

$\chi_{c1}(1P)$

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

See the Review on " $\psi(2S)$ and χ_c branching ratios" before the $\chi_{c0}(1P)$ Listings.

$\chi_{c1}(1P)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3510.67 ± 0.05 OUR AVERAGE		Error includes scale factor of 1.2.		
3508.4 ± 1.9 ± 0.7	460	¹ AAIJ	17BB LHCB	$p\bar{p} \rightarrow b\bar{b}X \rightarrow 2(K^+K^-)X$
3510.71 ± 0.04 ± 0.09	4.8k	² AAIJ	17BI LHCB	$\chi_{c1} \rightarrow J/\psi\mu^+\mu^-$
3510.30 ± 0.14 ± 0.16		ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
3510.719 ± 0.051 ± 0.019		ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+e^-\gamma$
3509.4 ± 0.9		BAI	99B BES	$\psi(2S) \rightarrow \gamma X$
3510.60 ± 0.087 ± 0.019	513	³ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+e^-\gamma$
3511.3 ± 0.4 ± 0.4	30	BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+e^-X$
3512.3 ± 0.3 ± 4.0		⁴ GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
3507.4 ± 1.7	91	⁵ LEMOIGNE	82 GOLI	$185\pi^-Be \rightarrow \gamma\mu^+\mu^-A$
3510.4 ± 0.6		OREGLIA	82 CBAL	$e^+e^- \rightarrow J/\psi 2\gamma$
3510.1 ± 1.1	254	⁶ HIMEL	80 MRK2	$e^+e^- \rightarrow J/\psi 2\gamma$
3509 ± 11	21	BRANDELIK	79B DASP	$e^+e^- \rightarrow J/\psi 2\gamma$
3507 ± 3		⁶ BARTEL	78B CNTR	$e^+e^- \rightarrow J/\psi 2\gamma$
3505.0 ± 4 ± 4		^{6,7} TANENBAUM	78 MRK1	e^+e^-
3513 ± 7	367	⁶ BIDDICK	77 CNTR	$\psi(2S) \rightarrow \gamma X$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3500 ± 10	40	TANENBAUM	75 MRK1	Hadrons γ

¹ From a fit of the $\phi\phi$ invariant mass with the width of $\chi_{c1}(1P)$ fixed to the PDG 16 value.² AAIJ 17BI reports also $m(\chi_{c2}) - m(\chi_{c1}) = 45.39 \pm 0.07 \pm 0.03$ MeV.³ Recalculated by ANDREOTTI 05A, using the value of $\psi(2S)$ mass from AULCHENKO 03.⁴ Using mass of $\psi(2S) = 3686.0$ MeV.⁵ $J/\psi(1S)$ mass constrained to 3097 MeV.⁶ Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.⁷ From a simultaneous fit to radiative and hadronic decay channels.

$\chi_{c1}(1P)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.84 ± 0.04 OUR FIT					
0.88 ± 0.05 OUR AVERAGE					
1.39 ^{+0.40} _{-0.38} ^{+0.26} _{-0.77}			ABLIKIM	05G BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
0.876 ± 0.045 ± 0.026			ANDREOTTI	05A E835	$p\bar{p} \rightarrow e^+e^-\gamma$
0.87 ± 0.11 ± 0.08		513	¹ ARMSTRONG	92 E760	$\bar{p}p \rightarrow e^+e^-\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.3	95		BAGLIN	86B SPEC	$\bar{p}p \rightarrow e^+e^-X$
<3.8	90		GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$

¹Recalculated by ANDREOTTI 05A. **$\chi_{c1}(1P)$ DECAY MODES**

Mode	Fraction (Γ_j/Γ)	Scale factor/ Confidence level
Hadronic decays		
Γ_1 $3(\pi^+\pi^-)$	$(5.8 \pm 1.4) \times 10^{-3}$	S=1.2
Γ_2 $2(\pi^+\pi^-)$	$(7.6 \pm 2.6) \times 10^{-3}$	
Γ_3 $\pi^+\pi^-\pi^0\pi^0$	$(1.19 \pm 0.15) \%$	
Γ_4 $\rho^+\pi^-\pi^0 + \text{c.c.}$	$(1.45 \pm 0.24) \%$	
Γ_5 $\rho^0\pi^+\pi^-$	$(3.9 \pm 3.5) \times 10^{-3}$	
Γ_6 $4\pi^0$	$(5.4 \pm 0.8) \times 10^{-4}$	
Γ_7 $\pi^+\pi^-K^+K^-$	$(4.5 \pm 1.0) \times 10^{-3}$	
Γ_8 $K^+K^-\pi^0\pi^0$	$(1.12 \pm 0.27) \times 10^{-3}$	
Γ_9 $K^+K^-\pi^+\pi^-\pi^0$	$(1.15 \pm 0.13) \%$	
Γ_{10} $K_S^0 K^\pm \pi^\mp \pi^+ \pi^-$	$(7.5 \pm 0.8) \times 10^{-3}$	
Γ_{11} $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(8.6 \pm 1.4) \times 10^{-3}$	
Γ_{12} $\rho^-K^+\bar{K}^0 + \text{c.c.}$	$(5.0 \pm 1.2) \times 10^{-3}$	
Γ_{13} $K^*(892)^0\bar{K}^0\pi^0 \rightarrow$ $K^+\pi^-\bar{K}^0\pi^0 + \text{c.c.}$	$(2.3 \pm 0.6) \times 10^{-3}$	
Γ_{14} $K^+K^-\eta\pi^0$	$(1.12 \pm 0.34) \times 10^{-3}$	
Γ_{15} $\pi^+\pi^-K_S^0K_S^0$	$(6.9 \pm 2.9) \times 10^{-4}$	
Γ_{16} $K^+K^-\eta$	$(3.2 \pm 1.0) \times 10^{-4}$	
Γ_{17} $\bar{K}^0K^+\pi^- + \text{c.c.}$	$(7.0 \pm 0.6) \times 10^{-3}$	
Γ_{18} $K^*(892)^0\bar{K}^0 + \text{c.c.}$	$(10 \pm 4) \times 10^{-4}$	
Γ_{19} $K^*(892)^+K^- + \text{c.c.}$	$(1.4 \pm 0.6) \times 10^{-3}$	
Γ_{20} $K_J^*(1430)^0\bar{K}^0 + \text{c.c.} \rightarrow$ $K_S^0K^+\pi^- + \text{c.c.}$	$< 8 \times 10^{-4}$	CL=90%
Γ_{21} $K_J^*(1430)^+K^- + \text{c.c.} \rightarrow$ $K_S^0K^+\pi^- + \text{c.c.}$	$< 2.1 \times 10^{-3}$	CL=90%
Γ_{22} $K^+K^-\pi^0$	$(1.81 \pm 0.24) \times 10^{-3}$	
Γ_{23} $\eta\pi^+\pi^-$	$(4.62 \pm 0.23) \times 10^{-3}$	
Γ_{24} $a_0(980)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(3.2 \pm 0.4) \times 10^{-3}$	S=2.2
Γ_{25} $a_2(1320)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(1.76 \pm 0.24) \times 10^{-4}$	
Γ_{26} $a_2(1700)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$(4.6 \pm 0.7) \times 10^{-5}$	
Γ_{27} $f_2(1270)\eta \rightarrow \eta\pi^+\pi^-$	$(3.5 \pm 0.6) \times 10^{-4}$	
Γ_{28} $f_4(2050)\eta \rightarrow \eta\pi^+\pi^-$	$(2.5 \pm 0.9) \times 10^{-5}$	
Γ_{29} $\pi_1(1400)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$< 5 \times 10^{-5}$	CL=90%
Γ_{30} $\pi_1(1600)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$< 1.5 \times 10^{-5}$	CL=90%
Γ_{31} $\pi_1(2015)^+\pi^- + \text{c.c.} \rightarrow \eta\pi^+\pi^-$	$< 8 \times 10^{-6}$	CL=90%
Γ_{32} $f_2(1270)\eta$	$(6.7 \pm 1.1) \times 10^{-4}$	
Γ_{33} $\pi^+\pi^-\eta'$	$(2.2 \pm 0.4) \times 10^{-3}$	
Γ_{34} $K^+K^-\eta'(958)$	$(8.8 \pm 0.9) \times 10^{-4}$	

