

$\Upsilon(10860)$

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

$\Upsilon(10860)$ MASS

<u>VALUE (GeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
10.865 ± 0.008 OUR AVERAGE	Error includes scale factor of 1.1.		
10.868 ± 0.006 ± 0.005	BESSION	85	CLEO $e^+e^- \rightarrow$ hadrons
10.845 ± 0.020	LOVELOCK	85	CUSB $e^+e^- \rightarrow$ hadrons

$\Upsilon(10860)$ WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
110 ± 13 OUR AVERAGE			
112 ± 17 ± 23	BESSION	85	CLEO $e^+e^- \rightarrow$ hadrons
110 ± 15	LOVELOCK	85	CUSB $e^+e^- \rightarrow$ hadrons

$\Upsilon(10860)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 e^+e^-	$(2.8 \pm 0.7) \times 10^{-6}$	
Γ_2 $B\bar{B}X$	$(59 \pm 14) \%$	
Γ_3 $B\bar{B}$	< 13.8 %	90%
Γ_4 $B\bar{B}^* + \text{c.c.}$	$(14 \pm 6) \%$	
Γ_5 $B^*\bar{B}^*$	$(44 \pm 11) \%$	
Γ_6 $B\bar{B}^{(*)}\pi$	< 19.7 %	90%
Γ_7 $B\bar{B}\pi\pi$	< 8.9 %	90%
Γ_8 $B_s^{(*)}\bar{B}_s^{(*)}(X)$	$(19.3 \pm 2.9) \%$	
Γ_9 $B_s^{(*)}\bar{B}_s^{(*)}$		
Γ_{10} $B_s\bar{B}_s$		
Γ_{11} $B_s\bar{B}_s^* + \text{c.c.}$		
Γ_{12} $B_s^*\bar{B}_s^*$		
Γ_{13} $\Upsilon(1S)\pi^+\pi^-$	$(5.3 \pm 0.6) \times 10^{-3}$	
Γ_{14} $\Upsilon(2S)\pi^+\pi^-$	$(7.8 \pm 1.3) \times 10^{-3}$	
Γ_{15} $\Upsilon(3S)\pi^+\pi^-$	$(4.8 \pm \frac{1.9}{1.7}) \times 10^{-3}$	
Γ_{16} $\Upsilon(1S)K^+K^-$	$(6.1 \pm 1.8) \times 10^{-4}$	

Inclusive Decays.

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

Γ_{17}	ϕ anything	$(13.8 \pm 2.4 \text{ } ^{+} \text{ } _{-1.7}) \%$
Γ_{18}	D^0 anything + c.c.	$(108 \pm 8) \%$
Γ_{19}	D_s anything + c.c.	$(47 \pm 6) \%$
Γ_{20}	J/ψ anything	$(2.06 \pm 0.21) \%$

$\Upsilon(10860)$ PARTIAL WIDTHS

$\Gamma(e^+e^-)$				Γ_1
<u>VALUE (keV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
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

$\Upsilon(10860)$ BRANCHING RATIOS

$\Gamma(B\bar{B}X)/\Gamma_{\text{total}}$				Γ_2/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.589 ± 0.100 ± 0.092	¹ HUANG	07	CLEO	$\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\bar{B})/\Gamma_{\text{total}}$				Γ_3/Γ
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
< 0.138	90	¹ HUANG	07	CLEO $\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\bar{B})/\Gamma(B\bar{B}X)$				Γ_3/Γ_2
<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
< 0.22	90	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma_{\text{total}}$				Γ_4/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.143 ± 0.053 ± 0.027	¹ HUANG	07	CLEO	$\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\bar{B}^* + \text{c.c.})/\Gamma(B\bar{B}X)$				Γ_4/Γ_2
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.24 ± 0.09 ± 0.03	10	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B^*\bar{B}^*)/\Gamma_{\text{total}}$				Γ_5/Γ
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.436 ± 0.083 ± 0.072	¹ HUANG	07	CLEO	$\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B^*\bar{B}^*)/\Gamma(B\bar{B}X)$				Γ_5/Γ_2
<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.74 ± 0.15 ± 0.08	31	AQUINES	06	CLE3 $\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.197	90	¹ HUANG 07	CLEO	$\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\bar{B}^{(*)}\pi)/\Gamma(B\bar{B}X)$ Γ_6/Γ_2

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

$\Gamma(B\bar{B}\pi\pi)/\Gamma_{\text{total}}$ Γ_7/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.089	90	¹ HUANG 07	CLEO	$\Upsilon(5S) \rightarrow$ hadrons

$\Gamma(B\bar{B}\pi\pi)/\Gamma(B\bar{B}X)$ Γ_7/Γ_2

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

$\Gamma(B_s^{(*)}\bar{B}_s^{(*)}(X))/\Gamma_{\text{total}}$ Γ_8/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.193±0.029 OUR EVALUATION	Taking into account common systematics.		

