

# $\chi_{b2}(2P)$

$$J^G(J^{PC}) = 0^+(2^{++})$$

$J$  needs confirmation.

Observed in radiative decay of the  $\Upsilon(3S)$ , therefore  $C = +$ . Branching ratio requires E1 transition, M1 is strongly disfavored, therefore  $P = +$ .

## $\chi_{b2}(2P)$ MASS

VALUE (GeV)	DOCUMENT ID
<b>10.26865 ± 0.00022 ± 0.00050 OUR EVALUATION</b>	From $\gamma$ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

## $m_{\chi_{b2}(2P)} - m_{\chi_{b1}(2P)}$

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
<b>13.5 ± 0.4 ± 0.5</b>	<sup>1</sup> HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma X, \ell^+\ell^-\gamma\gamma$
<sup>1</sup> From the average photon energy for inclusive and exclusive events. Supersedes NARAIN 91.			

## $\gamma$ ENERGY IN $\Upsilon(3S)$ DECAY

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
<b>86.19 ± 0.22 OUR EVALUATION</b>		Treating systematic errors as correlated		
<b>86.40 ± 0.18 OUR AVERAGE</b>				
86.04 ± 0.06 ± 0.27		ARTUSO	05	CLEO $\Upsilon(3S) \rightarrow \gamma X$
86 ± 1	101	CRAWFORD	92B	CLE2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
86.7 ± 0.4	10319	<sup>2</sup> HEINTZ	92	CSB2 $e^+e^- \rightarrow \gamma X$
86.9 ± 0.4	157	<sup>3</sup> HEINTZ	92	CSB2 $e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
86.4 ± 0.1 ± 0.4	30741	MORRISON	91	CLE2 $e^+e^- \rightarrow \gamma X$
<sup>2</sup> A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.				
<sup>3</sup> A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.				

## $\chi_{b2}(2P)$ DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )	Confidence level
$\Gamma_1$ $\omega \Upsilon(1S)$	( 1.10 <sup>+0.34</sup> <sub>-0.30</sub> ) %	
$\Gamma_2$ $\gamma \Upsilon(2S)$	(16.2 ± 2.4 ) %	
$\Gamma_3$ $\gamma \Upsilon(1S)$	( 7.1 ± 1.0 ) %	
$\Gamma_4$ $\pi\pi\chi_{b2}(1P)$	( 6.0 ± 2.1 ) × 10 <sup>-3</sup>	
$\Gamma_5$ $D^0 X$	< 2.4 %	90%
$\Gamma_6$ $\pi^+\pi^- K^+ K^- \pi^0$	< 1.1 × 10 <sup>-4</sup>	90%
$\Gamma_7$ $2\pi^+\pi^- K^- K_S^0$	< 9 × 10 <sup>-5</sup>	90%
$\Gamma_8$ $2\pi^+\pi^- K^- K_S^0 2\pi^0$	< 7 × 10 <sup>-4</sup>	90%

$\Gamma_9$	$2\pi^+ 2\pi^- 2\pi^0$	$( 3.9 \pm 1.6 ) \times 10^{-4}$	
$\Gamma_{10}$	$2\pi^+ 2\pi^- K^+ K^-$	$( 9 \pm 4 ) \times 10^{-5}$	
$\Gamma_{11}$	$2\pi^+ 2\pi^- K^+ K^- \pi^0$	$( 2.4 \pm 1.1 ) \times 10^{-4}$	
$\Gamma_{12}$	$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	$( 4.7 \pm 2.3 ) \times 10^{-4}$	
$\Gamma_{13}$	$3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	$< 4 \times 10^{-4}$	90%
$\Gamma_{14}$	$3\pi^+ 3\pi^-$	$( 9 \pm 4 ) \times 10^{-5}$	
$\Gamma_{15}$	$3\pi^+ 3\pi^- 2\pi^0$	$( 1.2 \pm 0.4 ) \times 10^{-3}$	
$\Gamma_{16}$	$3\pi^+ 3\pi^- K^+ K^-$	$( 1.4 \pm 0.7 ) \times 10^{-4}$	
$\Gamma_{17}$	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	$( 4.2 \pm 1.7 ) \times 10^{-4}$	
$\Gamma_{18}$	$4\pi^+ 4\pi^-$	$( 9 \pm 5 ) \times 10^{-5}$	
$\Gamma_{19}$	$4\pi^+ 4\pi^- 2\pi^0$	$( 1.3 \pm 0.5 ) \times 10^{-3}$	

