[c]	$<$ 4.5		$\times 10^{-6}$	90%	–
$\gamma X\overline{X}(m_X < 3.1$ GeV)	[d]	$<$ 1		$\times 10^{-3}$	90%	–
$\gamma X\overline{X}(m_X < 4.5$ GeV)	[e]	$<$ 2.4		$\times 10^{-4}$	90%	–
$\gamma X \to \gamma +\geq 4$ prongs	[f]	$<$ 1.78		$\times 10^{-4}$	95%	–
$\gamma a_1^0 \to \gamma \mu^+ \mu^-$	[g]	$<$ 9		$\times 10^{-6}$	90%	–
$\gamma a_1^0 \to \gamma \tau^+ \tau^-$	[a]	$<$ 5.0		$\times 10^{-5}$	90%	–

Lepton Family number (*LF*) violating modes

$\mu^\pm \tau^\mp$	*LF*	$<$ 6.0		$\times 10^{-6}$	95%	4563

Other decays

invisible		$<$ 3.0		$\times 10^{-4}$	90%	–

$\chi_{b0}(1P)$ [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)
$\gamma\,\Upsilon(1S)$	(1.76±0.35) %		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
$2\pi^+\pi^-K^-K^0_S2\pi^0$	< 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

$\chi_{b1}(1P)$ [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)
$\gamma\,\Upsilon(1S)$	(33.9±2.2) %		423
$D^0\,X$	(12.6±2.2) %		–
$\pi^+\pi^-K^+K^-\pi^0$	(2.0±0.6) $\times 10^{-4}$		4892
$2\pi^+\pi^-K^-K^0_S$	(1.3±0.5) $\times 10^{-4}$		4892
$2\pi^+\pi^-K^-K^0_S2\pi^0$	< 6 $\times 10^{-4}$	90%	4863
$2\pi^+2\pi^-2\pi^0$	(8.0±2.5) $\times 10^{-4}$		4921
$2\pi^+2\pi^-K^+K^-$	(1.5±0.5) $\times 10^{-4}$		4878
$2\pi^+2\pi^-K^+K^-\pi^0$	(3.5±1.2) $\times 10^{-4}$		4863
$2\pi^+2\pi^-K^+K^-2\pi^0$	(8.6±3.2) $\times 10^{-4}$		4845
$3\pi^+2\pi^-K^-K^0_S\pi^0$	(9.3±3.3) $\times 10^{-4}$		4844
$3\pi^+3\pi^-$	(1.9±0.6) $\times 10^{-4}$		4921
$3\pi^+3\pi^-2\pi^0$	(1.7±0.5) $\times 10^{-3}$		4898

$3\pi^+3\pi^-K^+K^-$	$(\ 2.6\pm0.8)\times10^{-4}$	4844
$3\pi^+3\pi^-K^+K^-\pi^0$	$(\ 7.5\pm2.6)\times10^{-4}$	4825
$4\pi^+4\pi^-$	$(\ 2.6\pm0.9)\times10^{-4}$	4897
$4\pi^+4\pi^-2\pi^0$	$(\ 1.4\pm0.6)\times10^{-3}$	4867

$h_b(1P)$

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

Mass $m = 9899.3 \pm 1.0$ MeV

$h_b(1P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta_b(1S)\gamma$	(49^{+8}_{-7}) %	489

$\chi_{b2}(1P)$ [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)
$\gamma\,\Upsilon(1S)$	(19.1±1.2) %		442
D^0X	$<$ 7.9 %	90%	–
$\pi^+\pi^-K^+K^-\pi^0$	$(\ 8\ \pm5\ )\times10^{-5}$		4902
$2\pi^+\pi^-K^-K^0_S$	$<$ 1.0 $\times10^{-4}$	90%	4901
$2\pi^+\pi^-K^-K^0_S2\pi^0$	$(\ 5.3\pm2.4)\times10^{-4}$		4873
$2\pi^+2\pi^-2\pi^0$	$(\ 3.5\pm1.4)\times10^{-4}$		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

