

$\chi_{b0}(1P)$

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

J needs confirmation.

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

 $\chi_{b0}(1P)$ MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>
9859.44 ± 0.42 ± 0.31 OUR EVALUATION	From average γ energy below, using $\Upsilon(2S)$ mass = 10023.26 ± 0.31 MeV

 $m_{\chi_{b1}(1P)} - m_{\chi_{b0}(1P)}$

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
32.49 ± 0.93	LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$

 γ ENERGY IN $\Upsilon(2S)$ DECAY

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
162.5 ± 0.4 OUR AVERAGE			
162.56 ± 0.19 ± 0.42	ARTUSO	05 CLEO	$\Upsilon(2S) \rightarrow \gamma X$
162.0 ± 0.8 ± 1.2	EDWARDS	99 CLE2	$\Upsilon(2S) \rightarrow \gamma\chi(1P)$
162.1 ± 0.5 ± 1.4	ALBRECHT	85E ARG	$\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
163.8 ± 1.6 ± 2.7	NERNST	85 CBAL	$\Upsilon(2S) \rightarrow \gamma X$
158.0 ± 7 ± 1	HAAS	84 CLEO	$\Upsilon(2S) \rightarrow \text{conv.}\gamma X$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
149.4 ± 0.7 ± 5.0	KLOPFEN...	83 CUSB	$\Upsilon(2S) \rightarrow \gamma X$

 $\chi_{b0}(1P)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1 $\gamma \Upsilon(1S)$	(1.94 ± 0.27) %	
Γ_2 $D^0 X$	< 10.4 %	90%
Γ_3 $\pi^+\pi^- K^+ K^- \pi^0$	< 1.6 × 10 ⁻⁴	90%
Γ_4 $2\pi^+\pi^- K^- K_S^0$	< 5 × 10 ⁻⁵	90%
Γ_5 $2\pi^+\pi^- K^- K_S^0 2\pi^0$	< 5 × 10 ⁻⁴	90%
Γ_6 $2\pi^+ 2\pi^- 2\pi^0$	< 2.1 × 10 ⁻⁴	90%
Γ_7 $2\pi^+ 2\pi^- K^+ K^-$	(1.1 ± 0.6) × 10 ⁻⁴	
Γ_8 $2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.7 × 10 ⁻⁴	90%
Γ_9 $2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 5 × 10 ⁻⁴	90%
Γ_{10} $3\pi^+ 2\pi^- K^- K_S^0 \pi^0$	< 1.6 × 10 ⁻⁴	90%
Γ_{11} $3\pi^+ 3\pi^-$	< 8 × 10 ⁻⁵	90%
Γ_{12} $3\pi^+ 3\pi^- 2\pi^0$	< 6 × 10 ⁻⁴	90%

Γ_{13}	$3\pi^+3\pi^-K^+K^-$	$(2.4 \pm 1.2) \times 10^{-4}$	
Γ_{14}	$3\pi^+3\pi^-K^+K^-\pi^0$	$< 1.0 \times 10^{-3}$	90%
Γ_{15}	$4\pi^+4\pi^-$	$< 8 \times 10^{-5}$	90%
Γ_{16}	$4\pi^+4\pi^-2\pi^0$	$< 2.1 \times 10^{-3}$	90%
Γ_{17}	$J/\psi J/\psi$	$< 7 \times 10^{-5}$	90%
Γ_{18}	$J/\psi\psi(2S)$	$< 1.2 \times 10^{-4}$	90%
Γ_{19}	$\psi(2S)\psi(2S)$	$< 3.1 \times 10^{-5}$	90%
Γ_{20}	$J/\psi(1S)$ anything	$< 2.3 \times 10^{-3}$	90%

$\chi_{b0}(1P)$ BRANCHING RATIOS

$\Gamma(\gamma\Upsilon(1S))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (%)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
1.94 ± 0.27 OUR AVERAGE					
2.07 ± 0.24 ± 0.21			1,2 LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$
1.76 ± 0.30 ± 0.18		87	3,4 KORNICER	11 CLEO	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 4.6	90		5 LEES	11J BABR	$\Upsilon(2S) \rightarrow X\gamma$
< 6	90		WALK	86 CBAL	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$
< 11	90		PAUSS	83 CUSB	$\Upsilon(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹ LEES 14M quotes $\Gamma(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}} = (7.75 \pm 0.91) \times 10^{-4}$ combining the results from samples of $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$ with and without converted photons. Assumes $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.48 \pm 0.05)\%$.

² LEES 14M reports $[\Gamma(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] = (7.75 \pm 0.91) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Assuming $B(\Upsilon(1S) \rightarrow \ell^+\ell^-) = (2.48 \pm 0.05)\%$.

⁴ KORNICER 11 reports $[\Gamma(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] = (6.59 \pm 0.96 \pm 0.60) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}} = (8.3 \pm 5.6^{+3.7}_{-2.6}) \times 10^{-4}$.

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 10.4 × 10⁻²	90	6,7 BRIERE	08	CLEO $\Upsilon(2S) \rightarrow \gamma D^0 X$

⁶ For $p_{D^0} > 2.5$ GeV/c.

⁷ The authors also present their result as $(5.6 \pm 3.6 \pm 0.5) \times 10^{-2}$.