Γ_{35}	$K_0^*(1430)^+ K^- + \text{c.c.}$	$(6.4 \begin{smallmatrix} +2.2 \\ -2.8 \end{smallmatrix}) \times 10^{-4}$	
Γ_{36}	$f_0(980)\eta'(958)$	$(1.6 \begin{smallmatrix} +1.4 \\ -0.7 \end{smallmatrix}) \times 10^{-4}$	
Γ_{37}	$f_0(1710)\eta'(958)$	$(7 \begin{smallmatrix} +7 \\ -5 \end{smallmatrix}) \times 10^{-5}$	
Γ_{38}	$f_2'(1525)\eta'(958)$	$(9 \pm 6) \times 10^{-5}$	
Γ_{39}	$\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-$	$(3.5 \pm 0.9) \times 10^{-7}$	
Γ_{40}	$K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}$	$(3.2 \pm 2.1) \times 10^{-3}$	
Γ_{41}	$K^*(892)^0 \bar{K}^*(892)^0$	$(1.4 \pm 0.4) \times 10^{-3}$	
Γ_{42}	$K^+ K^- K_S^0 K_S^0$	$< 4 \times 10^{-4}$	CL=90%
Γ_{43}	$K_S^0 K_S^0 K_S^0 K_S^0$	$(3.5 \pm 1.0) \times 10^{-5}$	
Γ_{44}	$K^+ K^- K^+ K^-$	$(5.4 \pm 1.1) \times 10^{-4}$	
Γ_{45}	$K^+ K^- \phi$	$(4.1 \pm 1.5) \times 10^{-4}$	
Γ_{46}	$\bar{K}^0 K^+ \pi^- \phi + \text{c.c.}$	$(3.3 \pm 0.5) \times 10^{-3}$	
Γ_{47}	$K^+ K^- \pi^0 \phi$	$(1.62 \pm 0.30) \times 10^{-3}$	
Γ_{48}	$\phi \pi^+ \pi^- \pi^0$	$(7.5 \pm 1.0) \times 10^{-4}$	
Γ_{49}	$\omega \omega$	$(5.7 \pm 0.7) \times 10^{-4}$	
Γ_{50}	$\omega K^+ K^-$	$(7.8 \pm 0.9) \times 10^{-4}$	
Γ_{51}	$\omega \phi$	$(2.7 \pm 0.4) \times 10^{-5}$	
Γ_{52}	$\phi \phi$	$(4.2 \pm 0.5) \times 10^{-4}$	
Γ_{53}	$\phi \phi \eta$	$(3.0 \pm 0.5) \times 10^{-4}$	
Γ_{54}	$\rho \bar{\rho}$	$(7.60 \pm 0.34) \times 10^{-5}$	
Γ_{55}	$\rho \bar{\rho} \pi^0$	$(1.55 \pm 0.18) \times 10^{-4}$	
Γ_{56}	$\rho \bar{\rho} \eta$	$(1.45 \pm 0.25) \times 10^{-4}$	
Γ_{57}	$\rho \bar{\rho} \omega$	$(2.12 \pm 0.31) \times 10^{-4}$	
Γ_{58}	$\rho \bar{\rho} \phi$	$< 1.7 \times 10^{-5}$	CL=90%
Γ_{59}	$\rho \bar{\rho} \pi^+ \pi^-$	$(5.0 \pm 1.9) \times 10^{-4}$	
Γ_{60}	$\rho \bar{\rho} \pi^0 \pi^0$	$< 5 \times 10^{-4}$	CL=90%
Γ_{61}	$\rho \bar{\rho} K^+ K^- (\text{non-resonant})$	$(1.27 \pm 0.22) \times 10^{-4}$	
Γ_{62}	$\rho \bar{\rho} K_S^0 K_S^0$	$< 4.5 \times 10^{-4}$	CL=90%
Γ_{63}	$\rho \bar{n} \pi^-$	$(3.8 \pm 0.5) \times 10^{-4}$	
Γ_{64}	$\bar{\rho} n \pi^+$	$(3.9 \pm 0.5) \times 10^{-4}$	
Γ_{65}	$\rho \bar{n} \pi^- \pi^0$	$(1.03 \pm 0.12) \times 10^{-3}$	
Γ_{66}	$\bar{\rho} n \pi^+ \pi^0$	$(1.01 \pm 0.12) \times 10^{-3}$	
Γ_{67}	$\Lambda \bar{\Lambda}$	$(1.14 \pm 0.11) \times 10^{-4}$	
Γ_{68}	$\Lambda \bar{\Lambda} \pi^+ \pi^-$	$(2.9 \pm 0.5) \times 10^{-4}$	
Γ_{69}	$\Lambda \bar{\Lambda} \pi^+ \pi^- (\text{non-resonant})$	$(2.5 \pm 0.6) \times 10^{-4}$	
Γ_{70}	$\Sigma(1385)^+ \bar{\Lambda} \pi^- + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%
Γ_{71}	$\Sigma(1385)^- \bar{\Lambda} \pi^+ + \text{c.c.}$	$< 1.3 \times 10^{-4}$	CL=90%
Γ_{72}	$K^+ \bar{\rho} \Lambda + \text{c.c.}$	$(4.2 \pm 0.4) \times 10^{-4}$	S=1.2
Γ_{73}	$K^*(892)^+ \bar{\rho} \Lambda + \text{c.c.}$	$(4.9 \pm 0.7) \times 10^{-4}$	
Γ_{74}	$K^+ \bar{\rho} \Lambda(1520) + \text{c.c.}$	$(1.7 \pm 0.4) \times 10^{-4}$	
Γ_{75}	$\Lambda(1520) \bar{\Lambda}(1520)$	$< 9 \times 10^{-5}$	CL=90%
Γ_{76}	$\Sigma^0 \bar{\Sigma}^0$	$(4.2 \pm 0.6) \times 10^{-5}$	

Γ_{77}	$\Sigma^+ \bar{p} K_S^0 + \text{c.c.}$	$(1.53 \pm 0.12) \times 10^{-4}$	
Γ_{78}	$\Sigma^0 \bar{p} K^+ + \text{c.c.}$	$(1.46 \pm 0.10) \times 10^{-4}$	
Γ_{79}	$\Sigma^+ \bar{\Sigma}^-$	$(3.6 \pm 0.7) \times 10^{-5}$	
Γ_{80}	$\Sigma^- \bar{\Sigma}^+$	$(5.7 \pm 1.5) \times 10^{-5}$	
Γ_{81}	$\Sigma(1385)^+ \bar{\Sigma}(1385)^-$	$< 9 \times 10^{-5}$	CL=90%
Γ_{82}	$\Sigma(1385)^- \bar{\Sigma}(1385)^+$	$< 5 \times 10^{-5}$	CL=90%
Γ_{83}	$K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$	$(1.35 \pm 0.24) \times 10^{-4}$	
Γ_{84}	$\Xi^0 \bar{\Xi}^0$	$< 6 \times 10^{-5}$	CL=90%
Γ_{85}	$\Xi^- \bar{\Xi}^+$	$(8.0 \pm 2.1) \times 10^{-5}$	
Γ_{86}	$\pi^+ \pi^- + K^+ K^-$	$< 2.1 \times 10^{-3}$	
Γ_{87}	$K_S^0 K_S^0$	$< 6 \times 10^{-5}$	CL=90%
Γ_{88}	$\eta_c \pi^+ \pi^-$	$< 3.2 \times 10^{-3}$	CL=90%

Radiative decays

Γ_{89}	$\gamma J/\psi(1S)$	$(34.3 \pm 1.0) \%$	
Γ_{90}	$\gamma \rho^0$	$(2.16 \pm 0.17) \times 10^{-4}$	
Γ_{91}	$\gamma \omega$	$(6.8 \pm 0.8) \times 10^{-5}$	
Γ_{92}	$\gamma \phi$	$(2.4 \pm 0.5) \times 10^{-5}$	
Γ_{93}	$\gamma \gamma$	$< 6.3 \times 10^{-6}$	CL=90%
Γ_{94}	$e^+ e^- J/\psi(1S)$	$(3.46 \pm 0.22) \times 10^{-3}$	
Γ_{95}	$\mu^+ \mu^- J/\psi(1S)$	$(2.33 \pm 0.29) \times 10^{-4}$	

CONSTRAINED FIT INFORMATION

A multiparticle fit to $\chi_{c1}(1P)$, $\chi_{c0}(1P)$, $\chi_{c2}(1P)$, and $\psi(2S)$ with 4 total widths, a partial width, 25 combinations of partial widths obtained from integrated cross section, and 84 branching ratios uses 248 measurements to determine 49 parameters. The overall fit has a $\chi^2 = 378.1$ for 199 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta p_i \delta p_j \rangle / (\delta p_i \delta p_j)$, in percent, from the fit to parameters p_i , including the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_{44}	3				
x_{54}	4	2			
x_{67}	7	3	4		
x_{89}	23	9	2	20	
Γ	-12	-5	-63	-10	-41
	x_{17}	x_{44}	x_{54}	x_{67}	x_{89}

$\chi_{c1}(1P)$ PARTIAL WIDTHS $\chi_{c1}(1P) \Gamma(i)\Gamma(\gamma J/\psi(1S))/\Gamma(\text{total})$ $\Gamma(p\bar{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ $\Gamma_{54}\Gamma_{89}/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
21.9±0.8 OUR FIT			
21.4±0.9 OUR AVERAGE			
21.5±0.5±0.8	¹ ANDREOTTI 05A	E835	$p\bar{p} \rightarrow e^+e^-\gamma$
21.4±1.5±2.2	^{1,2} ARMSTRONG 92	E760	$\bar{p}p \rightarrow e^+e^-\gamma$
19.9 ^{+4.4} _{-4.0}	¹ BAGLIN 86B	SPEC	$\bar{p}p \rightarrow e^+e^-\chi$

¹ Calculated by us using $B(J/\psi(1S) \rightarrow e^+e^-) = 0.0593 \pm 0.0010$.² Recalculated by ANDREOTTI 05A. $\chi_{c1}(1P)$ BRANCHING RATIOS

HADRONIC DECAYS

 $\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
5.8±1.4 OUR EVALUATION	Error includes scale factor of 1.2. Treating systematic error as correlated.		