$\Upsilon(2S)$

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

Mass $m = 10023.26 \pm 0.31$ MeV
$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.50 \pm 0.13$ MeV
Full width $\Gamma = 31.98 \pm 2.63$ keV
$\Gamma_{ee} = 0.612 \pm 0.011$ 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
$\Upsilon(1S)\pi^0$	$< 4 \times 10^{-5}$	CL=90%	531
$\Upsilon(1S)\eta$	$(2.9 \pm 0.4) \times 10^{-4}$	S=2.0	126
$J/\psi(1S)$ anything	$< 6 \times 10^{-3}$	CL=90%	4533
$\overline{d}$ anything	$(3.4 \pm 0.6) \times 10^{-5}$		–
hadrons	(94 ±11) %		–
ggg	(58.8 ± 1.2) %		–
γgg	(8.8 ± 1.1) %		–
Sum of 100 exclusive modes	$(2.90 \pm 0.30) \times 10^{-3}$		–
Radiative decays			
$\gamma\chi_{b1}(1P)$	(6.9 ± 0.4) %		130
$\gamma\chi_{b2}(1P)$	(7.15 ± 0.35) %		110
$\gamma\chi_{b0}(1P)$	(3.8 ± 0.4) %		162
$\gamma f_0(1710)$	$< 5.9 \times 10^{-4}$	CL=90%	4864
$\gamma f_2'(1525)$	$< 5.3 \times 10^{-4}$	CL=90%	4896
$\gamma f_2(1270)$	$< 2.41 \times 10^{-4}$	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
$\gamma X(3872) \to \pi^+\pi^- J/\psi$	$< 8 \times 10^{-7}$	CL=90%	–
$\gamma X(3872) \to \pi^+\pi^-\pi^0 J/\psi$	$< 2.4 \times 10^{-6}$	CL=90%	–
$\gamma X(3915) \to \omega J/\psi$	$< 2.8 \times 10^{-6}$	CL=90%	–
$\gamma X(4140) \to \phi J/\psi$	$< 1.2 \times 10^{-6}$	CL=90%	–
$\gamma X(4350) \to \phi J/\psi$	$< 1.3 \times 10^{-6}$	CL=90%	–
$\gamma\eta_b(1S)$	$(3.9 \pm 1.5) \times 10^{-4}$		606
$\gamma X \to \gamma + \geq 4$ prongs	[i] $< 1.95 \times 10^{-4}$	CL=95%	–
$\gamma A^0 \to \gamma$hadrons	$< 8 \times 10^{-5}$	CL=90%	–
$\gamma a_1^0 \to \gamma\mu^+\mu^-$	$< 8.3 \times 10^{-6}$	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

$\Upsilon(1D)$

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

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

$\Upsilon(1D)$ 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

$\chi_{b0}(2P)$ [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)
$\gamma\,\Upsilon(2S)$	(4.6 ± 2.1) %		207
$\gamma\,\Upsilon(1S)$	$(9\ \pm6\ )\times10^{-3}$		743
D^0X	$<$ 8.2 %	90%	–
$\pi^+\pi^-K^+K^-\pi^0$	$<$ 3.4 $\times10^{-5}$	90%	5064
$2\pi^+\pi^-K^-K^0_S$	$<$ 5 $\times10^{-5}$	90%	5063
$2\pi^+\pi^-K^-K^0_S2\pi^0$	$<$ 2.2 $\times10^{-4}$	90%	5036
$2\pi^+2\pi^-2\pi^0$	$<$ 2.4 $\times10^{-4}$	90%	5092
$2\pi^+2\pi^-K^+K^-$	$<$ 1.5 $\times10^{-4}$	90%	5050
$2\pi^+2\pi^-K^+K^-\pi^0$	$<$ 2.2 $\times10^{-4}$	90%	5035
$2\pi^+2\pi^-K^+K^-2\pi^0$	$<$ 1.1 $\times10^{-3}$	90%	5019
$3\pi^+2\pi^-K^-K^0_S\pi^0$	$<$ 7 $\times10^{-4}$	90%	5018
$3\pi^+3\pi^-$	$<$ 7 $\times10^{-5}$	90%	5091
$3\pi^+3\pi^-2\pi^0$	$<$ 1.2 $\times10^{-3}$	90%	5070
$3\pi^+3\pi^-K^+K^-$	$<$ 1.5 $\times10^{-4}$	90%	5017
$3\pi^+3\pi^-K^+K^-\pi^0$	$<$ 7 $\times10^{-4}$	90%	4999
$4\pi^+4\pi^-$	$<$ 1.7 $\times10^{-4}$	90%	5069
$4\pi^+4\pi^-2\pi^0$	$<$ 6 $\times10^{-4}$	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)	Scale factor	p (MeV/c)
$\omega\,\Upsilon(1S)$	$(\ 1.63^{+0.40}_{-0.34})$ %		135
$\gamma\,\Upsilon(2S)$	(19.9 ±1.9) %		230
$\gamma\,\Upsilon(1S)$	(9.2 ±0.8) %	1.1	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

