NODE=M079

$\chi_{b0}(2P)$

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

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

NODE=M079

$\chi_{b0}(2P)$ MASS

NODE=M079M

VALUE (MeV)	DOCUMENT ID
10232.5±0.4±0.5 OUR EVALUATION	From γ energy below, using $\Upsilon(3S)$ mass = 10355.2 ± 0.5 MeV

NODE=M079M
→ UNCHECKED ←

$m_{\chi_{b1}(2P)} - m_{\chi_{b0}(2P)}$

NODE=M079M2
NODE=M079M2

VALUE (MeV)	DOCUMENT ID		TECN	COMMENT
23.8±1.7	LEES	14M	BABR	$\Upsilon(3S) \to \gamma\gamma\mu^+\mu^-$

γ ENERGY IN $\Upsilon(3S)$ DECAY

NODE=M079DM

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	COMMENT
121.9 ±0.4 OUR EVALUATION		Treating systematic errors as correlated			
122.2 ±0.5 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.			
121.55±0.16±0.46		ARTUSO	05	CLEO	$\Upsilon(3S) \to \gamma X$
123.0 ±0.8	4959	[1] HEINTZ	92	CSB2	$e^+e^- \to \gamma X$
124.6 ±1.4	17	[2] HEINTZ	92	CSB2	$e^+e^- \to \ell^+\ell^-\gamma\gamma$
122.3 ±0.3 ±0.6	9903	MORRISON	91	CLE2	$e^+e^- \to \gamma X$

NODE=M079DM
→ UNCHECKED ←

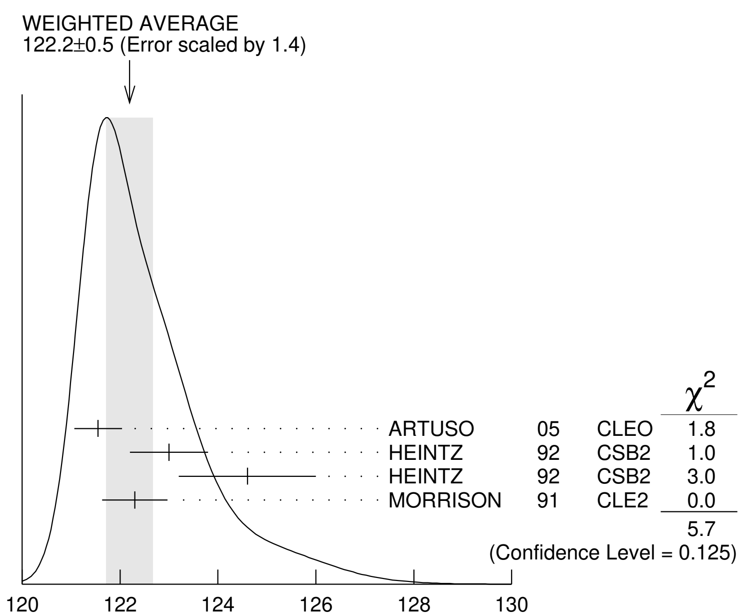
OCCUR=2

[1] A systematic uncertainty on the energy scale of 0.9% not included. Supersedes NARAIN 91.

NODE=M079DM;LINKAGE=A

[2] A systematic uncertainty on the energy scale of 0.9% not included. Supersedes HEINTZ 91.

NODE=M079DM;LINKAGE=B



γ energy in $\Upsilon(3S)$ decay (MeV)

$\chi_{b0}(2P)$ DECAY MODES

NODE=M079215;NODE=M079

	Mode	Fraction (Γ_i/Γ)	Confidence level	
Γ_1	$\gamma\,\Upsilon(2S)$	(1.38 ± 0.30) %		DESIG=2
Γ_2	$\gamma\,\Upsilon(1S)$	$(3.8\ \pm1.7\ ) \times 10^{-3}$		DESIG=1
Γ_3	$D^0 X$	< 8.2 %	90%	DESIG=3
Γ_4	$\pi^+\pi^-K^+K^-\pi^0$	$< 3.4 \times 10^{-5}$	90%	DESIG=4
Γ_5	$2\pi^+\pi^-K^-K^0_S$	$< 5 \times 10^{-5}$	90%	DESIG=5
Γ_6	$2\pi^+\pi^-K^-K^0_S2\pi^0$	$< 2.2 \times 10^{-4}$	90%	DESIG=6
Γ_7	$2\pi^+2\pi^-2\pi^0$	$< 2.4 \times 10^{-4}$	90%	DESIG=7
Γ_8	$2\pi^+2\pi^-K^+K^-$	$< 1.5 \times 10^{-4}$	90%	DESIG=8