5.8±1.1 OUR AVERAGE

5.4±0.7±0.9	¹ BAI 99B	BES	$\psi(2S) \rightarrow \gamma\chi_{c1}$
16.0±5.9±0.8	¹ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$. $\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
7.6±2.6 OUR EVALUATION	Treating systematic error as correlated.		

8 ±4 OUR AVERAGE Error includes scale factor of 1.5.

4.6±2.1±2.6	¹ BAI 99B	BES	$\psi(2S) \rightarrow \gamma\chi_{c1}$
12.5±4.2±0.6	¹ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$. $\Gamma(\pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.19±0.15±0.03	604.7	¹ HE 08B	CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $1.28 \pm 0.06 \pm 0.15 \pm 0.08 \%$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+\pi^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.45±0.24±0.04	712.3	^{1,2} HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $1.56 \pm 0.13 \pm 0.22 \pm 0.10$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^+\pi^-\pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Calculated by us. We have added the values from HE 08B for $\rho^+\pi^-\pi^0$ and $\rho^-\pi^+\pi^0$ decays assuming uncorrelated statistical and fully correlated systematic uncertainties.

$\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
3.9±3.5	¹ TANENBAUM 78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Estimated using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

$\Gamma(4\pi^0)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
5.4±0.8±0.1	608	¹ ABLIKIM 11A	BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

¹ ABLIKIM 11A reports $(0.57 \pm 0.03 \pm 0.08) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow 4\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
4.5±1.0 OUR EVALUATION	Treating systematic error as correlated.		
4.5±0.9 OUR AVERAGE			

4.2±0.4±0.9 ¹ BAI 99B BES $\psi(2S) \rightarrow \gamma\chi_{c1}$

7.3±3.0±0.4 ¹ TANENBAUM 78 MRK1 $\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.12±0.27±0.03	45.1	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $(0.12 \pm 0.02 \pm 0.02 \pm 0.01) \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+K^-\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
11.46±0.12±1.29	12k	¹ ABLIKIM 13B	BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
7.52±0.11±0.79	5.1k	¹ ABLIKIM	13B BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

 $\Gamma(K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.86±0.13±0.02	141.3	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.92 \pm 0.09 \pm 0.11 \pm 0.06$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(\rho^- K^+ \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.50±0.12±0.01	141.3	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.54 \pm 0.11 \pm 0.07 \pm 0.03$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho^- K^+ \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

 $\Gamma(K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{13}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.23±0.06±0.01	141.3	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.25 \pm 0.06 \pm 0.03 \pm 0.02$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 \pi^0 \rightarrow K^+ \pi^- \bar{K}^0 \pi^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.112±0.034±0.003	141.3	¹ HE	08B CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$

¹ HE 08B reports $0.12 \pm 0.03 \pm 0.02 \pm 0.01$ % from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \eta \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
6.9±2.9±0.2	19.8±7.7	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1}\gamma$

¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+ \pi^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (0.67 \pm 0.26 \pm 0.11) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^+ K^- \eta)/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$3.2 \pm 1.0 \pm 0.1$	¹ ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(0.34 \pm 0.10 \pm 0.04) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
7.0 ± 0.6 OUR FIT	

$\Gamma(K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{18}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.98 \pm 0.37 \pm 0.02$	22	¹ ABLIKIM	06R	BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 06R reports $(1.1 \pm 0.4 \pm 0.1) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^0 + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{19}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.43 \pm 0.65 \pm 0.03$	27	¹ ABLIKIM	06R	BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 06R reports $(1.6 \pm 0.7 \pm 0.2) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{20}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 8 \times 10^{-4}$	90	¹ ABLIKIM	06R	BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 06R reports $< 0.9 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_J^*(1430)^0 \bar{K}^0 + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{21}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.1 \times 10^{-3}$	90	¹ ABLIKIM	06R	BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 06R reports $< 2.4 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K_J^*(1430)^+ K^- + \text{c.c.} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(K^+ K^- \pi^0)/\Gamma_{\text{total}}$ Γ_{22}/Γ

<u>VALUE (units 10^{-3})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.81 ± 0.24 ± 0.04	¹ ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(1.95 \pm 0.16 \pm 0.23) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{23}/Γ

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
4.62 ± 0.23 OUR AVERAGE				
4.58 ± 0.23 ± 0.11		^{1,2} ABLIKIM	17K	BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$
4.7 ± 0.5 ± 0.1		³ ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$
5.3 ± 0.9 ± 0.1	222	⁴ ABLIKIM	06R	BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(4.67 \pm 0.03 \pm 0.23 \pm 0.16) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ATHAR 07 reports $(5.0 \pm 0.3 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ ABLIKIM 06R reports $(5.9 \pm 0.7 \pm 0.8) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{24}/Γ

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
3.2 ± 0.4 OUR AVERAGE Error includes scale factor of 2.2.				
3.33 ± 0.19 ± 0.08		^{1,2} ABLIKIM	17K	BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$
1.79 ± 0.63 ± 0.04	58	³ ABLIKIM	06R	BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(3.40 \pm 0.03 \pm 0.19 \pm 0.11) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ABLIKIM 06R reports $(2.0 \pm 0.5 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_0(980)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(a_2(1320)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ **Γ_{25} / Γ**

<u>VALUE (units 10^{-3})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.176 \pm 0.023 \pm 0.004$	1,2 ABLIKIM	17K	BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(0.18 \pm 0.01 \pm 0.02 \pm 0.01) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_2(1320)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(a_2(1700)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ **Γ_{26} / Γ**

<u>VALUE (units 10^{-5})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$4.6 \pm 0.7 \pm 0.1$	1,2 ABLIKIM	17K	BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(4.7 \pm 0.4 \pm 0.6 \pm 0.2) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow a_2(1700)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(f_2(1270)\eta \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ **Γ_{27} / Γ**

<u>VALUE (units 10^{-4})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$3.5 \pm 0.6 \pm 0.1$	1,2 ABLIKIM	17K	BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(0.36 \pm 0.01 \pm 0.06 \pm 0.01) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(f_4(2050)\eta \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ **Γ_{28} / Γ**

<u>VALUE (units 10^{-5})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$2.5 \pm 0.9 \pm 0.1$	1,2 ABLIKIM	17K	BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $(2.6 \pm 0.4 \pm 0.8 \pm 0.1) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_4(2050)\eta \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi_1(1400)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ **Γ_{29} / Γ**

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$< 5 \times 10^{-5}$	90	1,2 ABLIKIM	17K	BES3 $\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $< 4.6 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi_1(1400)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $\text{B}(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\pi_1(1600)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{30} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.5 \times 10^{-5}$	90	1,2 ABLIKIM 17K	BES3	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $< 1.5 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi_1(1600)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\pi_1(2015)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{31} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 8 \times 10^{-6}$	90	1,2 ABLIKIM 17K	BES3	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$

¹ From an amplitude analysis using an isobar model.

² ABLIKIM 17K reports $< 8 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi_1(2015)^+ \pi^- + \text{c.c.} \rightarrow \eta \pi^+ \pi^-) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(f_2(1270)\eta) / \Gamma_{\text{total}}$ Γ_{32} / Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
0.67 ± 0.11 OUR AVERAGE				
$0.63 \pm 0.11 \pm 0.02$		1,2 ABLIKIM 17K	BES3	$\psi(2S) \rightarrow \gamma \eta \pi^+ \pi^-$
$2.7 \pm 0.8 \pm 0.1$	53	³ ABLIKIM 06R	BES2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ ABLIKIM 17K reports $(6.4 \pm 1.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² From an amplitude analysis using an isobar model.

³ ABLIKIM 06R reports $(3.0 \pm 0.7 \pm 0.5) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow f_2(1270)\eta) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\pi^+ \pi^- \eta') / \Gamma_{\text{total}}$ Γ_{33} / Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$2.2 \pm 0.4 \pm 0.1$	¹ ATHAR 07	CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ATHAR 07 reports $(2.4 \pm 0.4 \pm 0.3) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^+ \pi^- \eta') / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.0907 \pm 0.0011 \pm 0.0054$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^+ K^- \eta'(958)) / \Gamma_{\text{total}}$ Γ_{34} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
8.75 ± 0.87	310	¹ ABLIKIM 14J	BES3	$\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹ Derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.2 \pm 0.4)\%$. Uncertainty includes both statistical and systematic contributions combined in quadrature.