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

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

Mass $m = 102686.5 \pm 0.22 \pm 0.50$ MeV
$m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)} = 13.5 \pm 0.6$ MeV

$\chi_{b2}(2P)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\omega\,\Upsilon(1S)$	$(\ 1.10^{+0.34}_{-0.30})$ %		50904
$\gamma\,\Upsilon(2S)$	(10.6 ±2.6) %	S=2.0	50854
$\gamma\,\Upsilon(1S)$	(7.0 ±0.7) %		50907
$\pi\pi\,\chi_{b2}(1P)$	(5.1 ±0.9) $\times 10^{-3}$		50864
$D^0 X$	< 2.4 %	CL=90%	–
$\pi^+\pi^- K^+ K^- \pi^0$	< 1.1 $\times 10^{-4}$	CL=90%	51338
$2\pi^+\pi^- K^- K^0_S$	< 9 $\times 10^{-5}$	CL=90%	51338

$2\pi^+\pi^- K^- K^0_S 2\pi^0$	$<$ 7	$\times 10^{-4}$	CL=90%	51335
$2\pi^+ 2\pi^- 2\pi^0$	(3.9 $\pm$1.6)	$\times 10^{-4}$		51341
$2\pi^+ 2\pi^- K^+ K^-$	(9 $\pm$4)	$\times 10^{-5}$		51337
$2\pi^+ 2\pi^- K^+ K^- \pi^0$	(2.4 $\pm$1.1)	$\times 10^{-4}$		51335
$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	(4.7 $\pm$2.3)	$\times 10^{-4}$		51334
$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	$<$ 4	$\times 10^{-4}$	CL=90%	51333
$3\pi^+ 3\pi^-$	(9 $\pm$4)	$\times 10^{-5}$		51341
$3\pi^+ 3\pi^- 2\pi^0$	(1.2 $\pm$0.4)	$\times 10^{-3}$		51339
$3\pi^+ 3\pi^- K^+ K^-$	(1.4 $\pm$0.7)	$\times 10^{-4}$		51333
$3\pi^+ 3\pi^- K^+ K^- \pi^0$	(4.2 $\pm$1.7)	$\times 10^{-4}$		51332
$4\pi^+ 4\pi^-$	(9 $\pm$5)	$\times 10^{-5}$		51339
$4\pi^+ 4\pi^- 2\pi^0$	(1.3 $\pm$0.5)	$\times 10^{-3}$		51336

$\Upsilon(3S)$

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

Mass $m = 10355.2 \pm 0.5$ MeV
$m_{\Upsilon(3S)} - m_{\Upsilon(2S)} = 331.50 \pm 0.13$ MeV
Full width $\Gamma = 20.32 \pm 1.85$ keV
$\Gamma_{ee} = 0.443 \pm 0.008$ keV