Γ_9	$2\pi^+ 2\pi^- K^+ K^- \pi^0$	< 2.2	$\times 10^{-4}$	90%	DESIG=9
Γ_{10}	$2\pi^+ 2\pi^- K^+ K^- 2\pi^0$	< 1.1	$\times 10^{-3}$	90%	DESIG=10
Γ_{11}	$3\pi^+ 2\pi^- K^- K^0_S \pi^0$	< 7	$\times 10^{-4}$	90%	DESIG=11
Γ_{12}	$3\pi^+ 3\pi^-$	< 7	$\times 10^{-5}$	90%	DESIG=12
Γ_{13}	$3\pi^+ 3\pi^- 2\pi^0$	< 1.2	$\times 10^{-3}$	90%	DESIG=13
Γ_{14}	$3\pi^+ 3\pi^- K^+ K^-$	< 1.5	$\times 10^{-4}$	90%	DESIG=14
Γ_{15}	$3\pi^+ 3\pi^- K^+ K^- \pi^0$	< 7	$\times 10^{-4}$	90%	DESIG=15
Γ_{16}	$4\pi^+ 4\pi^-$	< 1.7	$\times 10^{-4}$	90%	DESIG=16
Γ_{17}	$4\pi^+ 4\pi^- 2\pi^0$	< 6	$\times 10^{-4}$	90%	DESIG=17

$\chi_{b0}(2P)$ BRANCHING RATIOS

NODE=M079220

$\Gamma(\gamma\Upsilon(2S))/\Gamma_{\text{total}}$ Γ_1/Γ

NODE=M079R2
NODE=M079R2

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
1.38±0.30 OUR AVERAGE					
$1.31\pm0.27^{+0.13}_{-0.12}$		[3,4] LEES	14M	BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
$3.6 \pm1.6 \pm0.3$		[3,5] HEINTZ	92	CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<2.8	90	[6] LEES	11J	BABR	$\Upsilon(3S) \rightarrow X\gamma$
<8.9	90	[7] CRAWFORD	92B	CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

[3] Assuming B($\Upsilon(2S) \rightarrow \mu^+\mu^-$) = (1.93 ± 0.17)%. NODE=M079R2;LINKAGE=D

[4] LEES 14M reports $[\Gamma(\chi_{b0}(2P) \rightarrow \gamma\Upsilon(2S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] = (7.7 \pm 1.6) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = (5.9 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=M079R2;LINKAGE=E

[5] Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma\Upsilon(2S)) = (0.28 \pm 0.12 \pm 0.03)\%$ using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.44 \pm 0.10)\%$. Supersedes HEINTZ 91. NODE=M079R2;LINKAGE=C

[6] LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma\Upsilon(2S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))/\Gamma_{\text{total}} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$. NODE=M079R2;LINKAGE=LE

[7] Using $B(\Upsilon(2S) \rightarrow \mu^+\mu^-) = (1.37 \pm 0.26)\%$, $B(\Upsilon(3S) \rightarrow \gamma\gamma\Upsilon(2S))\times 2\, B(\Upsilon(2S) \rightarrow \mu^+\mu^-) < 1.19 \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \chi_{b0}(2P)\gamma) = 0.049$. NODE=M079R2;LINKAGE=B

$\Gamma(\gamma\Upsilon(1S))/\Gamma_{\text{total}}$ Γ_2/Γ

NODE=M079R1
NODE=M079R1

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
0.38±0.17 OUR AVERAGE					
$0.36\pm0.17\pm0.03$		[8,9,10] LEES	14M	BABR	$\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$
$0.9 \pm0.7 \pm0.1$		[9,11] HEINTZ	92	CSB2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.2	90	[12] LEES	11J	BABR	$\Upsilon(3S) \rightarrow X\gamma$
<2.5	90	[13] CRAWFORD	92B	CLE2	$e^+e^- \rightarrow \ell^+\ell^-\gamma\gamma$

[8] LEES 14M quotes $\Gamma(\chi_{b0}(2P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))/\Gamma_{\text{total}} = (2.1 \pm 1.0) \times 10^{-4}$ combining the results from $\Upsilon(3S) \rightarrow \gamma\gamma\mu^+\mu^-$ samples with and without photon conversions. NODE=M079R1;LINKAGE=D

[9] Assuming B($\Upsilon(1S) \rightarrow \mu^+\mu^-$) = (2.48 ± 0.05)%. NODE=M079R1;LINKAGE=E

[10] LEES 14M reports $[\Gamma(\chi_{b0}(2P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}}] \times [B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))] = (2.1 \pm 1.0) \times 10^{-4}$ which we divide by our best value $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) = (5.9 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. NODE=M079R1;LINKAGE=F