$\Gamma(K_0^*(1430)^+ K^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$6.41 \pm 0.57^{+2.09}_{-2.71}$	¹ ABLIKIM	14J	BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

$\Gamma(f_0(980)\eta'(958))/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$1.65 \pm 0.47^{+1.32}_{-0.56}$	¹ ABLIKIM	14J	BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

$\Gamma(f_0(1710)\eta'(958))/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$0.71 \pm 0.22^{+0.68}_{-0.48}$	¹ ABLIKIM	14J	BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

$\Gamma(f_2'(1525)\eta'(958))/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$0.92 \pm 0.23^{+0.55}_{-0.51}$	¹ ABLIKIM	14J	BES3 $\psi(2S) \rightarrow \gamma K^+ K^- \eta'(958)$

¹ Normalized to $B(\chi_{c1} \rightarrow K^+ K^- \eta'(958))$ branching fraction.

$\Gamma(\pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
0.35 ± 0.09		ABLIKIM	18D	BES3 $\psi(2S) \rightarrow \gamma \pi^0 \pi^+ \pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<6	90	¹ ABLIKIM	11D	BES3 $\psi(2S) \rightarrow \gamma \pi^0 \pi^+ \pi^-$
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¹ ABLIKIM 11D reports $[\Gamma(\chi_{c1}(1P) \rightarrow \pi^0 f_0(980) \rightarrow \pi^0 \pi^+ \pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 6.0 \times 10^{-7}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{40}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
32 ± 21	¹ TANENBAUM	78	MRK1 $\psi(2S) \rightarrow \gamma \chi_{c1}$

¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

$\Gamma(K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{41}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.44 \pm 0.36 \pm 0.03$	28.4 ± 5.5	^{1,2} ABLIKIM	04H	BES $\psi(2S) \rightarrow \gamma K^+ K^- \pi^+ \pi^-$

¹ ABLIKIM 04H reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^0 \bar{K}^*(892)^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (1.40 \pm 0.27 \pm 0.22) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Assumes $B(K^*(892)^0 \rightarrow K^- \pi^+) = 2/3$.

$\Gamma(K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{42}/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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$<4 \times 10^{-4}$	90	3.2 ± 2.4	¹ ABLIKIM	050 BES2	$\psi(2S) \rightarrow \chi_{c1} \gamma$
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¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] < 4.2 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{43}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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$0.35 \pm 0.10 \pm 0.01$	22	¹ ABLIKIM	19AA BES3	$\psi(2S) \rightarrow \gamma 4K_S^0$
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¹ Using $B(K_S^0 \rightarrow \pi^+ \pi^-) = (69.20 \pm 0.05)\%$. ABLIKIM 19AA reports $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^0 K_S^0 K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (3.4 \pm 0.9 \pm 0.3) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value..

$\Gamma(K^+ K^- K^+ K^-)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (units 10^{-3})	DOCUMENT ID
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0.54 ± 0.11 OUR FIT

$\Gamma(K^+ K^- \phi)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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$0.41 \pm 0.15 \pm 0.01$	17	¹ ABLIKIM	06T BES2	$\psi(2S) \rightarrow \gamma 2K^+ 2K^-$
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¹ ABLIKIM 06T reports $(0.46 \pm 0.16 \pm 0.06) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- \phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\bar{K}^0 K^+ \pi^- \phi + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{46}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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$3.27 \pm 0.28 \pm 0.46$	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$
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$\Gamma(K^+ K^- \pi^0 \phi)/\Gamma_{\text{total}}$ Γ_{47}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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$1.62 \pm 0.12 \pm 0.28$	ABLIKIM	15M BES3	$\psi(2S) \rightarrow \gamma \chi_{c1}$
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$\Gamma(\phi \pi^+ \pi^- \pi^0)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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$0.75 \pm 0.06 \pm 0.08$	373	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma \chi_{c1}$
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¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1} \gamma) = (9.2 \pm 0.4)\%$.

$\Gamma(\omega \omega)/\Gamma_{\text{total}}$ Γ_{49}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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$5.7 \pm 0.7 \pm 0.1$	597	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons
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¹ ABLIKIM 11K reports $(6.0 \pm 0.3 \pm 0.7) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\omega K^+ K^-)/\Gamma_{\text{total}}$ Γ_{50}/Γ

<u>VALUE (units 10^{-3})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.78±0.04±0.08	628	¹ ABLIKIM	13B BES3	$e^+ e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.

$\Gamma(\omega\phi)/\Gamma_{\text{total}}$ Γ_{51}/Γ

<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.27±0.04±0.01	105	¹ ABLIKIM	19J BES3	$\psi(2S) \rightarrow \gamma$ hadrons

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.21±0.06±0.01 15 ^{2,3} ABLIKIM 11K BES3 $\psi(2S) \rightarrow \gamma$ hadrons

¹ ABLIKIM 19J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ = $(2.67 \pm 0.31 \pm 0.27) \times 10^{-6}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 11K reports $(0.22 \pm 0.06 \pm 0.02) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \omega\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Superseded by ABLIKIM 19J.

$\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{52}/Γ

<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
4.2±0.5±0.1	366	¹ ABLIKIM	11K BES3	$\psi(2S) \rightarrow \gamma$ hadrons

¹ ABLIKIM 11K reports $(4.4 \pm 0.3 \pm 0.5) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \phi\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\phi\phi\eta)/\Gamma_{\text{total}}$ Γ_{53}/Γ

<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
3.0±0.4±0.2	83.6	¹ ABLIKIM	20B BES3	$\psi(2S) \rightarrow \gamma\phi\phi\eta$

¹ ABLIKIM 20B reports $(2.96 \pm 0.43 \pm 0.22) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \phi\phi\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$.

$\Gamma(\rho\bar{\rho})/\Gamma_{\text{total}}$ Γ_{54}/Γ

<u>VALUE (units 10^{-4})</u>	<u>DOCUMENT ID</u>
0.760±0.034 OUR FIT	

$\Gamma(p\bar{p}\pi^0)/\Gamma_{\text{total}}$ **Γ_{55}/Γ**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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0.155 ± 0.018 OUR AVERAGE

0.163 ± 0.019 ± 0.004	¹ ONYISI	10	CLE3 $\psi(2S) \rightarrow \gamma p\bar{p}X$
0.112 ± 0.047 ± 0.003	² ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ ONYISI 10 reports $(1.75 \pm 0.16 \pm 0.13 \pm 0.11) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ATHAR 07 reports $(1.2 \pm 0.5 \pm 0.1) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(p\bar{p}\eta)/\Gamma_{\text{total}}$ **Γ_{56}/Γ**

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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0.145 ± 0.024 ± 0.004		¹ ONYISI	10	CLE3 $\psi(2S) \rightarrow \gamma p\bar{p}X$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

< 0.15	90	² ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma h^+ h^- h^0$
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¹ ONYISI 10 reports $(1.56 \pm 0.22 \pm 0.14 \pm 0.10) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ATHAR 07 reports $< 0.16 \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\eta)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(p\bar{p}\omega)/\Gamma_{\text{total}}$ **Γ_{57}/Γ**

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
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0.212 ± 0.030 ± 0.005		¹ ONYISI	10	CLE3 $\psi(2S) \rightarrow \gamma p\bar{p}X$
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¹ ONYISI 10 reports $(2.28 \pm 0.28 \pm 0.16 \pm 0.14) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\omega)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(p\bar{p}\phi)/\Gamma_{\text{total}}$ **Γ_{58}/Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$< 1.7 \times 10^{-5}$	90	¹ ABLIKIM	11F	BES3 $\psi(2S) \rightarrow \gamma p\bar{p}K^+ K^-$
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¹ ABLIKIM 11F reports $< 1.82 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p}\phi)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\rho\bar{p}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{59}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID	TECN	COMMENT
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0.50±0.19 OUR EVALUATION Treating systematic error as correlated.

0.50±0.19 OUR AVERAGE

0.46±0.12±0.15		¹ BAI	99B	BES	$\psi(2S) \rightarrow \gamma\chi_{c1}$
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1.08±0.77±0.05		¹ TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$
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¹ Rescaled by us using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.8 \pm 0.4)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.6 \pm 0.5)\%$.

$\Gamma(\rho\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}$ Γ_{60}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$<5 \times 10^{-4}$	90	¹ HE	08B	CLEO	$e^+e^- \rightarrow \gamma h^+ h^- h^0 h^0$
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¹ HE 08B reports $< 0.05 \times 10^{-2}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho\bar{p}\pi^0\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\rho\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}$ Γ_{61}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.27±0.22±0.03	82 ± 9	¹ ABLIKIM	11F	BES3	$\psi(2S) \rightarrow \gamma\rho\bar{p}K^+K^-$
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¹ ABLIKIM 11F reports $(1.35 \pm 0.15 \pm 0.19) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \rho\bar{p}K^+K^- \text{ (non-resonant)})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\rho\bar{p}K_S^0K_S^0)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (units 10^{-4})	CL%	DOCUMENT ID	TECN	COMMENT
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<4.5	90	¹ ABLIKIM	06D	BES2	$\psi(2S) \rightarrow \gamma\chi_{c1}$
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¹ Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.1 \pm 0.6)\%$.

