$\Upsilon(10860)$

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

$\Upsilon(10860)$ MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
$10889.9^{+3.2}_{-2.6}$ OUR AVERAGE				
$10884.7^{+3.6}_{-3.4}{}^{+8.9}_{-1.0}$	[1] MIZUK	16	BELL	$e^+e^- \to h_b(1P,2P)\pi^+\pi^-$
$10891.1\pm 3.2^{+1.2}_{-2.0}$	[2] SANTEL	16	BELL	$e^+e^- \to \Upsilon(1S,2S,3S)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$10881.8^{+1.0}_{-1.1}\pm1.2$	[3,4] SANTEL	16	BELL	$e^+e^- \to$ hadrons
10879 ± 3	[5,6] CHEN	10	BELL	$e^+e^- \to$ hadrons
$10888.4^{+2.7}_{-2.6}\pm1.2$	[7] CHEN	10	BELL	$e^+e^- \to \Upsilon(1S,2S,3S)\pi^+\pi^-$
10876 ± 2	[5] AUBERT	09E	BABR	$e^+e^- \to$ hadrons
10869 ± 2	[8] AUBERT	09E	BABR	$e^+e^- \to$ hadrons
$10868 \pm 6 \pm 5$	[9] BESSON	85	CLEO	$e^+e^- \to$ hadrons
10845 ± 20	[10] LOVELOCK	85	CUSB	$e^+e^- \to$ hadrons

[1] From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, $n = 1$, 2 cross sections at 22 energy points within $\sqrt{s} = 10.77$–11.02 GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

[2] From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, $n = 1$, 2, 3 cross sections at 25 energy points within $\sqrt{s} = 10.6$–11.05 GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

[3] From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s}$ = 10.82–11.05 GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

[4] Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

[5] In a model where a flat non-resonant $b\overline{b}$-continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

[6] The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

[7] In a model where a flat nonresonant $\Upsilon(1S,2S,3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.

[8] In a model where a non-resonant $b\overline{b}$-continuum represented by a threshold function at $\sqrt{s}=2m_B$ is incoherently added to a flat component interfering with two Breit-Wigner resonances. Not independent of other AUBERT 09E results. Systematic uncertainties not estimated.

[9] Assuming four Gaussians with radiative tails and a single step in R.

[10] In a coupled-channel model with three resonances and a smooth step in R.

$\Upsilon(10860)$ WIDTH

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
$51 ^{+6}_{-7}$ OUR AVERAGE				
$40.6^{+12.7}_{-8.0}{}^{+1.1}_{-19.1}$	[11] MIZUK	16	BELL	$e^+ e^- \to h_b(1P,2P)\pi^+\pi^-$
$53.7^{+7.1}_{-5.6}{}^{+1.3}_{-5.4}$	[12] SANTEL	16	BELL	$e^+ e^- \to \Upsilon(1S,2S,3S)\pi^+\pi^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$48.5^{+1.9}_{-1.8}{}^{+2.0}_{-2.8}$	[13,14] SANTEL	16	BELL	$e^+ e^- \to$ hadrons
$46 ^{+9}_{-7}$	[15,16] CHEN	10	BELL	$e^+ e^- \to$ hadrons
$30.7^{+8.3}_{-7.0} \pm 3.1$	[17] CHEN	10	BELL	$e^+ e^- \to \Upsilon(1S,2S,3S)\pi^+\pi^-$
43 ± 4	[15] AUBERT	09E	BABR	$e^+ e^- \to$ hadrons
74 ± 4	[18] AUBERT	09E	BABR	$e^+ e^- \to$ hadrons
$112 \pm 17 \pm 23$	[19] BESSON	85	CLEO	$e^+ e^- \to$ hadrons
110 ± 15	[20] LOVELOCK	85	CUSB	$e^+ e^- \to$ hadrons

[11] From a simultaneous fit to the $h_b(nP)\pi^+\pi^-$, n = 1, 2 cross sections at 22 energy points within $\sqrt{s}$ = 10.77–11.02 GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with eight resonance parameters (a mass and width for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single relative phase, a single relative amplitude, and two overall normalization factors, one for each n). The systematic error estimate is dominated by possible interference with a small nonresonant continuum amplitude.