### $\chi_{b2}(2P)$ BRANCHING RATIOS

#### $\Gamma(\omega \Upsilon(1S))/\Gamma_{\text{total}}$ $\Gamma_1/\Gamma$

<u>VALUE (units <math>10^{-2}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>1.10^{+0.32+0.11}_{-0.28-0.10}</math></b>	$20.1^{+5.8}_{-5.1}$	<sup>4</sup> CRONIN-HEN..04	CLE3	$\Upsilon(3S) \rightarrow \gamma \omega \Upsilon(1S)$

<sup>4</sup> Using  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.4 \pm 0.8)\%$  and  $B(\Upsilon(1S) \rightarrow \ell^+ \ell^-) = 2$   
 $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = 2 (2.48 \pm 0.06)\%$ .

#### $\Gamma(\gamma \Upsilon(2S))/\Gamma_{\text{total}}$ $\Gamma_2/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.162 \pm 0.024</math> OUR AVERAGE</b>			
$0.135 \pm 0.025 \pm 0.035$	<sup>5</sup> CRAWFORD 92B	CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
$0.173 \pm 0.021 \pm 0.019$	<sup>6</sup> HEINTZ 92	CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

<sup>5</sup> Using  $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.37 \pm 0.26)\%$ ,  $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(2S)) \times 2 B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (4.98 \pm 0.94 \pm 0.62) \times 10^{-4}$ , and  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 0.135 \pm 0.003 \pm 0.017$ .

<sup>6</sup> Using  $B(\Upsilon(2S) \rightarrow \mu^+ \mu^-) = (1.44 \pm 0.10)\%$ ,  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.1 \pm 0.5 \pm 0.4)\%$  and assuming  $e\mu$  universality. Supersedes HEINTZ 91.

#### $\Gamma(\gamma \Upsilon(1S))/\Gamma_{\text{total}}$ $\Gamma_3/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.071 \pm 0.010</math> OUR AVERAGE</b>			
$0.072 \pm 0.014 \pm 0.013$	<sup>7</sup> CRAWFORD 92B	CLE2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$
$0.070 \pm 0.010 \pm 0.006$	<sup>8</sup> HEINTZ 92	CSB2	$e^+ e^- \rightarrow \ell^+ \ell^- \gamma \gamma$

<sup>7</sup> Using  $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.07)\%$ ,  $B(\Upsilon(3S) \rightarrow \gamma \gamma \Upsilon(2S)) \times 2 B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (5.03 \pm 0.94 \pm 0.63) \times 10^{-4}$ , and  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 0.135 \pm 0.003 \pm 0.017$ .

<sup>8</sup> Using  $B(\Upsilon(1S) \rightarrow \mu^+ \mu^-) = (2.57 \pm 0.07)\%$ ,  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (11.1 \pm 0.5 \pm 0.4)\%$  and assuming  $e\mu$  universality. Supersedes HEINTZ 91.

#### $\Gamma(\pi \pi \chi_{b2}(1P))/\Gamma_{\text{total}}$ $\Gamma_4/\Gamma$

<u>VALUE (units <math>10^{-3}</math>)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>6.0 \pm 1.6 \pm 1.4</math></b>	<sup>9</sup> CAWLFIELD 06	CLE3	$\Upsilon(3S) \rightarrow 2(\gamma \pi \ell)$

<sup>9</sup> CAWLFIELD 06 quote  $\Gamma(\chi_b(2P) \rightarrow \pi \pi \chi_b(1P)) = 0.83 \pm 0.22 \pm 0.08 \pm 0.19$  keV assuming l-spin conservation, no D-wave contribution,  $\Gamma(\chi_{b1}(2P)) = 96 \pm 16$  keV, and  $\Gamma(\chi_{b2}(2P)) = 138 \pm 19$  keV.

**$\Gamma(D^0 X)/\Gamma_{\text{total}}$**   **$\Gamma_5/\Gamma$**

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>&lt;2.4 \times 10^{-2}</math></b>	90	10,11 BRIERE	08	CLEO $\Upsilon(3S) \rightarrow \gamma D^0 X$

<sup>10</sup> For  $p_{D^0} > 2.5$  GeV/c.

<sup>11</sup> The authors also present their result as  $(0.2 \pm 1.4 \pm 0.1) \times 10^{-2}$ .

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

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>&lt;1.1</math></b>	90	12 ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma \pi^+ \pi^- K^+ K^- \pi^0$

<sup>12</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow \pi^+ \pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 14 \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$ .