$\Upsilon(3S)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\Upsilon(2S)$ anything	(10.6 $\pm$0.8) %		296
$\Upsilon(2S)\pi^+\pi^-$	(2.82$\pm$0.18) %	S=1.6	177
$\Upsilon(2S)\pi^0\pi^0$	(1.85$\pm$0.14) %		190
$\Upsilon(2S)\gamma\gamma$	(5.0 $\pm$0.7) %		327
$\Upsilon(2S)\pi^0$	$<$ 5.1 $\times 10^{-4}$	CL=90%	298
$\Upsilon(1S)\pi^+\pi^-$	(4.37$\pm$0.08) %		813
$\Upsilon(1S)\pi^0\pi^0$	(2.20$\pm$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
$h_b(1P)\pi^0 \rightarrow \gamma\eta_b(1S)\pi^0$	(4.3 $\pm$1.4) $\times 10^{-4}$		–
$h_b(1P)\pi^+\pi^-$	$<$ 1.2 $\times 10^{-4}$	CL=90%	353
$\tau^+\tau^-$	(2.29$\pm$0.30) %		4863
$\mu^+\mu^-$	(2.18$\pm$0.21) %	S=2.1	5177
e^+e^-	seen		5178
ggg	(35.7 $\pm$2.6) %		–
γgg	(9.7 $\pm$1.8) $\times 10^{-3}$		–

Radiative decays

$\gamma\chi_{b2}(2P)$		(13.1 ±1.6) %		S=3.4	†
$\gamma\chi_{b1}(2P)$		(12.6 ±1.2) %		S=2.4	99
$\gamma\chi_{b0}(2P)$		(5.9 ±0.6) %		S=1.4	122
$\gamma\chi_{b2}(1P)$		(9.9 ±1.3)	$\times 10^{-3}$	S=2.0	434
$\gamma A^0 \rightarrow$ γhadrons		< 8	$\times 10^{-5}$	CL=90%	–
$\gamma\chi_{b1}(1P)$		(9 ±5)	$\times 10^{-4}$	S=1.9	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)	$\times 10^{-4}$		913
$\gamma X \rightarrow$ $\gamma +\geq 4$ prongs	[j]	< 2.2	$\times 10^{-4}$	CL=95%	–
$\gamma a_1^0 \rightarrow$ $\gamma\mu^+\mu^-$		< 5.5	$\times 10^{-6}$	CL=90%	–
$\gamma a_1^0 \rightarrow$ $\gamma\tau^+\tau^-$	[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
$\mu^\pm\tau^\mp$	*LF*	< 3.1	$\times 10^{-6}$	CL=90%	5025

$\chi_b(3P)$

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

Mass $m = 10534 \pm 9$ MeV

$\chi_b(3P)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\Upsilon(1S)\gamma$	seen	1019
$\Upsilon(2S)\gamma$	seen	498

$\Upsilon(4S)$ or $\Upsilon(10580)$

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

Mass $m = 10579.4 \pm 1.2$ MeV
Full width $\Gamma = 20.5 \pm 2.5$ MeV
$\Gamma_{ee} = 0.272 \pm 0.029$ keV (S = 1.5)

$\Upsilon(4S)$ DECAY MODES	Fraction (Γ_i/Γ)		Confidence level	p (MeV/c)
$B\overline{B}$	> 96	%	95%	327
B^+B^-	(51.3 ±0.6)	%		332
D_s^+ anything + c.c.	(17.8 ±2.6)	%		–
$B^0\overline{B}^0$	(48.7 ±0.6)	%		327
$J/\psi K_S^0(J/\psi,\ \eta_c)K_S^0$	< 4	$\times 10^{-7}$	90%	–
non-$B\overline{B}$	< 4	%	95%	–
e^+e^-	(1.57±0.08)	$\times 10^{-5}$		5290
$\rho^+\rho^-$	< 5.7	$\times 10^{-6}$	90%	5233