[11] Recalculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P)) \times B(\chi_{b0}(2P) \rightarrow \gamma\Upsilon(1S)) = (0.05 \pm 0.04 \pm 0.01)\%$ using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.05)\%$. Supersedes HEINTZ 91. NODE=M079R1;LINKAGE=C

[12] LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \rightarrow \gamma\Upsilon(1S))/\Gamma_{\text{total}} \times \Gamma(\Upsilon(3S) \rightarrow \gamma\chi_{b0}(2P))/\Gamma_{\text{total}} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$. NODE=M079R1;LINKAGE=LE

[13] Using $B(\Upsilon(1S) \rightarrow \mu^+\mu^-) = (2.57 \pm 0.07)\%$, $B(\Upsilon(3S) \rightarrow \gamma\gamma\Upsilon(1S))\times 2\, B(\Upsilon(1S) \rightarrow \mu^+\mu^-) < 0.63 \times 10^{-4}$, and $B(\Upsilon(3S) \rightarrow \chi_{b0}(2P)\gamma) = 0.049$. NODE=M079R1;LINKAGE=B

$\Gamma(D^0 X)/\Gamma_{\text{total}}$ Γ_3/Γ

NODE=M079R01
NODE=M079R01

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<8.2 \times 10^{-2}$	90	[14,15] BRIERE	08	CLEO	$\Upsilon(3S) \rightarrow \gamma D^0 X$

[14] For $p_{D^0} > 2.5$ GeV/c. NODE=M079R01;LINKAGE=BR

[15] The authors also present their result as $(4.1 \pm 3.0 \pm 0.4) \times 10^{-2}$. NODE=M079R01;LINKAGE=RI

$\Gamma(\pi^+\pi^-K^+K^-\pi^0)/\Gamma_{total}$ — Γ_4/Γ

NODE=M079R02

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<0.34	90	[16] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma\pi^+\pi^-K^+K^-\pi^0$

[16] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to \pi^+\pi^-K^+K^-\pi^0)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 2 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R02;LINKAGE=AS

$\Gamma(2\pi^+\pi^-K^-K^0_S)/\Gamma_{total}$ — Γ_5/Γ

NODE=M079R03

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<0.5	90	[17] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 2\pi^+\pi^-K^-K^0_S$

[17] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 2\pi^+\pi^-K^-K^0_S)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 3 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R03;LINKAGE=AS

$\Gamma(2\pi^+\pi^-K^-K^0_S 2\pi^0)/\Gamma_{total}$ — Γ_6/Γ

NODE=M079R04

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<2.2	90	[18] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 2\pi^+\pi^-K^-2\pi^0$

[18] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 2\pi^+\pi^-K^-K^0_S 2\pi^0)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 13 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R04;LINKAGE=AS

$\Gamma(2\pi^+2\pi^-2\pi^0)/\Gamma_{total}$ — Γ_7/Γ

NODE=M079R05

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<2.4	90	[19] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 2\pi^+2\pi^-2\pi^0$

[19] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 2\pi^+2\pi^-2\pi^0)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 14 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R05;LINKAGE=AS

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

NODE=M079R06

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<1.5	90	[20] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 2\pi^+2\pi^-K^+K^-$

[20] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 2\pi^+2\pi^-K^+K^-)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 9 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R06;LINKAGE=AS

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

NODE=M079R07

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<2.2	90	[21] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 2\pi^+2\pi^-K^+K^-\pi^0$

[21] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 2\pi^+2\pi^-K^+K^-\pi^0)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 13 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R07;LINKAGE=AS

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

NODE=M079R08

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<11	90	[22] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 2\pi^+2\pi^-K^+K^-2\pi^0$

[22] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 2\pi^+2\pi^-K^+K^-2\pi^0)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 63 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R08;LINKAGE=AS

$\Gamma(3\pi^+2\pi^-K^-K^0_S\pi^0)/\Gamma_{total}$ — Γ_{11}/Γ

NODE=M079R09

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<7	90	[23] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 3\pi^+2\pi^-K^-K^0_S\pi^0$

[23] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 3\pi^+2\pi^-K^-K^0_S\pi^0)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 39 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R09;LINKAGE=AS

$\Gamma(3\pi^+3\pi^-)/\Gamma_{total}$ — Γ_{12}/Γ

NODE=M079R10

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<0.7	90	[24] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 3\pi^+3\pi^-$

[24] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 3\pi^+3\pi^-)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 4 \times 10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9 \times 10^{-2}$.