**$\Gamma(2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}$**   **$\Gamma_7/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>&lt;0.9</math></b>	90	13 ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- K_S^0$

<sup>13</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ \pi^- K^- K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 12 \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$ .

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

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>&lt;7</math></b>	90	14 ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma 2\pi^+ \pi^- K^- 2\pi^0$

<sup>14</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ \pi^- K^- K_S^0 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 87 \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$ .

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

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>3.9 \pm 1.6 \pm 0.5</math></b>	23	15 ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- 2\pi^0$

<sup>15</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (51 \pm 16 \pm 13) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.9 \pm 0.4 \pm 0.1</math></b>	11	16 ASNER	08A	CLEO $\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^-$

<sup>16</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 4 \pm 3) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_{11}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>2.4 \pm 1.0 \pm 0.3</math></b>	16	<sup>17</sup> ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- \pi^0$

<sup>17</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (32 \pm 11 \pm 8) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>4.7 \pm 2.2 \pm 0.6</math></b>	14	<sup>18</sup> ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 2\pi^+ 2\pi^- K^+ K^- 2\pi^0$

<sup>18</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 2\pi^+ 2\pi^- K^+ K^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (62 \pm 23 \pm 17) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(3\pi^+2\pi^-K^-K_S^0\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_{13}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>&lt;4</math></b>	90	<sup>19</sup> ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$

<sup>19</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] < 58 \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = 13.1 \times 10^{-2}$ .

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

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>0.9 \pm 0.4 \pm 0.1</math></b>	14	<sup>20</sup> ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^-$

<sup>20</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 4 \pm 3) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_{15}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>12 \pm 4 \pm 1</math></b>	45	<sup>21</sup> ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$

<sup>21</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (159 \pm 33 \pm 43) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(3\pi^+3\pi^-K^+K^-)/\Gamma_{\text{total}}$**   **$\Gamma_{16}/\Gamma$**

<u>VALUE (units <math>10^{-4}</math>)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b><math>1.4 \pm 0.7 \pm 0.2</math></b>	12	<sup>22</sup> ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$

<sup>22</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (19 \pm 7 \pm 5) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(3\pi^+3\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_{17}/\Gamma$**

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>4.2 \pm 1.7 \pm 0.5</math></b>	16	<sup>23</sup> ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^- \pi^0$

<sup>23</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 3\pi^+ 3\pi^- K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (55 \pm 16 \pm 15) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(4\pi^+4\pi^-)/\Gamma_{\text{total}}$**   **$\Gamma_{18}/\Gamma$**

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>0.9 \pm 0.4 \pm 0.1</math></b>	9	<sup>24</sup> ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^-$

<sup>24</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (12 \pm 5 \pm 3) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\Gamma(4\pi^+4\pi^-2\pi^0)/\Gamma_{\text{total}}$**   **$\Gamma_{19}/\Gamma$**

VALUE (units $10^{-4}$ )	EVTS	DOCUMENT ID	TECN	COMMENT
<b><math>13 \pm 5 \pm 2</math></b>	27	<sup>25</sup> ASNER	08A CLEO	$\Upsilon(3S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$

<sup>25</sup> ASNER 08A reports  $[\Gamma(\chi_{b2}(2P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P))] = (165 \pm 46 \pm 50) \times 10^{-6}$  which we divide by our best value  $B(\Upsilon(3S) \rightarrow \gamma \chi_{b2}(2P)) = (13.1 \pm 1.6) \times 10^{-2}$ . Our first error is their experiment's error and our second error is the systematic error from using our best value.

**$\chi_{b2}(2P)$  REFERENCES**

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.)
CAWLFIELD	06	PR D73 012003	C. Cawfield <i>et al.</i>	(CLEO Collab.)
ARTUSO	05	PRL 94 032001	M. Artuso <i>et al.</i>	(CLEO Collab.)
CRONIN-HENNESSY	04	PRL 92 222002	D. Cronin-Hennessy <i>et al.</i>	(CLEO3 Collab.)
CRAWFORD	92B	PL B294 139	G. Crawford, R. Fulton	(CLEO Collab.)
HEINTZ	92	PR D46 1928	U. Heintz <i>et al.</i>	(CUSB II Collab.)
HEINTZ	91	PRL 66 1563	U. Heintz <i>et al.</i>	(CUSB Collab.)
MORRISON	91	PRL 67 1696	R.J. Morrison <i>et al.</i>	(CLEO Collab.)
NARAIN	91	PRL 66 3113	M. Narain <i>et al.</i>	(CUSB Collab.)