[12] From a simultaneous fit to the $\Upsilon(nS)\pi^+\pi^-$, n = 1, 2, 3 cross sections at 25 energy points within $\sqrt{s}$ = 10.6–11.05 GeV to a pair of interfering Breit-Wigner amplitudes modified by phase space factors, with fourteen resonance parameters (a mass, width, and three amplitudes for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, a single universal relative phase, and three decoherence coefficients, one for each n). Continuum contributions were measured (and therefore fixed) to be zero.

[13] From a fit to the total hadronic cross sections measured at 60 energy points within $\sqrt{s}$ = 10.82–11.05 GeV to a pair of interfering Breit-Wigner amplitudes and two floating continuum amplitudes with $1/\sqrt{s}$ dependence, one coherent with the resonances and one incoherent, with six resonance parameters (a mass, width, and an amplitude for each of $\Upsilon(10860)$ and $\Upsilon(11020)$, one relative phase, and one decoherence coefficient).

[14] Not including uncertain and potentially large systematic errors due to assumed continuum amplitude $1/\sqrt{s}$ dependence and related interference contributions.

[15] In a model where a flat non-resonant $b\overline{b}$-continuum is incoherently added to a second flat component interfering with two Breit-Wigner resonances. Systematic uncertainties not estimated.

[16] The parameters of the $\Upsilon(11020)$ are fixed to those in AUBERT 09E.

[17] In a model where a flat nonresonant $\Upsilon(1S,2S,3S)\pi^+\pi^-$ continuum interferes with a single Breit-Wigner resonance.

[18] In a model where a non-resonant $b\overline{b}$-continuum represented by a threshold function at $\sqrt{s}=2m_B$ is incoherently added to a flat component interfering with two Breit-Wigner resonances. Not independent of other AUBERT 09E results. Systematic uncertainties not estimated.

[19] Assuming four Gaussians with radiative tails and a single step in R.

[20] In a coupled-channel model with three resonances and a smooth step in R.

