

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

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

$J$  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.

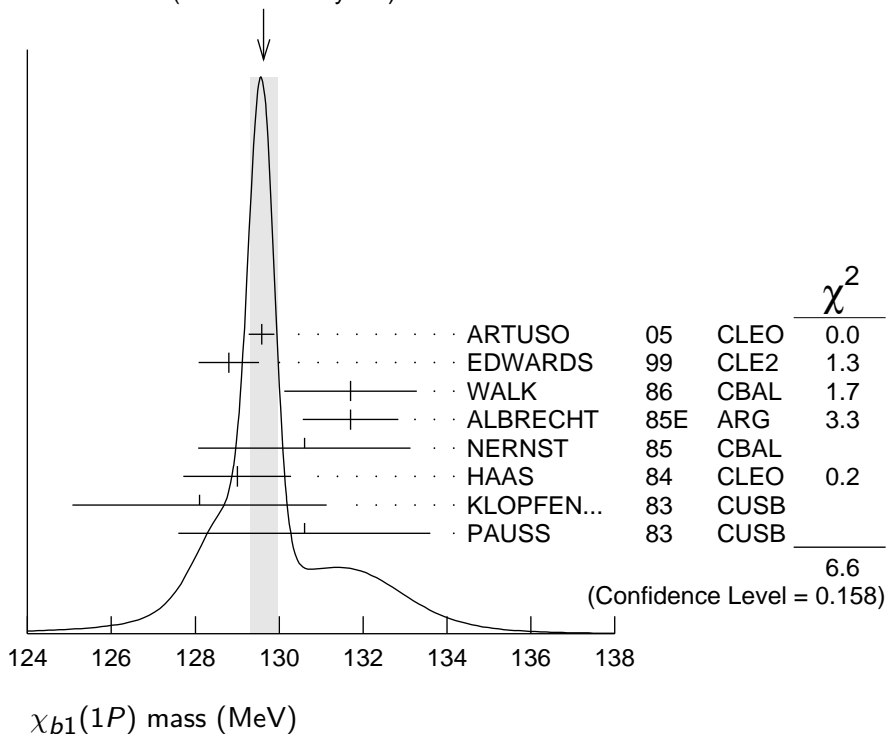
## $\chi_{b1}(1P)$ MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>
<b>9892.78 ± 0.26 ± 0.31 OUR EVALUATION</b>	From average $\gamma$ energy below, using $\Upsilon(2S)$ mass = 10023.26 ± 0.31 MeV

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

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>129.63 ± 0.33 OUR AVERAGE</b>	Error includes scale factor of 1.3. See the ideogram below.		
129.58 ± 0.09 ± 0.29	ARTUSO	05	CLEO $\Upsilon(2S) \rightarrow \gamma X$
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 $\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

WEIGHTED AVERAGE  
129.63 ± 0.33 (Error scaled by 1.3)



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

	Mode	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level
$\Gamma_1$	$\gamma \Upsilon(1S)$	$(33.9 \pm 2.2) \%$	
$\Gamma_2$	$D^0 X$	$(12.6 \pm 2.2) \%$	
$\Gamma_3$	$\pi^+ \pi^- K^+ K^- \pi^0$	$(2.0 \pm 0.6) \times 10^{-4}$	
$\Gamma_4$	$2\pi^+ \pi^- K^- K_S^0$	$(1.3 \pm 0.5) \times 10^{-4}$	
$\Gamma_5$	$2\pi^+ \pi^- K^- K_S^0 2\pi^0$	$< 6 \times 10^{-4}$	90%
$\Gamma_6$	$2\pi^+ 2\pi^- 2\pi^0$	$(8.0 \pm 2.5) \times 10^{-4}$	
$\Gamma_7$	$2\pi^+ 2\pi^- K^+ K^-$	$(1.5 \pm 0.5) \times 10^{-4}$	
$\Gamma_8$	$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$(3.5 \pm 1.2) \times 10^{-4}$	
$\Gamma_9$	$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$(8.6 \pm 3.2) \times 10^{-4}$	
$\Gamma_{10}$	$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$(9.3 \pm 3.3) \times 10^{-4}$	
$\Gamma_{11}$	$3\pi^+ 3\pi^-$	$(1.9 \pm 0.6) \times 10^{-4}$	
$\Gamma_{12}$	$3\pi^+ 3\pi^- 2\pi^0$	$(1.7 \pm 0.5) \times 10^{-3}$	
$\Gamma_{13}$	$3\pi^+ 3\pi^- K^+ K^-$	$(2.6 \pm 0.8) \times 10^{-4}$	
$\Gamma_{14}$	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$(7.5 \pm 2.6) \times 10^{-4}$	
$\Gamma_{15}$	$4\pi^+ 4\pi^-$	$(2.6 \pm 0.9) \times 10^{-4}$	
$\Gamma_{16}$	$4\pi^+ 4\pi^- 2\pi^0$	$(1.4 \pm 0.6) \times 10^{-3}$	