0.195^{+0.030}_{-0.023} OUR AVERAGE

0.180±0.013±0.032	² DRUTSKOY 07	BELL	$\Upsilon(5S) \rightarrow D^0 X, D_s X$
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0.21 ^{+0.06} _{-0.03}	³ HUANG 07	CLEO	$\Upsilon(5S) \rightarrow D_s X$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.160±0.026±0.058	⁴ ARTUSO 05B	CLEO	$e^+e^- \rightarrow D_x X$
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$\Gamma(B_s^*\bar{B}_s^*)/\Gamma(B_s^{(*)}\bar{B}_s^{(*)})$ $\Gamma_{12}/\Gamma_9 = \Gamma_{12}/(\Gamma_{10}+\Gamma_{11}+\Gamma_{12})$

VALUE (units 10 ⁻²)	DOCUMENT ID	TECN	COMMENT
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93⁺⁷₋₉±1	⁵ DRUTSKOY 07A	BELL	10.86 $e^+e^- \rightarrow B_s^{(*)}\bar{B}_s^{(*)}$
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$\Gamma(B_s\bar{B}_s)/\Gamma(B_s^*\bar{B}_s^*)$ Γ_{10}/Γ_{12}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<0.16	90	BONVICINI 06	CLE3	e^+e^-
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$\Gamma(B_s\bar{B}_s^* + \text{c.c.})/\Gamma(B_s^*\bar{B}_s^*)$ Γ_{11}/Γ_{12}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<0.16	90	BONVICINI 06	CLE3	e^+e^-
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$\Gamma(\Upsilon(1S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
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5.3±0.3±0.5	325	⁶ CHEN 08	BELL	10.87 $e^+e^- \rightarrow \Upsilon(1S)\pi^+\pi^-$
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$\Gamma(\Upsilon(2S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{14}/Γ

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
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7.8±0.6±1.1	186	⁶ CHEN 08	BELL	10.87 $e^+e^- \rightarrow \Upsilon(2S)\pi^+\pi^-$
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$\Gamma(\Upsilon(3S)\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.8^{+1.8}_{-1.5} \pm 0.7$	10	⁶ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(3S)\pi^+\pi^-$

$\Gamma(\Upsilon(1S)K^+K^-)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.1^{+1.6}_{-1.4} \pm 1.0$	20	⁶ CHEN	08	BELL $10.87 e^+ e^- \rightarrow \Upsilon(1S)K^+K^-$

$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
$0.138 \pm 0.007^{+0.023}_{-0.015}$	HUANG	07	CLEO $\Upsilon(5S) \rightarrow \phi X$

$\Gamma(D^0 \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{18}/Γ

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

$\Gamma(D_s \text{ anything} + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.47 ± 0.06 OUR AVERAGE			
$0.472 \pm 0.024 \pm 0.072$	² DRUTSKOY	07	BELL $\Upsilon(5S) \rightarrow D_s X$
$0.45 \pm 0.10 \pm 0.04$	⁷ ARTUSO	05B	CLE3 $e^+ e^- \rightarrow D_s X$

$\Gamma(J/\psi \text{ anything})/\Gamma_{\text{total}}$ Γ_{20}/Γ

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

¹ Using measurements or limits from AQUINES 06.

² Using $B(D_s^+ \rightarrow \phi\pi^+) = (4.4 \pm 0.6)\%$ from PDG 06.

³ Supersedes ARTUSO 05B. Combining inclusive ϕ , D_s , and B measurements. Using $B(D_s^+ \rightarrow \phi\pi^+) = 4.4 \pm 0.6\%$ from PDG 06.

⁴ Uses a model-dependent estimate $B(B_s \rightarrow D_s X) = (92 \pm 11)\%$.

⁵ From a measurement of $\sigma(e^+ e^- \rightarrow B_s^* \bar{B}_s^*) / \sigma(e^+ e^- \rightarrow B_s^{(*)} \bar{B}_s^{(*)})$ at $\sqrt{s} = 10.86$ GeV.

⁶ Assuming that the observed events are solely due to the $\Upsilon(5S)$ resonance.

⁷ ARTUSO 05B reports $[B(\Upsilon(10860) \rightarrow D_s \text{ anything} + \text{c.c.})] \times [B(D_s^+ \rightarrow \phi\pi^+)] = 0.0198 \pm 0.0019 \pm 0.0038$. We divide by our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.38 \pm 0.35) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Upsilon(10860)$ REFERENCES

CHEN	08	PRL 100 112001	K.-F. Chen <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07	PRL 98 052001	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
DRUTSKOY	07A	PR D76 012002	A. Drutskoy <i>et al.</i>	(BELLE Collab.)
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)
AQUINES	06	PRL 96 152001	O. Aquines <i>et al.</i>	(CLEO Collab.)
BONVICINI	06	PRL 96 022002	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)
BESSON	85	PRL 54 381	D. Besson <i>et al.</i>	(CLEO Collab.)
LOVELOCK	85	PRL 54 377	D.M.J. Lovelock <i>et al.</i>	(CUSB Collab.)