$\Upsilon(10860)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	$B\overline{B}X$	$(76.2^{+2.7}_{-4.0})$ %	
Γ_2	$B\overline{B}$	(5.5 ± 1.0) %	
Γ_3	$B\overline{B}^* +$ c.c.	(13.7 ± 1.6) %	
Γ_4	$B^*\overline{B}^*$	(38.1 ± 3.4) %	
Γ_5	$B\overline{B}^{(*)}\pi$	< 19.7 %	90%
Γ_6	$B\overline{B}\pi$	(0.0 ± 1.2) %	
Γ_7	$B^*\overline{B}\pi + B\overline{B}^*\pi$	(7.3 ± 2.3) %	
Γ_8	$B^*\overline{B}^*\pi$	(1.0 ± 1.4) %	
Γ_9	$B\overline{B}\pi\pi$	< 8.9 %	90%
Γ_{10}	$B_s^{(*)}\overline{B}_s^{(*)}$	(20.1 ± 3.1) %	
Γ_{11}	$B_s\overline{B}_s$	$(5 \pm 5) \times 10^{-3}$	
Γ_{12}	$B_s\overline{B}_s^* +$ c.c.	(1.35 ± 0.32) %	
Γ_{13}	$B_s^*\overline{B}_s^*$	(17.6 ± 2.7) %	
Γ_{14}	no open-bottom	$(3.8^{+5.0}_{-0.5})$ %	
Γ_{15}	e^+e^-	$(6.1 \pm 1.6) \times 10^{-6}$	
Γ_{16}	$K^*(892)^0\overline{K}^0$	$< 1.0 \times 10^{-5}$	90%
Γ_{17}	$\Upsilon(1S)\pi^+\pi^-$	$(5.3 \pm 0.6) \times 10^{-3}$	
Γ_{18}	$\Upsilon(2S)\pi^+\pi^-$	$(7.8 \pm 1.3) \times 10^{-3}$	
Γ_{19}	$\Upsilon(3S)\pi^+\pi^-$	$(4.8^{+1.9}_{-1.7}) \times 10^{-3}$	
Γ_{20}	$\Upsilon(1S)K^+K^-$	$(6.1 \pm 1.8) \times 10^{-4}$	
Γ_{21}	$h_b(1P)\pi^+\pi^-$	$(3.5^{+1.0}_{-1.3}) \times 10^{-3}$	
Γ_{22}	$h_b(2P)\pi^+\pi^-$	$(5.7^{+1.7}_{-2.1}) \times 10^{-3}$	
Γ_{23}	$\chi_{b0}(1P)\pi^+\pi^-\pi^0$	$< 6.3 \times 10^{-3}$	90%
Γ_{24}	$\chi_{b0}(1P)\omega$	$< 3.9 \times 10^{-3}$	90%
Γ_{25}	$\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega}$	$< 4.8 \times 10^{-3}$	90%
Γ_{26}	$\chi_{b1}(1P)\pi^+\pi^-\pi^0$	$(1.85 \pm 0.33) \times 10^{-3}$	
Γ_{27}	$\chi_{b1}(1P)\omega$	$(1.57 \pm 0.30) \times 10^{-3}$	
Γ_{28}	$\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega}$	$(5.2 \pm 1.9) \times 10^{-4}$	
Γ_{29}	$\chi_{b2}(1P)\pi^+\pi^-\pi^0$	$(1.17 \pm 0.30) \times 10^{-3}$	
Γ_{30}	$\chi_{b2}(1P)\omega$	$(6.0 \pm 2.7) \times 10^{-4}$	
Γ_{31}	$\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{\text{non}-\omega}$	$(6 \pm 4) \times 10^{-4}$	
Γ_{32}	$\gamma X_b \to \gamma \Upsilon(1S)\omega$	$< 3.8 \times 10^{-5}$	90%

Inclusive Decays.

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

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_{33}	ϕ anything	$(13.8^{+2.4}_{-1.7})$ %	

Γ_{34}	D^0 anything + c.c.	(108 ±8) %
Γ_{35}	D_s anything + c.c.	(46 ±6) %
Γ_{36}	J/ψ anything	(2.06±0.21) %
Γ_{37}	B^0 anything + c.c.	(77 ±8) %
Γ_{38}	B^+ anything + c.c.	(72 ±6) %

Υ(10860) PARTIAL WIDTHS

$\Gamma(e^+e^-)$ — Γ_{15}

VALUE (keV)	DOCUMENT ID		TECN	COMMENT
0.31 ±0.07 OUR AVERAGE	Error includes scale factor of 1.3.			
0.22 ±0.05 ±0.07	BESSON	85	CLEO	$e^+e^- \rightarrow$ hadrons
0.365±0.070	LOVELOCK	85	CUSB	$e^+e^- \rightarrow$ hadrons

Υ(10860) BRANCHING RATIOS

"OUR EVALUATION" is obtained based on averages of rescaled data listed below. The averages and rescaling were performed by the Heavy Flavor Averaging Group (HFLAV) and are described at http://www.slac.stanford.edu/xorg/hflav/.