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

$\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$						$\Gamma_1/\Gamma$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT		
<b>0.339 ± 0.022 OUR AVERAGE</b>						
$0.331 \pm 0.018 \pm 0.017$	3222	<sup>1,2</sup> KORNICER 11	CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$		
$0.350 \pm 0.023 \pm 0.018$	13k	<sup>3</sup> LEES 11J	BABR	$\Upsilon(2S) \rightarrow X \gamma$		
$0.32 \pm 0.06 \pm 0.07$		WALK 86	CBAL	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$		
$0.47 \pm 0.18$		KLOPFEN... 83	CUSB	$\Upsilon(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$		

<sup>1</sup> Assuming  $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = (2.48 \pm 0.05)\%$ .

<sup>2</sup> KORNICER 11 reports  $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$   
 $= (22.8 \pm 0.4 \pm 1.2) \times 10^{-3}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))$   
 $= (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

<sup>3</sup> LEES 11J reports  $[\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$   
 $= (24.1 \pm 0.6 \pm 1.5) \times 10^{-3}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))$   
 $= (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D^0 X)/\Gamma_{\text{total}}$						$\Gamma_2/\Gamma$
VALUE (units $10^{-2}$ )	EVTS	DOCUMENT ID	TECN	COMMENT		
<b>12.6 ± 1.9 ± 1.1</b>	2310	<sup>4</sup> BRIERE 08	CLEO	$\Upsilon(2S) \rightarrow \gamma D^0 X$		

<sup>4</sup> For  $p_{D^0} > 2.5 \text{ GeV}/c$ .

**$\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_3/\Gamma$**

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>2.0 \pm 0.6 \pm 0.1</math></b>	18	<sup>5</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$

<sup>5</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$  =  $(14 \pm 3 \pm 3) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$**   **$\Gamma_4/\Gamma$**

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>1.3 \pm 0.5 \pm 0.1</math></b>	11	<sup>6</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$

<sup>6</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$  =  $(9 \pm 3 \pm 2) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_5/\Gamma$**

VALUE (units $10^{-4}$ )	CL%	DOCUMENT ID	TECN	COMMENT
<b>&lt;6</b>	90	<sup>7</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$

<sup>7</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$  <  $42 \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = 6.9 \times 10^{-2}$ .

**$\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_6/\Gamma$**

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>8.0 \pm 2.4 \pm 0.4</math></b>	46	<sup>8</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$

<sup>8</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$  =  $(55 \pm 9 \pm 14) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$**   **$\Gamma_7/\Gamma$**

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>1.5 \pm 0.5 \pm 0.1</math></b>	18	<sup>9</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$

<sup>9</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$  =  $(10 \pm 3 \pm 2) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_8/\Gamma$**

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>3.5 \pm 1.2 \pm 0.2</math></b>	22	<sup>10</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$

<sup>10</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$  =  $(24 \pm 6 \pm 6) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_9/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>8.6 \pm 3.2 \pm 0.4</math></b>	26	<sup>11</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$

<sup>11</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (59 \pm 14 \pm 17) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_{10}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>9.3 \pm 3.3 \pm 0.5</math></b>	21	<sup>12</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$