$\Gamma(\rho\bar{n}\pi^-)/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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3.8±0.5±0.1	1412	¹ ABLIKIM	12J	BES3	$\psi(2S) \rightarrow \gamma\rho\bar{n}\pi^-$
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¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \rho\bar{n}\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ = $(0.37 \pm 0.02 \pm 0.04) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\bar{p}n\pi^+)/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
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3.9±0.5±0.1	1625	¹ ABLIKIM	12J	BES3	$\psi(2S) \rightarrow \gamma\bar{p}n\pi^+$
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¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \bar{p}n\pi^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ = $(0.38 \pm 0.02 \pm 0.04) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\rho\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.3±1.1±0.2	1082	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\rho\bar{n}\pi^-\pi^0$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \rho\bar{n}\pi^-\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (1.00 \pm 0.05 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
10.1±1.1±0.2	1261	¹ ABLIKIM	12J BES3	$\psi(2S) \rightarrow \gamma\bar{p}n\pi^+\pi^0$

¹ ABLIKIM 12J reports $[\Gamma(\chi_{c1}(1P) \rightarrow \bar{p}n\pi^+\pi^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))] = (0.98 \pm 0.05 \pm 0.10) \times 10^{-4}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
1.14±0.11 OUR FIT	

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
29±5±1		105	¹ ABLIKIM	12i BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<150 90 ² ABLIKIM 06D BES2 $\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ ABLIKIM 12i reports $(31.1 \pm 3.4 \pm 3.9) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\psi(2S) \rightarrow \chi_{c1}\gamma) (9.1 \pm 0.6)\%$.

$\Gamma(\Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
25±6±1	13	¹ ABLIKIM	12i BES3	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}\pi^+\pi^-$

¹ ABLIKIM 12i reports $(26.2 \pm 5.5 \pm 3.3) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda}\pi^+\pi^- (\text{non-resonant}))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.3 × 10⁻⁴	90	¹ ABLIKIM	12i BES3	$\psi(2S) \rightarrow \gamma\Sigma(1385)^+\bar{\Lambda}\pi^-$

¹ ABLIKIM 12i reports $< 14 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^+\bar{\Lambda}\pi^- + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
<13	90	¹ ABLIKIM 12I	BES3	$\psi(2S) \rightarrow \gamma \Sigma(1385)^-\bar{\Lambda}\pi^+$
¹ ABLIKIM 12I reports $< 14 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^-\bar{\Lambda}\pi^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.				

$\Gamma(K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2 ± 0.4 OUR AVERAGE	Error includes scale factor of 1.2.			
$9.2^{+2.8}_{-2.4} \pm 0.4$	24	¹ LU	19 BELL	$B^+ \rightarrow \bar{p}\Lambda K^+ K^+$
$4.2 \pm 0.4 \pm 0.1$	3k	^{2,3} ABLIKIM	13D BES3	$\psi(2S) \rightarrow \gamma \Lambda \bar{p} K^+$
$3.1 \pm 0.9 \pm 0.1$		⁴ ATHAR	07 CLEO	$\psi(2S) \rightarrow \gamma h^+ h^- h^0$

¹ LU 19 reports $(9.15^{+2.63}_{-2.25} \pm 0.86) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(B^+ \rightarrow \chi_{c1}(1P)K^+)]$ assuming $B(B^+ \rightarrow \chi_{c1}(1P)K^+) = (4.79 \pm 0.23) \times 10^{-4}$, which we rescale to our best value $B(B^+ \rightarrow \chi_{c1}(1P)K^+) = (4.74 \pm 0.22) \times 10^{-4}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² ABLIKIM 13D reports $(4.5 \pm 0.2 \pm 0.4) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ Using $B(\Lambda \rightarrow p\pi^-) = 63.9\%$.

⁴ ATHAR 07 reports $(3.3 \pm 0.9 \pm 0.4) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^*(892)^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.9 \pm 0.7 \pm 0.1$	328	¹ ABLIKIM 19AU	BES3	$\psi(2S) \rightarrow \gamma K^{*+}\bar{p}\Lambda$

¹ ABLIKIM 19AU reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^*(892)^+\bar{p}\Lambda + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))] = (4.8 \pm 0.5 \pm 0.4) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(K^+\bar{p}\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.71 \pm 0.44 \pm 0.04$	48 ± 10	¹ ABLIKIM 11F	BES3	$\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

¹ ABLIKIM 11F reports $(1.81 \pm 0.38 \pm 0.28) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow K^+\bar{p}\Lambda(1520) + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<9 \times 10^{-5}$	90	¹ ABLIKIM	11F	BES3 $\psi(2S) \rightarrow \gamma p \bar{p} K^+ K^-$

¹ ABLIKIM 11F reports $< 1.00 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Lambda(1520)\bar{\Lambda}(1520))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$4.2 \pm 0.6 \pm 0.1$		103	¹ ABLIKIM	18V	BES3 $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
<6	90		² ABLIKIM	13H	BES3 $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$
<4	90	3.8 ± 2.5	³ NAIK	08	CLEO $\psi(2S) \rightarrow \gamma \Sigma^0 \bar{\Sigma}^0$

- • • We do not use the following data for averages, fits, limits, etc. • • •
- ¹ ABLIKIM 18V reports $[(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ = $(0.41 \pm 0.05 \pm 0.03) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ABLIKIM 13H reports $< 0.62 \times 10^{-4}$ from a measurement of $[(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.
- ³ NAIK 08 reports $< 0.44 \times 10^{-4}$ from a measurement of $[(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{\Sigma}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$3.6 \pm 0.6 \pm 0.1$		59	¹ ABLIKIM	18V	BES3 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
<8	90		² ABLIKIM	13H	BES3 $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$
<6	90	4.3 ± 2.3	³ NAIK	08	CLEO $\psi(2S) \rightarrow \gamma \Sigma^+ \bar{\Sigma}^-$

- • • We do not use the following data for averages, fits, limits, etc. • • •
- ¹ ABLIKIM 18V reports $[(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ = $(0.35 \pm 0.06 \pm 0.02) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.
- ² ABLIKIM 13H reports $< 0.87 \times 10^{-4}$ from a measurement of $[(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.
- ³ NAIK 08 reports $< 0.65 \times 10^{-4}$ from a measurement of $[(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{\Sigma}^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}$ Γ_{80}/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.7 \pm 1.4 \pm 0.6$	214	¹ ABLIKIM	20I	BES3 $\psi(2S) \rightarrow \gamma \Sigma^- \bar{\Sigma}^+$

¹ ABLIKIM 20i reports $(5.7 \pm 1.4 \pm 0.6) \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^- \bar{\Sigma}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$.

$\Gamma(\Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}$ Γ_{81}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 9 \times 10^{-5}$	90	¹ ABLIKIM	12i	BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

¹ ABLIKIM 12i reports $< 10 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^+ \bar{\Sigma}(1385)^-)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}$ Γ_{82}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5 \times 10^{-5}$	90	¹ ABLIKIM	12i	BES3 $\psi(2S) \rightarrow \gamma \Lambda \bar{\Lambda} \pi^+ \pi^-$

¹ ABLIKIM 12i reports $< 5.7 \times 10^{-5}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Sigma(1385)^- \bar{\Sigma}(1385)^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}$ Γ_{83}/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$1.35 \pm 0.24 \pm 0.03$	49	¹ ABLIKIM	15i	BES3 $\psi(2S) \rightarrow \gamma K^- \Lambda \bar{\Xi}^+ + \text{c.c.}$

¹ ABLIKIM 15i reports $[\Gamma(\chi_{c1}(1P) \rightarrow K^- \Lambda \bar{\Xi}^+ + \text{c.c.})/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ $= (1.32 \pm 0.20 \pm 0.12) \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$< 6 \times 10^{-5}$	90	1.7 ± 2.4	¹ NAIK	08	CLEO $\psi(2S) \rightarrow \gamma \Xi^0 \bar{\Xi}^0$

¹ NAIK 08 reports $< 0.60 \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^0 \bar{\Xi}^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
$0.80 \pm 0.21 \pm 0.02$	16.4 ± 4.3		¹ NAIK	08	CLEO $\psi(2S) \rightarrow \gamma \Xi^+ \bar{\Xi}^-$

• • • We do not use the following data for averages, fits, limits, etc. • • •

< 3.4	90		² ABLIKIM	06D	BES2 $\psi(2S) \rightarrow \gamma \chi_{c1}$
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¹ NAIK 08 reports $(0.86 \pm 0.22 \pm 0.08) \times 10^{-4}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \Xi^- \bar{\Xi}^+)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Using $B(\psi(2S) \rightarrow \chi_{c1} \gamma) (9.1 \pm 0.6)\%$.