$\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10 ⁻⁴)	CL%	DOCUMENT ID	TECN	COMMENT
< 1.6	90	8 ASNER	08A	CLEO $\Upsilon(2S) \rightarrow \gamma\pi^+\pi^-K^+K^-\pi^0$

⁸ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] < 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

$\Gamma(2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}$ **Γ_4/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.5	90	⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-K_S^0$

⁹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] < 2 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

 $\Gamma(2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}$ **Γ_5/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹⁰ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+\pi^-K^-2\pi^0$

¹⁰ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+\pi^-K^-K_S^02\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] < 18 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

 $\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}$ **Γ_6/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.1	90	¹¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-2\pi^0$

¹¹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+2\pi^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] < 8 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

 $\Gamma(2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}$ **Γ_7/Γ**

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.1 \pm 0.6 \pm 0.1$	7	¹² ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-$

¹² ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] = (4 \pm 2 \pm 1) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}$ **Γ_8/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<2.7	90	¹³ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-\pi^0$

¹³ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] < 10 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

 $\Gamma(2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}$ **Γ_9/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<5	90	¹⁴ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$

¹⁴ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] < 20 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = 3.8 \times 10^{-2}$.

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<1.6	90	¹⁵ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 2\pi^- K^- K_S^0 \pi^0$
¹⁵ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 2\pi^- K^- K_S^0 \pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 6 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	¹⁶ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^-$
¹⁶ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 3 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<6	90	¹⁷ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- 2\pi^0$
¹⁷ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 22 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$2.4 \pm 1.2 \pm 0.2$	9	¹⁸ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-$
¹⁸ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $= (9 \pm 4 \pm 2) \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

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

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<10	90	¹⁹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 3\pi^+ 3\pi^- K^+ K^-\pi^0$
¹⁹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 3\pi^+ 3\pi^- K^+ K^-\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 37 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

 $\Gamma(4\pi^+4\pi^-)/\Gamma_{\text{total}}$ **Γ_{15}/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<0.8	90	²⁰ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^-$
²⁰ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+ 4\pi^-)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 3 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

 $\Gamma(4\pi^+4\pi^-2\pi^0)/\Gamma_{\text{total}}$ **Γ_{16}/Γ**

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
<21	90	²¹ ASNER	08A CLEO	$\Upsilon(2S) \rightarrow \gamma 4\pi^+ 4\pi^- 2\pi^0$
²¹ ASNER 08A reports $[\Gamma(\chi_{b0}(1P) \rightarrow 4\pi^+ 4\pi^- 2\pi^0)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P))]$ $< 77 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(2S) \rightarrow \gamma \chi_{b0}(1P)) = 3.8 \times 10^{-2}$.				

$$\Gamma(J/\psi J/\psi)/\Gamma_{\text{total}} \qquad \Gamma_{17}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<7	90	22 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma\psi X$
22 SHEN 12 reports $< 7.1 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow J/\psi J/\psi)/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.				

$$\Gamma(J/\psi\psi(2S))/\Gamma_{\text{total}} \qquad \Gamma_{18}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<12	90	23 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma\psi X$
23 SHEN 12 reports $< 12 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow J/\psi\psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.				

$$\Gamma(\psi(2S)\psi(2S))/\Gamma_{\text{total}} \qquad \Gamma_{19}/\Gamma$$

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<3.1	90	24 SHEN	12 BELL	$\Upsilon(2S) \rightarrow \gamma\psi X$
24 SHEN 12 reports $< 3.1 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{b0}(1P) \rightarrow \psi(2S)\psi(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))]$ assuming $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4) \times 10^{-2}$.				

$$\Gamma(J/\psi(1S)\text{anything})/\Gamma_{\text{total}} \qquad \Gamma_{20}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<2.3 $\times 10^{-3}$	90	JIA	17A BELL	$e^+e^- \rightarrow \text{hadrons}$

$\chi_{b0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

$$\Gamma(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}} \qquad \Gamma_1/\Gamma \times \Gamma_{61}^{\Upsilon(2S)}/\Gamma\Upsilon(2S)$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.7 $\times 10^{-3}$	90	25 LEES	11J BABR	$\Upsilon(2S) \rightarrow X\gamma$
25 LEES 11J quotes a central value of $\Gamma(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))/\Gamma_{\text{total}} = (8.3 \pm 5.6^{+3.7}_{-2.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $\Gamma(\gamma\Upsilon(1S))/\Gamma_{\text{total}} < 4.6\%$ using $B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) = (3.8 \pm 0.4)\%$.				

$$B(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P)) \times B(\Upsilon(1S) \rightarrow \ell^+\ell^-)$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.67 \pm 0.28 OUR AVERAGE				
2.9 $^{+1.7}_{-1.4}$ $^{+0.1}_{-0.8}$		26 LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$
1.63 \pm 0.24 \pm 0.15	87	KORNICER	11 CLEO	$e^+e^- \rightarrow \gamma\gamma\ell^+\ell^-$
26 From a sample of $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$ with one converted photon.				

$$[B(\chi_{b0}(1P) \rightarrow \gamma\Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma\chi_{b0}(1P))] / [B(\chi_{b1}(1P) \rightarrow \gamma\Upsilon(1S)) \times B(\Upsilon(2S) \rightarrow \gamma\chi_{b1}(1P))]$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
3.28 \pm 0.37	27 LEES	14M BABR	$\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$
27 From a sample of $\Upsilon(2S) \rightarrow \gamma\gamma\mu^+\mu^-$ without converted photons.			

$\chi_{b0}(1P)$ REFERENCES

JIA	17A	PR D96 112002	S. Jia <i>et al.</i>	(BELLE Collab.)
LEES	14M	PR D90 112010	J.P. Lees <i>et al.</i>	(BABAR Collab.)
SHEN	12	PR D85 071102	C.P. Shen <i>et al.</i>	(BELLE Collab.)
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.)
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.)
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+)