<sup>12</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (64 \pm 16 \pm 16) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(3\pi^+3\pi^-)/\Gamma_{\text{total}}$**   **$\Gamma_{11}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>1.9 \pm 0.6 \pm 0.1</math></b>	25	<sup>13</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$

<sup>13</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (13 \pm 3 \pm 3) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_{12}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>17 \pm 5 \pm 1</math></b>	56	<sup>14</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$

<sup>14</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (119 \pm 18 \pm 32) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(3\pi^+3\pi^-K^+K^-)/\Gamma_{\text{total}}$**   **$\Gamma_{13}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>2.6 \pm 0.8 \pm 0.1</math></b>	21	<sup>15</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$

<sup>15</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (18 \pm 4 \pm 4) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(3\pi^+3\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_{14}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>7.5 \pm 2.6 \pm 0.4</math></b>	28	<sup>16</sup> ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$

<sup>16</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))] = (52 \pm 11 \pm 14) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) = (6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(4\pi^+ 4\pi^-)/\Gamma_{\text{total}}$					$\Gamma_{15}/\Gamma$
VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT	
<b>2.6±0.9±0.1</b>	24	<sup>17</sup> ASNER	08A	CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$

<sup>17</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$   
 $= (18 \pm 4 \pm 5) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) =$   
 $(6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is  
the systematic error from using our best value.

$\Gamma(4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}$					$\Gamma_{16}/\Gamma$
VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT	
<b>14±5±1</b>	26	<sup>18</sup> ASNER	08A	CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$

<sup>18</sup> ASNER 08A reports  $[\Gamma(\chi_{b1}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))]$   
 $= (96 \pm 24 \pm 29) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) =$   
 $(6.9 \pm 0.4) \times 10^{-2}$ . Our first error is their experiment's error and our second error is  
the systematic error from using our best value.

### $\chi_{b1}(1P)$ Cross-Particle Branching Ratios

$\Gamma(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P))/\Gamma_{\text{total}}$					$\Gamma_1/\Gamma \times \Gamma_{14}^{\Upsilon(2S)}/\Gamma \Upsilon(2S)$
VALUE (units $10^{-3}$ )	EVTS	DOCUMENT ID	TECN	COMMENT	
<b>24.1±0.6±1.5</b>	13k	LEES	11J	BABR	$\Upsilon(2S) \rightarrow X\gamma$

$B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$					
VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT	
<b>5.65±0.11±0.27</b>	3222	KORNICER	11	CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

$B(\chi_{b1}(1P) \rightarrow \gamma \Upsilon(1S)) \times B(\Upsilon(3S) \rightarrow \gamma \chi_{b1}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+ \ell^-)$					
VALUE (units $10^{-5}$ )	EVTS	DOCUMENT ID	TECN	COMMENT	
<b>1.33±0.30±0.23</b>	50	KORNICER	11	CLEO	$e^+ e^- \rightarrow \gamma \gamma \ell^+ \ell^-$

$B(\chi_{b2}(1P) \rightarrow \rho X + \bar{\rho} X)/B(\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X)$				
VALUE	DOCUMENT ID	TECN	COMMENT	
<b>1.068±0.010±0.040</b>	BRIERE	07	CLEO	$\Upsilon(2S) \rightarrow \gamma \chi_{bJ}(1P)$

$B(\chi_{b0}(1P) \rightarrow \rho X + \bar{\rho} X)/B(\chi_{b1}(1P) \rightarrow \rho X + \bar{\rho} X)$				
VALUE	DOCUMENT ID	TECN	COMMENT	
<b>1.11±0.15±0.20</b>	BRIERE	07	CLEO	$\Upsilon(2S) \rightarrow \gamma \chi_{bJ}(1P)$

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

KORNICER	11	PR D83 054003	M. Kornicer <i>et al.</i>	(CLEO Collab.)
LEES	11J	PR D84 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ASNER	08A	PR D78 091103	D.M. Asner <i>et al.</i>	(CLEO Collab.)
BRIERE	08	PR D78 092007	R.A. Briere <i>et al.</i>	(CLEO Collab.)
BRIERE	07	PR D76 012005	R.A. Briere <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
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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