$[\Gamma(\pi^+\pi^-) + \Gamma(K^+K^-)]/\Gamma_{\text{total}}$ Γ_{86}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<21 \times 10^{-4}$		¹ FELDMAN 77	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c1}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<38 \times 10^{-4}$	90	¹ BRANDELIK 79B	DASP	$\psi(2S) \rightarrow \gamma\chi_{c1}$
¹ Estimated using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.				

$\Gamma(K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{87}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6 \times 10^{-5}$	90	¹ ABLIKIM 050	BES2	$\psi(2S) \rightarrow \chi_{c1}\gamma$
¹ ABLIKIM 050 reports $[\Gamma(\chi_{c1}(1P) \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ $< 0.6 \times 10^{-5}$ which we divide by our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = 9.75 \times 10^{-2}$.				

$\Gamma(\eta_c \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{88}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<3.2 \times 10^{-3}$	90	^{1,2} ABLIKIM 13B	BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<4.4 \times 10^{-3}$	90	^{1,3} ABLIKIM 13B	BES3	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$
¹ Using 1.06×10^8 $\psi(2S)$ mesons and $B(\psi(2S) \rightarrow \chi_{c1}\gamma) = (9.2 \pm 0.4)\%$.				
² Using the $\eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ decays.				
³ Using the $\eta_c \rightarrow K^+ K^- \pi^0$ decays.				

————— RADIATIVE DECAYS —————

$\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{89}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
34.3 ± 1.0 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$34.75 \pm 0.11 \pm 1.70$	1.9M	¹ ABLIKIM 17U	BES3	$e^+e^- \rightarrow \gamma X$
$37.9 \pm 0.8 \pm 2.1$		² ADAM 05A	CLEO	$e^+e^- \rightarrow \psi(2S) \rightarrow \gamma\chi_{c1}$
¹ Not independent from $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))$ and the product $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) \times B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))$ also measured in ABLIKIM 17U.				
² Uses $B(\psi(2S) \rightarrow \gamma\chi_{c1} \rightarrow \gamma\gamma J/\psi)$ from ADAM 05A and $B(\psi(2S) \rightarrow \gamma\chi_{c1})$ from ATHAR 04.				

$\Gamma(\gamma\rho^0)/\Gamma_{\text{total}}$ Γ_{90}/Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
216 ± 17 OUR AVERAGE				
$215 \pm 22 \pm 5$	432 ± 25	¹ ABLIKIM 11E	BES3	$\psi(2S) \rightarrow \gamma\gamma\rho^0$
$217 \pm 24 \pm 5$	186 ± 15	² BENNETT 08A	CLEO	$\psi(2S) \rightarrow \gamma\gamma\rho^0$
¹ ABLIKIM 11E reports $(228 \pm 13 \pm 22) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma\rho^0)/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.				

² BENNETT 08A reports $(243 \pm 19 \pm 22) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma \rho^0) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\gamma\omega) / \Gamma_{\text{total}}$ Γ_{91} / Γ

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
68 ± 8 OUR AVERAGE				
66 ± 9 ± 2	136 ± 14	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\omega$
74 ± 17 ± 2	39 ± 7	² BENNETT	08A CLEO	$\psi(2S) \rightarrow \gamma\gamma\omega$

¹ ABLIKIM 11E reports $(69.7 \pm 7.2 \pm 6.6) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma\omega) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BENNETT 08A reports $(83 \pm 15 \pm 12) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma\omega) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\gamma\phi) / \Gamma_{\text{total}}$ Γ_{92} / Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
24 ± 5 ± 1		43 ± 9	¹ ABLIKIM	11E BES3	$\psi(2S) \rightarrow \gamma\gamma\phi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<23 90 5.2 ± 3.1 ² BENNETT 08A CLEO $\psi(2S) \rightarrow \gamma\gamma\phi$

¹ ABLIKIM 11E reports $(25.8 \pm 5.2 \pm 2.3) \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma\phi) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.2 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BENNETT 08A reports $< 26 \times 10^{-6}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow \gamma\phi) / \Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 9.75 \times 10^{-2}$.

$\Gamma(\gamma\gamma) / \Gamma_{\text{total}}$ Γ_{93} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
< 6.3 × 10⁻⁶	90	ABLIKIM	17AE BES3	$\psi(2S) \rightarrow \gamma \chi_{c1} \rightarrow 3\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 3.5 × 10 ⁻⁵	90	ECKLUND	08A CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1} \rightarrow 3\gamma$
<150 × 10 ⁻⁵	90	¹ YAMADA	77 DASP	$e^+ e^- \rightarrow 3\gamma$

¹ Estimated using $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = 0.087$. The errors do not contain the uncertainty in the $\psi(2S)$ decay.

$\Gamma(e^+e^- J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$3.65 \pm 0.23 \pm 0.09$	1.9k	^{1,2} ABLIKIM	17I	BES3 $\psi(2S) \rightarrow \gamma e^+ e^- J/\psi$
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¹ ABLIKIM 17I reports $(3.73 \pm 0.09 \pm 0.25) \times 10^{-3}$ from a measurement of $[\Gamma(\chi_{c1}(1P) \rightarrow e^+ e^- J/\psi(1S))/\Gamma_{\text{total}}] \times [B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))]$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.55 \pm 0.31) \times 10^{-2}$, which we rescale to our best value $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) = (9.75 \pm 0.24) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² Not independent from other measurements reported by ABLIKIM 17I

$\Gamma(e^+e^- J/\psi(1S))/\Gamma(\gamma J/\psi(1S))$ Γ_{94}/Γ_{89}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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$10.1 \pm 0.3 \pm 0.5$	1.9k	¹ ABLIKIM	17I	BES3 $\psi(2S) \rightarrow e^+ e^- \gamma J/\psi$
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¹ Uses $B(\psi(2S) \rightarrow \gamma \chi_{c1}(1P)) \times B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (351.8 \pm 1.0 \pm 12.0) \times 10^{-4}$ from ABLIKIM 17N and accounts for common systematic errors.

$\Gamma(\mu^+ \mu^- J/\psi(1S))/\Gamma(e^+ e^- J/\psi(1S))$ Γ_{95}/Γ_{94}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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$6.73 \pm 0.51 \pm 0.50$	222	ABLIKIM	19Z	BES3 $\psi(2S) \rightarrow \gamma \chi_c \rightarrow \gamma(\mu^+ \mu^- J/\psi)$
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$\chi_{c1}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$ $\Gamma_{54}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}$

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
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2.14 ± 0.10 OUR FIT

1.1 ± 1.0	¹ BAI	98I	BES $\psi(2S) \rightarrow \gamma \chi_{c1} \rightarrow \gamma p\bar{p}$
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¹ Calculated by us. The value for $B(\chi_{c1} \rightarrow p\bar{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

$\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}$ $\Gamma_{67}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_{\psi(2S)}$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
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11.1 ± 1.1 OUR FIT

10.9 ± 1.1 OUR AVERAGE

$11.2 \pm 1.0 \pm 0.9$	136	¹ ABLIKIM	13H	BES3 $\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}$
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$10.5 \pm 1.6 \pm 0.6$	46 ± 7	² NAIK	08	CLEO $\psi(2S) \rightarrow \gamma \Lambda\bar{\Lambda}$
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¹ Calculated by us. ABLIKIM 13H reports $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) = (12.2 \pm 1.1 \pm 1.1) \times 10^{-5}$ from a measurement of $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) \times B(\psi(2S) \rightarrow \gamma \chi_{c1})$ assuming $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.2 \pm 0.4)\%$.

² Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) = (11.6 \pm 1.8 \pm 0.7 \pm 0.7) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma \chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \Lambda\bar{\Lambda})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}{\Gamma_{67}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
3.20 ± 0.30 OUR FIT				
7.1 ^{+2.8}_{-2.4} ± 1.3	9.0 ^{+3.5} _{-3.1}	¹ BAI	03E BES	$\psi(2S) \rightarrow \gamma\Lambda\bar{\Lambda}$

¹ BAI 03E reports [$B(\chi_{c1} \rightarrow \Lambda\bar{\Lambda}) B(\psi(2S) \rightarrow \gamma\chi_{c1}) / B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-)] \times [B^2(\Lambda \rightarrow \pi^-p) / B(J/\psi \rightarrow p\bar{p})] = (1.33^{+0.52}_{-0.46} \pm 0.25)\%$. We calculate from this measurement the presented value using $B(\Lambda \rightarrow \pi^-p) = (63.9 \pm 0.5)\%$ and $B(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$.