NODE=M079R10;LINKAGE=AS

$\Gamma(3\pi^+3\pi^-2\pi^0)/\Gamma_{total}$ Γ_{13}/Γ

NODE=M079R11
NODE=M079R11

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<12	90	[25] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 3\pi^+3\pi^-2\pi^0$

[25] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 3\pi^+3\pi^-2\pi^0)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 72\times10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9\times10^{-2}$.

NODE=M079R11;LINKAGE=AS

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

NODE=M079R12
NODE=M079R12

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<1.5	90	[26] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 3\pi^+3\pi^-K^+K^-$

[26] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 3\pi^+3\pi^-K^+K^-)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 9\times10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9\times10^{-2}$.

NODE=M079R12;LINKAGE=AS

$\Gamma(3\pi^+3\pi^-K^+K^-\pi^0)/\Gamma_{total}$ Γ_{15}/Γ

NODE=M079R13
NODE=M079R13

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<7	90	[27] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 3\pi^+3\pi^-K^+K^-\pi^0$

[27] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 3\pi^+3\pi^-K^+K^-\pi^0)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 43\times10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9\times10^{-2}$.

NODE=M079R13;LINKAGE=AS

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

NODE=M079R14
NODE=M079R14

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<1.7	90	[28] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 4\pi^+4\pi^-$

[28] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 4\pi^+4\pi^-)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 10\times10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9\times10^{-2}$.

NODE=M079R14;LINKAGE=AS

$\Gamma(4\pi^+4\pi^-2\pi^0)/\Gamma_{total}$ Γ_{17}/Γ

NODE=M079R15
NODE=M079R15

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<6	90	[29] ASNER	08A	CLEO	$\Upsilon(3S) \to \gamma 4\pi^+4\pi^-2\pi^0$

[29] ASNER 08A reports $[\Gamma(\chi_{b0}(2P) \to 4\pi^+4\pi^-2\pi^0)/\Gamma_{total}] \times [B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] < 38\times10^{-6}$ which we divide by our best value $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = 5.9\times10^{-2}$.

NODE=M079R15;LINKAGE=AS

$\Gamma(\chi_{b0}(2P) \to \gamma\Upsilon(1S))/\Gamma_{total} \times \Gamma(\Upsilon(3S) \to \gamma\chi_{b0}(2P))/\Gamma_{total}$ $\Gamma_2/\Gamma \times \Gamma_{22}^{\Upsilon(3S)}/\Gamma^{\Upsilon(3S)}$

NODE=M079B01
NODE=M079B01

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN	COMMENT
<8.2	90	[30] LEES	11J	BABR	$\Upsilon(3S) \to X\gamma$

[30] LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \to \gamma\Upsilon(1S))/\Gamma_{total} \times \Gamma(\Upsilon(3S) \to \gamma\chi_{b0}(2P))/\Gamma_{total} = (3.9 \pm 2.2^{+1.2}_{-0.6}) \times 10^{-4}$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \to \gamma\Upsilon(1S)) < 1.2\%$ using $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.

NODE=M079B01;LINKAGE=LE

$B(\chi_{b0}(2P) \to \gamma\Upsilon(1S)) \times B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) \times B(\Upsilon(1S) \to \ell^+\ell^-)$

NODE=M079A02
NODE=M079A02

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
1.4±0.9 OUR AVERAGE				
$1.7^{+1.5}_{-1.4}{}^{+0.1}_{-1.2}$	[31] LEES	14M	BABR	$\Upsilon(3S) \to \gamma\gamma\mu^+\mu^-$
$1.3\pm1.0\pm0.3$	[32] HEINTZ	92	CSB2	$\Upsilon(3S) \to \gamma\gamma\ell^+\ell^-$

[31] From a sample of $\Upsilon(3S) \to \gamma\gamma\mu^+\mu^-$ with one converted photon.

[32] Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) \times B(\chi_{b0}(2P) \to \gamma\Upsilon(1S)) = (0.05 \pm 0.04 \pm 0.01)\%$ using $B(\Upsilon(1S) \to \mu^+\mu^-) = (2.57 \pm 0.05)\%$.

NODE=M079A02;LINKAGE=A
NODE=M079A02;LINKAGE=K

$[B(\chi_{b0}(2P) \to \gamma\Upsilon(1S)) \times B(\Upsilon(3S) \to \gamma\chi_{b0}(2P))] / [B(\chi_{b1}(2P) \to \gamma\Upsilon(1S)) \times B(\Upsilon(3S) \to \gamma\chi_{b1}(2P))]$

NODE=M079A00
NODE=M079A00

VALUE (%)	DOCUMENT ID		TECN	COMMENT
1.71±0.80	[33] LEES	14M	BABR	$\Upsilon(3S) \to \gamma\gamma\mu^+\mu^-$

[33] From a sample of $\Upsilon(3S) \to \gamma\gamma\mu^+\mu^-$ without converted photons.