$\Gamma(B\overline{B}X)/\Gamma_{total}$ — Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$0.762^{+0.027}_{-0.043}$ OUR EVALUATION					
0.71 ±0.06 OUR AVERAGE					
0.737±0.032±0.051	1063	[21] DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X,\ B^0X$
0.589±0.100±0.092		[22] HUANG	07	CLEO	$\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\overline{B})/\Gamma_{total}$ — Γ_2/Γ

VALUE (units 10^{-2})	CL%	DOCUMENT ID		TECN	COMMENT
$5.5^{+1.0}_{-0.9}\pm0.4$		[23] DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X,\ B^0X$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<13.8	90	[22] HUANG	07	CLEO	$\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\overline{B})/\Gamma(B\overline{B}X)$ — Γ_2/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.22	90	AQUINES	06	CLE3	$\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\overline{B}^* + \text{c.c.})/\Gamma_{total}$ — Γ_3/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.137±0.016 OUR AVERAGE				
0.137±0.013±0.011	[23] DRUTSKOY	10	BELL	$\Upsilon(5S) \rightarrow B^+X,\ B^0X$
0.143±0.053±0.027	[22] HUANG	07	CLEO	$\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\overline{B}^* + \text{c.c.})/\Gamma(B\overline{B}X)$ — Γ_3/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.24±0.09±0.03	10	AQUINES	06	CLE3	$\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B^*\overline{B}^*)/\Gamma_{total}$ — Γ_4/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.381±0.034 OUR AVERAGE				
$0.375^{+0.021}_{-0.019}\pm0.030$	[23] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^+X,\ B^0X$
$0.436\pm0.083\pm0.072$	[22] HUANG	07	CLEO	$\Upsilon(5S) \to$ hadrons

$\Gamma(B^*\overline{B}^*)/\Gamma(B\overline{B}X)$ — Γ_4/Γ_1

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.74±0.15±0.08	31	AQUINES	06	CLE3	$\Upsilon(5S) \to$ hadrons

$\Gamma(B\overline{B}^{(*)}\pi)/\Gamma_{total}$ — Γ_5/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.197	90	[22] HUANG	07	CLEO	$\Upsilon(5S) \to$ hadrons

$\Gamma(B\overline{B}^{(*)}\pi)/\Gamma(B\overline{B}X)$ — Γ_5/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.32	90	AQUINES	06	CLE3	$\Upsilon(5S) \to$ hadrons

$\Gamma(B\overline{B}\pi)/\Gamma_{total}$ — Γ_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.0±1.2±0.3	0	[23] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^{+,0}\pi^-X$

$[\Gamma(B^*\overline{B}\pi)+\Gamma(B\overline{B}^*\pi)]/\Gamma_{total}$ — Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{7.3^{+2.3}_{-2.1}\pm0.8}$	38	[23] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^{+,0}\pi^-X$

$\Gamma(B^*\overline{B}^*\pi)/\Gamma_{total}$ — Γ_8/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{1.0^{+1.4}_{-1.3}\pm0.4}$	5	[23] DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^{+,0}\pi^-X$

$\Gamma(B\overline{B}\pi\pi)/\Gamma_{total}$ — Γ_9/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.089	90	[22] HUANG	07	CLEO	$\Upsilon(5S) \to$ hadrons

$\Gamma(B\overline{B}\pi\pi)/\Gamma(B\overline{B}X)$ — Γ_9/Γ_1

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.14	90	AQUINES	06	CLE3	$\Upsilon(5S) \to$ hadrons

$\Gamma(B_s^{(*)}\overline{B}_s^{(*)})/\Gamma_{total}$ — $\Gamma_{10}/\Gamma = (\Gamma_{11}+\Gamma_{12}+\Gamma_{13})/\Gamma$

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.201^{+0.030}_{-0.031}}$ **OUR EVALUATION**				
$\mathbf{0.189^{+0.027}_{-0.021}}$ **OUR AVERAGE**				
0.172 ± 0.030	[24] ESEN	13	BELL	$\Upsilon(5S) \to D^0X,\ D_sX$
$0.21\ ^{+0.06}_{-0.03}$	[25] HUANG	07	CLEO	$\Upsilon(5S) \to D_sX$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.180 \pm 0.013 \pm 0.032$	[26] DRUTSKOY	07	BELL	$\Upsilon(5S) \to D^0 X,\ D_s X$
$0.160 \pm 0.026 \pm 0.058$	[27] ARTUSO	05B	CLEO	$e^+ e^- \to D_x X$

