

$\eta_b(2S)$

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

OMITTED FROM SUMMARY TABLE

Quantum numbers shown are quark-model predictions.

 $\eta_b(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$9999.0 \pm 3.5^{+2.8}_{-1.9}$	26k	¹ MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- +$ hadrons

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

$9974.6 \pm 2.3 \pm 2.1$	11 ± 4	^{2,3,4} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons
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¹ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass difference measurement.² SANDILYA 13 (Belle Collab.) search for such a state reconstructed in the same 26 exclusive hadronic final states as DOBBS 12 using a sample of $(157.8 \pm 3.6) \times 10^6$ $\Upsilon(2S)$ decays or about 17 times larger and find no evidence for a signal. Their 90% C.L. upper limit on the branching fraction $B(\Upsilon(2S) \rightarrow \eta_b(2S)\gamma) \times \sum_i B(\eta_b(2S) \rightarrow X_i) < 4.9 \times 10^{-6}$, summed over the exclusive hadronic final states X_i , is an order of magnitude smaller than that reported by DOBBS 12.³ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.⁴ Assuming $\Gamma_{\eta_b(2S)} = 5$ MeV. Not independent of the corresponding mass difference measurement. **$m\Upsilon(2S) - m_{\eta_b(2S)}$**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
$24.3 \pm 3.5^{+2.8}_{-1.9}$	26k	⁵ MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^- +$ hadrons

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

$48.7 \pm 2.3 \pm 2.1$	11 ± 4	^{6,7,8} DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons
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⁵ Assuming $\Gamma_{\eta_b(2S)} = 4.9$ MeV. Not independent of the corresponding mass measurement.⁶ SANDILYA 13 (Belle Collab.) search for such a state reconstructed in the same 26 exclusive hadronic final states as DOBBS 12 using a sample of $(157.8 \pm 3.6) \times 10^6$ $\Upsilon(2S)$ decays or about 17 times larger and find no evidence for a signal. Their 90% C.L. upper limit on the branching fraction $B(\Upsilon(2S) \rightarrow \eta_b(2S)\gamma) \times \sum_i B(\eta_b(2S) \rightarrow X_i) < 4.9 \times 10^{-6}$, summed over the exclusive hadronic final states X_i , is an order of magnitude smaller than that reported by DOBBS 12.⁷ Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.⁸ Assuming $\Gamma_{\eta_b(2S)} = 5$ MeV. Not independent of the corresponding mass measurement. **$\eta_b(2S)$ WIDTH**

VALUE (MeV)	CL%	DOCUMENT ID	TECN	COMMENT
<24	90	MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^-$ hadrons

$\eta_b(2S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	seen

$\eta_b(2S)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$					Γ_1/Γ
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	26k	MIZUK	12	BELL $e^+e^- \rightarrow \gamma\pi^+\pi^-$ hadrons	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
seen	^{9,10}	DOBBS	12	$\Upsilon(2S) \rightarrow \gamma$ hadrons	

⁹SANDILYA 13 (Belle Collab.) search for such a state reconstructed in the same 26 exclusive hadronic final states as DOBBS 12 using a sample of $(157.8 \pm 3.6) \times 10^6$ $\Upsilon(2S)$ decays or about 17 times larger and find no evidence for a signal. Their 90% C.L. upper limit on the branching fraction $B(\Upsilon(2S) \rightarrow \eta_b(2S)\gamma) \times \sum_i B(\eta_b(2S) \rightarrow X_i) < 4.9 \times 10^{-6}$, summed over the exclusive hadronic final states X_i , is an order of magnitude smaller than that reported by DOBBS 12.

¹⁰Obtained by analyzing CLEO III data but not authored by the CLEO Collaboration.

$\eta_b(2S)$ REFERENCES

SANDILYA	13	PRL 111 112001	S. Sandilya <i>et al.</i>	(BELLE Collab.)
DOBBS	12	PRL 109 082001	S. Dobbs <i>et al.</i>	
MIZUK	12	PRL 109 232002	R. Mizuk <i>et al.</i>	(BELLE Collab.)