$J/\psi(1S)$ 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
$\Upsilon(1S)\pi^+\pi^-$	(8.1 $\pm$0.6)	$\times 10^{-5}$		1026
$\Upsilon(1S)\eta$	(1.96$\pm$0.28)	$\times 10^{-4}$		924
$\Upsilon(2S)\pi^+\pi^-$	(8.6 $\pm$1.3)	$\times 10^{-5}$		468
$h_b(1P)\pi^+\pi^-$	not seen			600
$\overline{d}$ anything	$<$ 1.3	$\times 10^{-5}$	90%	–

$\Upsilon(10860)$

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

Mass $m = 10876 \pm 11$ MeV
Full width $\Gamma = 55 \pm 28$ MeV
$\Gamma_{ee} = 0.31 \pm 0.07$ keV (S = 1.3)

$\Upsilon(10860)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$B\overline{B}X$	(75.9 $^{+2.7}_{-4.0}$) %		–
$B\overline{B}$	(5.5 $\pm$1.0) %		1303
$B\overline{B}^*$ + c.c.	(13.7 $\pm$1.6) %		–
$B^*\overline{B}^*$	(38.1 $\pm$3.4) %		1102
$B\overline{B}^{(*)}\pi$	$<$ 19.7 %	90%	990
$B\overline{B}\pi$	(0.0 $\pm$1.2) %		990
$B^*\overline{B}\pi$ + $B\overline{B}^*\pi$	(7.3 $\pm$2.3) %		–
$B^*\overline{B}^*\pi$	(1.0 $\pm$1.4) %		701
$B\overline{B}\pi\pi$	$<$ 8.9 %	90%	504
$B_s^{(*)}\overline{B}_s^{(*)}$	(19.9 $\pm$3.0) %		877
$B_s\overline{B}_s$	(5 $\pm$5) $\times 10^{-3}$		877
$B_s\overline{B}_s^*$ + c.c.	(1.34$\pm$0.32) %		–
$B_s^*\overline{B}_s^*$	(17.5 $\pm$2.6) %		495
no open-bottom	(4.2 $^{+5.0}_{-0.6}$) %		–
e^+e^-	(5.6 $\pm$3.1) $\times 10^{-6}$		5438
$\Upsilon(1S)\pi^+\pi^-$	(5.3 $\pm$0.6) $\times 10^{-3}$		1297
$\Upsilon(2S)\pi^+\pi^-$	(7.8 $\pm$1.3) $\times 10^{-3}$		774
$\Upsilon(3S)\pi^+\pi^-$	(4.8 $^{+1.9}_{-1.7}$) $\times 10^{-3}$		429

$\Upsilon(1S)K^+K^-$	$(\ 6.1 \ \pm 1.8 \ ) \times 10^{-4}$	947
$h_b(1P)\pi^+\pi^-$	$(\ 3.5 \ ^{+1.0}_{-1.3} \ ) \times 10^{-3}$	894
$h_b(2P)\pi^+\pi^-$	$(\ 6.0 \ ^{+2.1}_{-1.8} \ ) \times 10^{-3}$	534

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.	$(\ 72 \ \pm 6 \ )$ %	–

$\Upsilon(11020)$ $\quad I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 11019 \pm 8$ MeV
Full width $\Gamma = 79 \pm 16$ MeV
$\Gamma_{ee} = 0.130 \pm 0.030$ keV

$\Upsilon(11020)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
e^+e^-	$(1.6 \pm 0.5) \times 10^{-6}$	5510

NOTES

[a] $2m_\tau < \mathrm{M}(\tau^+\tau^-) < 7500$ MeV
[b] $2 < m_{K^+K^-} < 3$ GeV
[c] X = scalar with $m < 8.0$ GeV
[d] $X\overline{X}$ = vectors with $m < 3.1$ GeV
[e] X and $\overline{X}$ = zero spin with $m < 4.5$ GeV
[f] 1.5 GeV $< m_X <$ 5.0 GeV
[g] $201 < \mathrm{M}(\mu^+\mu^-) < 3565$ MeV
[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.