$\Gamma(B_s^{(*)} \overline{B}{}_s^{(*)})/\Gamma(B\overline{B}X)$ — Γ_{10}/Γ_1

VALUE	DOCUMENT ID
$0.264^{+0.052}_{-0.045}$ OUR EVALUATION	

$\Gamma(B_s^* \overline{B}{}_s^*)/\Gamma(B_s^{(*)} \overline{B}{}_s^{(*)})$ — $\Gamma_{13}/\Gamma_{10} = \Gamma_{13}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13})$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
87.8 ± 1.5 OUR AVERAGE					
87.0 ± 1.7		[28,29] ESEN	13	BELL	$B_s^0 \to D_s^- \pi^+$
$90.5 \pm 3.2 \pm 0.1$	227	[29,30] LI	12	BELL	$B_s^0 \to J/\psi \eta^{(\prime)}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$90.1^{+3.8}_{-4.0} \pm 0.2$		[31] LOUVOT	09	BELL	$10.86\ e^+ e^- \to B_s^{(*)} \overline{B}{}_s^{(*)}$
$93\ ^{+7}_{-9}\ \pm 1$		[31] DRUTSKOY	07A	BELL	Superseded by LOUVOT 09

$\Gamma(B_s \overline{B}_s)/\Gamma(B_s^{(*)} \overline{B}{}_s^{(*)})$ — $\Gamma_{11}/\Gamma_{10} = \Gamma_{11}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13})$

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
$2.6^{+2.6}_{-2.5}$	LOUVOT	09	BELL	$10.86\ e^+ e^- \to B_s^{(*)} \overline{B}{}_s^{(*)}$

$\Gamma(B_s \overline{B}_s)/\Gamma(B_s^* \overline{B}{}_s^*)$ — Γ_{11}/Γ_{13}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.16	90	BONVICINI	06	CLE3	$e^+ e^-$

$\Gamma(B_s \overline{B}{}_s^* + \text{c.c.})/\Gamma(B_s^{(*)} \overline{B}{}_s^{(*)})$ — $\Gamma_{12}/\Gamma_{10} = \Gamma_{12}/(\Gamma_{11}+\Gamma_{12}+\Gamma_{13})$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
6.7 ± 1.2 OUR AVERAGE					
7.3 ± 1.4		[28,29] ESEN	13	BELL	$B_s^0 \to D_s^- \pi^+$
$4.9 \pm 2.5 \pm 0.0$	227	[29,30] LI	12	BELL	$B_s^0 \to J/\psi \eta^{(\prime)}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$7.3^{+3.3}_{-3.0} \pm 0.1$		LOUVOT	09	BELL	$10.86\ e^+ e^- \to B_s^{(*)} \overline{B}{}_s^{(*)}$

$\Gamma(B_s \overline{B}{}_s^* + \text{c.c.})/\Gamma(B_s^* \overline{B}{}_s^*)$ — Γ_{12}/Γ_{13}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.16	90	BONVICINI	06	CLE3	$e^+ e^-$

$\Gamma(\text{no open-bottom})/\Gamma_{\text{total}}$ — Γ_{14}/Γ

VALUE	DOCUMENT ID
$0.038^{+0.051}_{-0.005}$ OUR EVALUATION	

$\Gamma(K^*(892)^0 \overline{K}^0)/\Gamma_{total}$ — Γ_{16}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.0 \times 10^{-5}$	90	SHEN	13A	BELL	$e^+ e^- \rightarrow K^*(892)^0 \overline{K}^0$

$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{total}$ — Γ_{17}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$5.3 \pm 0.3 \pm 0.5$	325	[32] CHEN	08	BELL	10.87 $e^+ e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$

