

# $\chi_{b1}(1P)$

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

$J$  needs confirmation.

Observed in radiative decay of the  $\Upsilon(2S)$ , therefore  $C = +$ . Branching ratio requires E1 transition, M1 is strongly disfavored, therefore  $P = +$ .  $J = 1$  from SKWARNICKI 87.

## $\chi_{b1}(1P)$ MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>9892.7 ± 0.6 OUR AVERAGE</b>	Error includes scale factor of 1.1.		
9893.7 ± 0.4 ± 0.6	<sup>1</sup> EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma\chi(1P)$
9890.7 ± 0.9 ± 1.3	<sup>1</sup> WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
9890.7 ± 0.3 ± 1.1	<sup>1</sup> ALBRECHT	85E ARG	$\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
9891.8 ± 0.8 ± 2.4	<sup>1</sup> NERNST	85 CBAL	$\Upsilon(2S) \rightarrow \gamma X$
9893.5 ± 0.8 ± 1.0	<sup>1</sup> HAAS	84 CLEO	$\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
9894.4 ± 0.4 ± 3.0	<sup>1</sup> KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma X$
9892 ± 3	<sup>1</sup> PAUSS	83 CUSB	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

<sup>1</sup> From  $\gamma$  energy below, assuming  $\Upsilon(2S)$  mass = 10023.3 MeV.

## $\gamma$ ENERGY IN $\Upsilon(2S)$ DECAY

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>129.8 ± 0.5 OUR AVERAGE</b>	Error includes scale factor of 1.1.		
128.8 ± 0.4 ± 0.6	EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma\chi(1P)$
131.7 ± 0.9 ± 1.3	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
131.7 ± 0.3 ± 1.1	ALBRECHT	85E ARG	$\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
130.6 ± 0.8 ± 2.4	NERNST	85 CBAL	$\Upsilon(2S) \rightarrow \gamma X$
129 ± 0.8 ± 1	HAAS	84 CLEO	$\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
128.1 ± 0.4 ± 3.0	KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma X$
130.6 ± 3.0	PAUSS	83 CUSB	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

## $\chi_{b1}(1P)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1 \quad \gamma \Upsilon(1S)$	(35 ± 8) %

## $\chi_{b1}(1P)$ BRANCHING RATIOS

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$	$\Gamma_1/\Gamma$		
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>0.35 ± 0.08 OUR AVERAGE</b>			
0.32 ± 0.06 ± 0.07	WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
0.47 ± 0.18	KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

## $\chi_{b1}(1P)$ REFERENCES

EDWARDS	99	PR D59 032003	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
SKWARNICKI	87	PRL 58 972	T. Skwarnicki <i>et al.</i>	(Crystal Ball Collab.) J
WALK	86	PR D34 2611	W.S. Walk <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	85E	PL 160B 331	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
NERNST	85	PRL 54 2195	R. Nernst <i>et al.</i>	(Crystal Ball Collab.)
HAAS	84	PRL 52 799	J. Haas <i>et al.</i>	(CLEO Collab.)
KLOPFEN...	83	PRL 51 160	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)
PAUSS	83	PL 130B 439	F. Pauss <i>et al.</i>	(MPIM, COLU, CORN, LSU+)

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