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{89}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
3.34 ± 0.06 OUR FIT				
3.24 ± 0.16 OUR AVERAGE		Error includes scale factor of 2.1. See the ideogram below.		
3.518 ± 0.010 ± 0.120	143k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma\gamma J/\psi$
3.442 ± 0.010 ± 0.132	1.9M	ABLIKIM	17U BES3	$e^+e^- \rightarrow \gamma X$
2.81 ± 0.05 ± 0.23	13k	BAI	04I BES2	$\psi(2S) \rightarrow J/\psi\gamma\gamma$
2.56 ± 0.12 ± 0.20		GAISER	86 CBAL	$\psi(2S) \rightarrow \gamma X$
2.78 ± 0.30		² OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma\chi_{c1}$
2.2 ± 0.5		³ BRANDELIK	79B DASP	$\psi(2S) \rightarrow \gamma\chi_{c1}$
2.9 ± 0.5		³ BARTEL	78B CNTR	$\psi(2S) \rightarrow \gamma\chi_{c1}$
5.0 ± 1.5		⁴ BIDDICK	77 CNTR	$e^+e^- \rightarrow \gamma X$
2.8 ± 0.9		² WHITAKER	76 MRK1	e^+e^-
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3.377 ± 0.009 ± 0.183	142k	⁵ ABLIKIM	12O BES3	$\psi(2S) \rightarrow \gamma\chi_{c1}$
3.56 ± 0.03 ± 0.12	24.9k	⁶ MENDEZ	08 CLEO	$\psi(2S) \rightarrow \gamma\chi_{c1}$
3.44 ± 0.06 ± 0.13	3.7k	⁷ ADAM	05A CLEO	Repl. by MENDEZ 08

¹ Uses $B(J/\psi \rightarrow e^+e^-) = (5.971 \pm 0.032)\%$ and $B(J/\psi \rightarrow \mu^+\mu^-) = (5.961 \pm 0.033)\%$.

² Recalculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

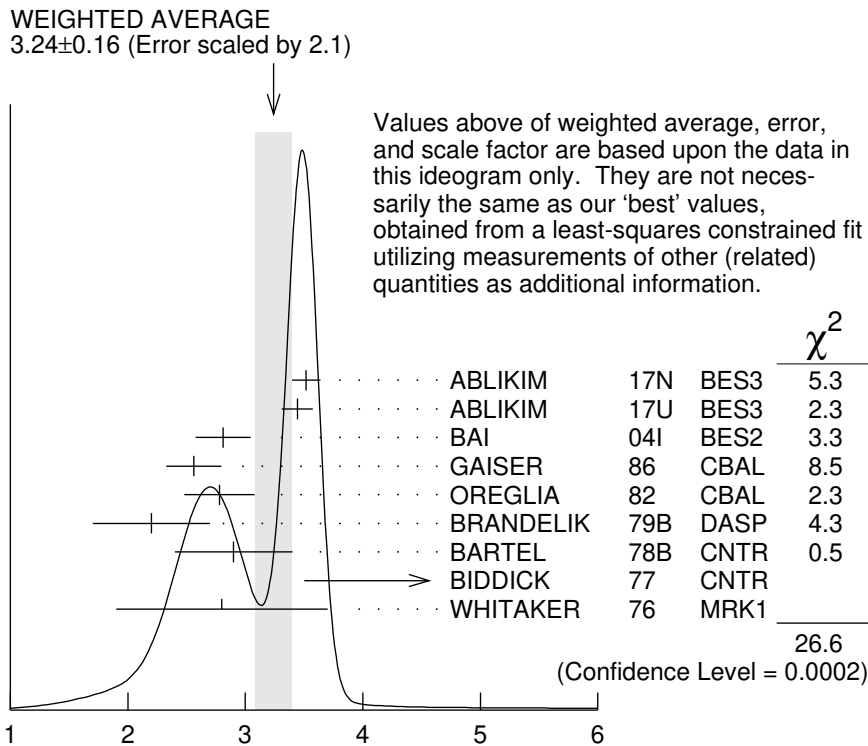
³ Recalculated by us using $B(J/\psi(1S) \rightarrow \mu^+\mu^-) = 0.0588 \pm 0.0010$.

⁴ Assumes isotropic gamma distribution.

⁵ Superseded by ABLIKIM 17N.

⁶ Not independent from other measurements of MENDEZ 08.

⁷ Not independent from other values reported by ADAM 05A.



$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma_{\text{total}}$ (units 10^{-2})

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{ anything})$$

$$\frac{\Gamma_{89}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_9^{\psi(2S)}}{\Gamma_{89}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)} + \Gamma_{12}^{\psi(2S)}/\Gamma_{13}^{\psi(2S)} + 0.343\Gamma_{152}^{\psi(2S)} + 0.190\Gamma_{153}^{\psi(2S)}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.43±0.10 OUR FIT				

• • • We do not use the following data for averages, fits, limits, etc. • • •

5.70±0.04±0.15	24.9k	¹ MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
5.77±0.10±0.12	3.7k	ADAM	05A	CLEO	Repl. by MENDEZ 08

¹ Not independent from other measurements of MENDEZ 08.

$$\Gamma(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma \chi_{c1}(1P))/\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)$$

$$\frac{\Gamma_{89}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}{\Gamma_{11}^{\psi(2S)}}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
9.63±0.17 OUR FIT				

10.15±0.28 OUR AVERAGE

10.17±0.07±0.27	24.9k	MENDEZ	08	CLEO	$\psi(2S) \rightarrow \gamma \chi_{c1}$
12.6 ±0.3 ±3.8	3k	¹ ABLIKIM	04B	BES	$\psi(2S) \rightarrow J/\psi X$
8.5 ±2.1		² HIMEL	80	MRK2	$\psi(2S) \rightarrow \gamma \chi_{c1}$

• • • We do not use the following data for averages, fits, limits, etc. • • •

10.24±0.17±0.23	3.7k	³ ADAM	05A	CLEO	Repl. by MENDEZ 08
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¹ From a fit to the J/ψ recoil mass spectra.

² The value for $B(\psi(2S) \rightarrow \gamma\chi_{c1}) \times B(\chi_{c1} \rightarrow \gamma J/\psi(1S))$ quoted in HIMEL 80 is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (33 \pm 3)\%$ and $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.138 \pm 0.018$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

³ Not independent from other values reported by ADAM 05A.

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{17}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

<u>VALUE (units 10^{-4})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
6.8±0.5 OUR FIT			
7.2±0.6 OUR AVERAGE			
7.3±0.5±0.5	¹ ATHAR	07	CLEO $\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$
7.0±0.5±0.9	² ABLIKIM	06R	BES2 $\psi(2S) \rightarrow \gamma\chi_{c1}$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^- + \text{c.c.})$ reported by ATHAR 07 was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (9.07 \pm 0.11 \pm 0.54)\%$.

² Calculated by us. ABLIKIM 06R reports $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-) = (4.0 \pm 0.3 \pm 0.5) \times 10^{-3}$. We use $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (8.7 \pm 0.4) \times 10^{-2}$.

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow \bar{K}^0 K^+ \pi^- + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \Gamma_{17}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

<u>VALUE (units 10^{-4})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
19.6±1.6 OUR FIT			
13.2±2.4±3.2	¹ BAI	99B	BES $\psi(2S) \rightarrow \gamma K_S^0 K^+ \pi^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow K_S^0 K^+ \pi^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma_{44}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_{\psi(2S)}}$$

<u>VALUE (units 10^{-4})</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.53±0.11 OUR FIT				
0.61±0.11±0.08	54	¹ ABLIKIM	06T	BES2 $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow 2K^+ 2K^-)$ reported by ABLIKIM 06T was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.8)\%$.

$$\frac{\Gamma(\chi_{c1}(1P) \rightarrow K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}}}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \Gamma_{44}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma_{11}^{\psi(2S)}}$$

<u>VALUE (units 10^{-4})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.52±0.31 OUR FIT			
1.13±0.40±0.29	¹ BAI	99B	BES $\psi(2S) \rightarrow \gamma K^+ K^+ K^- K^-$

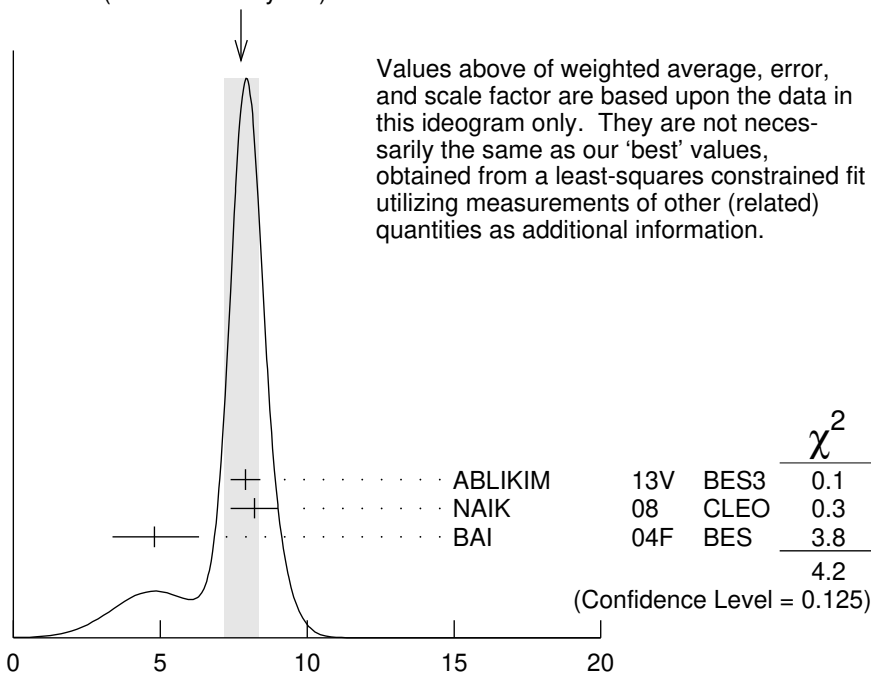
¹ Calculated by us. The value of $B(\chi_{c1} \rightarrow 2K^+ 2K^-)$ reported by BAI 99B was derived using $B(\psi(2S) \rightarrow \gamma\chi_{c1}(1P)) = (8.7 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