$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{total}$ — Γ_{18}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$7.8 \pm 0.6 \pm 1.1$	186	[32] CHEN	08	BELL	10.87 $e^+ e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$

$\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{total}$ — Γ_{19}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$4.8^{+1.8}_{-1.5} \pm 0.7$	10	[32] CHEN	08	BELL	10.87 $e^+ e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

$\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{total}$ — Γ_{20}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
$6.1^{+1.6}_{-1.4} \pm 1.0$	20	[32] CHEN	08	BELL	10.87 $e^+ e^- \rightarrow \Upsilon(1S)K^+K^-$

$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$ — Γ_{21}/Γ_{18}

VALUE	DOCUMENT ID		TECN	COMMENT
$0.45 \pm 0.08^{+0.07}_{-0.12}$	ADACHI	12	BELL	10.86 $e^+ e^- \rightarrow$ hadrons

$\Gamma(h_b(2P)\pi^+\pi^-)/\Gamma(\Upsilon(2S)\pi^+\pi^-)$ — Γ_{22}/Γ_{18}

VALUE	DOCUMENT ID		TECN	COMMENT
$0.77 \pm 0.08^{+0.22}_{-0.17}$	ADACHI	12	BELL	10.86 $e^+ e^- \rightarrow$ hadrons

$\Gamma(h_b(1P)\pi^+\pi^-)/\Gamma(h_b(2P)\pi^+\pi^-)$ — Γ_{21}/Γ_{22}

VALUE	DOCUMENT ID		TECN	COMMENT
$0.616 \pm 0.052 \pm 0.017$	MIZUK	16	BELL	$e^+ e^- \rightarrow h_b(1P, 2P)\pi^+\pi^-$

$\Gamma(\chi_{b0}(1P)\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{23}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6.3 \times 10^{-3}$	90	[33] HE	14	BELL	$\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b0}(1P)\omega)/\Gamma_{total}$ — Γ_{24}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.9 \times 10^{-3}$	90	[33] HE	14	BELL	$\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b0}(1P)(\pi^+\pi^-\pi^0)_{non-\omega})/\Gamma_{total}$ — Γ_{25}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<4.8 \times 10^{-3}$	90	[33] HE	14	BELL	$\Upsilon(5S) \rightarrow \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b1}(1P)\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{26}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.85±0.23±0.23	80	[33] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b1}(1P)\omega)/\Gamma_{total}$ — Γ_{27}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.57±0.22±0.21	60	[33] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{non-\omega})/\Gamma_{total}$ — Γ_{28}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
0.52±0.15±0.11	24	[33] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b2}(1P)\pi^+\pi^-\pi^0)/\Gamma_{total}$ — Γ_{29}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.17±0.27±0.14	29	[33] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b2}(1P)\omega)/\Gamma_{total}$ — Γ_{30}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
0.60±0.23±0.15	13	[33] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b2}(1P)\omega)/\Gamma(\chi_{b1}(1P)\omega)$ — Γ_{30}/Γ_{27}

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.38±0.16±0.09	[34] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{non-\omega})/\Gamma_{total}$ — Γ_{31}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
0.61±0.22±0.28	16	[33] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\chi_{b2}(1P)(\pi^+\pi^-\pi^0)_{non-\omega})/\Gamma(\chi_{b1}(1P)(\pi^+\pi^-\pi^0)_{non-\omega})$ — Γ_{31}/Γ_{28}

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.20±0.55±0.65	[34] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\gamma X_b \to \gamma\Upsilon(1S)\omega)/\Gamma_{total}$ — Γ_{32}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.8 \times 10^{-5}$	90	[35] HE	14	BELL	$\Upsilon(5S) \to \pi^+\pi^-\pi^0\gamma\Upsilon(1S)$