NODE=M079A00;LINKAGE=A

$\Gamma(\chi_{b0}(2P) \to \gamma\Upsilon(2S))/\Gamma_{total} \times \Gamma(\Upsilon(3S) \to \gamma\chi_{b0}(2P))/\Gamma_{total}$ $\Gamma_1/\Gamma \times \Gamma_{22}^{\Upsilon(3S)}/\Gamma^{\Upsilon(3S)}$

NODE=M079B02
NODE=M079B02

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
<1.6	90	[34] LEES	11J	BABR	$\Upsilon(3S) \to X\gamma$

[34] LEES 11J quotes a central value of $\Gamma(\chi_{b0}(2P) \to \gamma\Upsilon(2S))/\Gamma_{total} \times \Gamma(\Upsilon(3S) \to \gamma\chi_{b0}(2P))/\Gamma_{total} = (-0.3 \pm 0.2^{+0.5}_{-0.4})\%$ and derives a 90% CL upper limit of $B(\chi_{b0}(2P) \to \gamma\Upsilon(2S)) < 2.8\%$ using $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) = (5.9 \pm 0.6)\%$.

NODE=M079B02;LINKAGE=LE

$B(\chi_{b0}(2P) \to \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \to \gamma \chi_{b0}(2P)) \times B(\Upsilon(2S) \to \ell^+ \ell^-)$

NODE=M079A03
NODE=M079A03

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
4.4±1.6 OUR AVERAGE				
$6.6^{+4.9}_{-4.0}{}^{+2.0}_{-0.3}$	[35] LEES	14M	BABR	$\Upsilon(3S) \to \gamma\gamma\mu^+\mu^-$
4.0±1.7±0.3	[36] HEINTZ	92	CSB2	$\Upsilon(3S) \to \gamma\gamma\ell^+\ell^-$

[35] From a sample of $\Upsilon(3S) \to \gamma\gamma\mu^+\mu^-$ with one converted photon. NODE=M079A03;LINKAGE=A

[36] Calculated by us. HEINTZ 92 quotes $B(\Upsilon(3S) \to \gamma\chi_{b0}(2P)) \times B(\chi_{b0}(2P) \to \gamma\Upsilon(2S)) = (0.28 \pm 0.12 \pm 0.03)\%$ using $B(\Upsilon(2S) \to \mu^+\mu^-) = (1.44 \pm 0.10)\%$. NODE=M079A03;LINKAGE=B

$[B(\chi_{b0}(2P) \to \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \to \gamma \chi_{b0}(2P))] / [B(\chi_{b1}(2P) \to \gamma \Upsilon(2S)) \times B(\Upsilon(3S) \to \gamma \chi_{b1}(2P))]$

NODE=M079A01
NODE=M079A01

VALUE (%)	DOCUMENT ID		TECN	COMMENT
3.31±0.56	[37] LEES	14M	BABR	$\Upsilon(3S) \to \gamma\gamma\mu^+\mu^-$

[37] From a sample of $\Upsilon(3S) \to \gamma\gamma\mu^+\mu^-$ without converted photons. NODE=M079A01;LINKAGE=A

$\chi_{b0}(2P)$ REFERENCES

NODE=M079

LEES	14M	PR D90 112010	J.P. Lees *et al.*	(BABAR Collab.)	REFID=56343
LEES	11J	PR D84 072002	J.P. Lees *et al.*	(BABAR Collab.)	REFID=53936
ASNER	08A	PR D78 091103	D.M. Asner *et al.*	(CLEO Collab.)	REFID=52574
BRIERE	08	PR D78 092007	R.A. Briere *et al.*	(CLEO Collab.)	REFID=52577
ARTUSO	05	PRL 94 032001	M. Artuso *et al.*	(CLEO Collab.)	REFID=50454
CRAWFORD	92B	PL B294 139	G. Crawford *et al.*	(CLEO Collab.)	REFID=43177
HEINTZ	92	PR D46 1928	U. Heintz *et al.*	(CUSB II Collab.)	REFID=43604
HEINTZ	91	PRL 66 1563	U. Heintz *et al.*	(CUSB Collab.)	REFID=41580
MORRISON	91	PRL 67 1696	R.J. Morrison *et al.*	(CLEO Collab.)	REFID=41634
NARAIN	91	PRL 66 3113	M. Narain *et al.*	(CUSB Collab.)	REFID=41586