$\Gamma(\phi$ anything$)/\Gamma_{total}$ — Γ_{33}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
$0.138\pm0.007^{+0.023}_{-0.015}$	HUANG	07	CLEO	$\Upsilon(5S) \to \phi X$

$\Gamma(D^0$ anything + c.c.$)/\Gamma_{total}$ — Γ_{34}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
1.076±0.040±0.068	DRUTSKOY	07	BELL	$\Upsilon(5S) \to D^0 X$

$\Gamma(D_s$ anything + c.c.$)/\Gamma_{total}$ — Γ_{35}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.46 ±0.06 OUR AVERAGE				
0.472±0.024±0.072	[26] DRUTSKOY	07	BELL	$\Upsilon(5S) \to D_s X$
0.44 ±0.09 ±0.04	[36] ARTUSO	05B	CLE3	$e^+ e^- \to D_X X$

$\Gamma(J/\psi$ anything$)/\Gamma_{total}$ — Γ_{36}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
2.060±0.160±0.134	DRUTSKOY	07	BELL	$\Upsilon(5S) \to J/\psi X$

$\Gamma(B^0$ anything + c.c.$)/\Gamma_{total}$ — Γ_{37}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.770^{+0.058}_{-0.056}\pm0.061}$	352	DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^0 X$

$\Gamma(B^+$ anything + c.c.$)/\Gamma_{total}$ — Γ_{38}/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.721^{+0.039}_{-0.038}\pm0.050}$	711	DRUTSKOY	10	BELL	$\Upsilon(5S) \to B^+ X$

[21] Not independent of DRUTSKOY 10 values for $\Upsilon(5S) \to B^{\pm,0}$ anything.
[22] Using measurements or limits from AQUINES 06.
[23] Assuming isospin conservation.
[24] Supersedes DRUTSKOY 07.
[25] Supersedes ARTUSO 05B. Combining inclusive ϕ, D_s, and B measurements. Using $B(D_s^+ \to \phi\pi^+) = 4.4 \pm 0.6\%$ from PDG 06.
[26] Using $B(D_s^+ \to \phi\pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.
[27] Uses a model-dependent estimate $B(B_s \to D_s X) = (92 \pm 11)\%$.
[28] Supersedes LOUVOT 09.
[29] With $N(B_s^{(*)}\overline{B}_s^{(*)}) = (7.11 \pm 1.30) \times 10^6$.
[30] The ratios $N(B_s^*\overline{B}_s^*)$ / $N(B_s^{(*)}\overline{B}_s^{(*)})$ and $N(B_s^*\overline{B}_s^0)$ / $N(B_s^{(*)}\overline{B}_s^{(*)})$ are measured with a correlation coefficient of -0.72.
[31] From a measurement of $\sigma(e^+e^- \to B_s^*\overline{B}_s^*)$ / $\sigma(e^+e^- \to B_s^{(*)}\overline{B}_s^{(*)})$ at $\sqrt{s} = 10.86$ GeV.
[32] Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.
[33] Assuming that all the $b\overline{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \to b\overline{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14.
[34] Accounting for correlated systematics.
[35] Assuming that all the $b\overline{b}$ events are from $\Upsilon(5S)$ resonance decays and using $\sigma(e^+e^- \to b\overline{b}) = 0.340 \pm 0.016$ nb from ESEN 13. Correlated with other results from HE 14. For a state X_b with mass between 10.55 GeV/c^2 and 10.65 GeV/c^2, the obtained 90% upper limit as a function of m_{X_b} varies from 2.6×10^{-5} to 3.8×10^{-5}.
[36] ARTUSO 05B reports $[\Gamma(\Upsilon(10860) \to D_s$ anything + c.c.$)/\Gamma_{total}] \times [B(D_s^+ \to \phi\pi^+)] = 0.0198 \pm 0.0019 \pm 0.0038$ which we divide by our best value $B(D_s^+ \to \phi\pi^+) = (4.5 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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