$$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}} \quad \Gamma_{54}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-6})	EVTS	DOCUMENT ID	TECN	COMMENT
7.41 ± 0.35 OUR FIT				
7.8 ± 0.6 OUR AVERAGE		Error includes scale factor of 1.4. See the ideogram below.		
7.9 ± 0.4 ± 0.3	453	ABLIKIM	13V BES3	$\psi(2S) \rightarrow \gamma p\bar{p}$
8.2 ± 0.7 ± 0.4	141 ± 13	¹ NAIK	08 CLEO	$\psi(2S) \rightarrow \gamma p\bar{p}$
4.8 ^{+1.4} _{-1.3} ± 0.6	18.2 ^{+5.5} _{-4.9}	BAI	04F BES	$\psi(2S) \rightarrow \gamma\chi_{c1}(1P) \rightarrow \gamma p\bar{p}$

¹ Calculated by us. NAIK 08 reports $B(\chi_{c1} \rightarrow p\bar{p}) = (9.0 \pm 0.8 \pm 0.4 \pm 0.5) \times 10^{-5}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.07 \pm 0.11 \pm 0.54)\%$.

WEIGHTED AVERAGE
7.8 ± 0.6 (Error scaled by 1.4)



Values above of weighted average, error, and scale factor are based upon the data in this ideogram only. They are not necessarily the same as our 'best' values, obtained from a least-squares constrained fit utilizing measurements of other (related) quantities as additional information.

$$\Gamma(\chi_{c1}(1P) \rightarrow p\bar{p})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}} \quad \text{(units } 10^{-6}\text{)}$$

$$\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}} \quad \Gamma_{77}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.49 ± 0.09 ± 0.07	258	¹ ABLIKIM	19BB BES3	$\psi(2S) \rightarrow \gamma \Sigma^+ \bar{p} K_S^0 + \text{c.c.}$

¹ Calculated by us. ABLIKIM 19BB reports $B(\chi_{c1} \rightarrow \Sigma^+ \bar{p} K_S^0 + \text{c.c.}) = (1.53 \pm 0.10 \pm 0.08) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma\chi_{c1}) = (9.75 \pm 0.24)\%$ and other branching fractions from PDG 18.

$$\Gamma(\chi_{c1}(1P) \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.})/\Gamma_{\text{total}} \times \Gamma(\psi(2S) \rightarrow \gamma\chi_{c1}(1P))/\Gamma_{\text{total}} \quad \Gamma_{78}/\Gamma \times \Gamma_{152}^{\psi(2S)}/\Gamma\psi(2S)$$

VALUE (units 10^{-5})	EVTS	DOCUMENT ID	TECN	COMMENT
1.42 ± 0.07 ± 0.06	493	¹ ABLIKIM	20AE BES3	$\psi(2S) \rightarrow \gamma \Sigma^0 \bar{p} K^+ + \text{c.c.}$

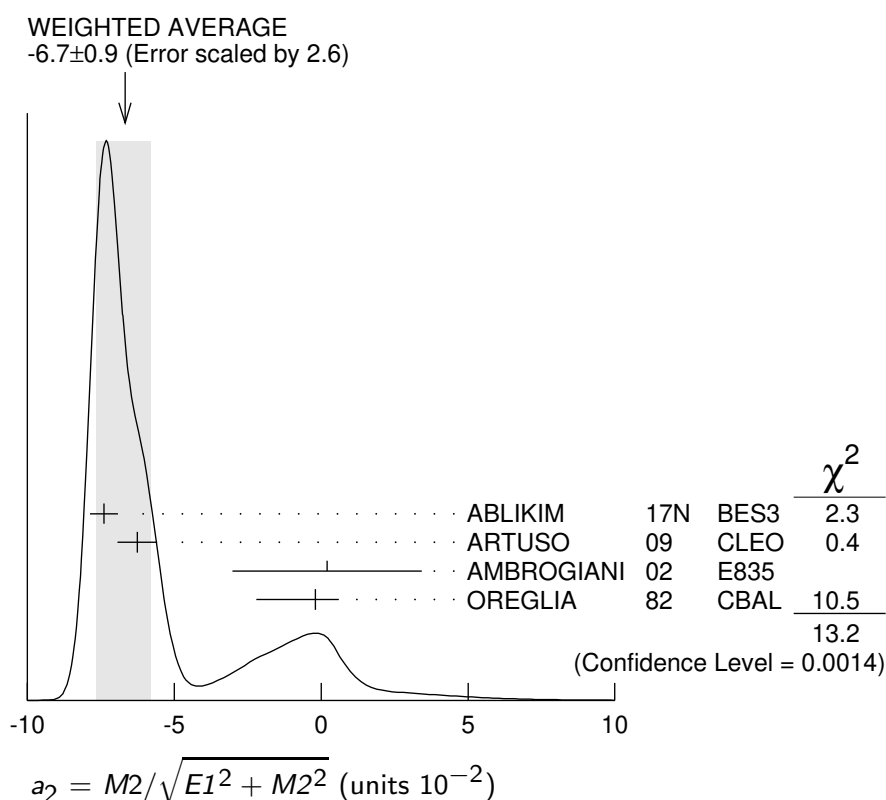
¹ Calculated by us. ABLIKIM 20AE reports $B(\chi_{c1} \rightarrow \Sigma^0 \bar{p} K^+ + \text{c.c.}) = (1.46 \pm 0.07 \pm 0.07) \times 10^{-4}$ using $B(\psi(2S) \rightarrow \gamma \chi_c^0) = (9.75 \pm 0.24)\%$ and other branching fractions from PDG 20.

MULTIPOLE AMPLITUDES IN $\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)$

$a_2 = M2/\sqrt{E1^2 + M2^2}$ Magnetic quadrupole fractional transition amplitude

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-6.7 ± 0.9 OUR AVERAGE		Error includes scale factor of 2.6. See the ideogram below.		
-7.40 ± 0.33 ± 0.34	164k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
-6.26 ± 0.63 ± 0.24	39k	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
0.2 ± 3.2 ± 0.4	2090	AMBROGIANI	02 E835	$p \bar{p} \rightarrow \chi_{c1} \rightarrow J/\psi \gamma$
-0.2 ^{+0.8} / _{-2.0}	921	OREGLIA	82 CBAL	$\psi(2S) \rightarrow \chi_{c1} \gamma \rightarrow J/\psi \gamma \gamma$

¹ Correlated with b_2 with correlation coefficient $\rho_{a_2 b_2} = 0.133$.



MULTIPOLE AMPLITUDES IN $\psi(2S) \rightarrow \gamma \chi_{c1}(1S)$ RADIATIVE DECAY

$b_2 = M2/\sqrt{E1^2 + M2^2}$ Magnetic quadrupole fractional transition amplitude

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.5 ± 0.4 OUR AVERAGE				
2.29 ± 0.39 ± 0.27	164k	¹ ABLIKIM	17N BES3	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
2.76 ± 0.73 ± 0.23	39k	ARTUSO	09 CLEO	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$
7.7 ^{+5.0} / _{-4.5}	921	OREGLIA	82 CBAL	$\psi(2S) \rightarrow \gamma \gamma \ell^+ \ell^-$

¹ Correlated with a_2 with correlation coefficient $\rho_{a_2 b_2} = 0.133$.

MULTIPOLE AMPLITUDE RATIOS IN RADIATIVE DECAYS

$\psi(2S) \rightarrow \gamma\chi_{c1}(1S)$ and $\chi_{c1} \rightarrow \gamma J/\psi(1S)$

 a_2/b_2 Magnetic quadrupole transition amplitude ratio

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$-2.27^{+0.57}_{-0.99}$	39k	¹ ARTUSO	09	CLEO $\psi(2S) \rightarrow \gamma\gamma\ell^+\ell^-$

¹ Statistical and systematic errors combined. Not independent of $a_2(\chi_{c1})$ and $b_2(\chi_{c1})$ values from ARTUSO 09. **$\chi_{c1}(1P)$ REFERENCES**

ABLIKIM	20AE	PR D102 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20B	PR D101 012012	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	20I	PR D101 092002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PDG	20	PTEP 2020 083C01	P.A. Zyla <i>et al.</i>	(PDG Collab.)
ABLIKIM	19AA	PR D99 052008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19AU	PR D100 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19BB	PR D100 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19J	PR D99 012015	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	19Z	PR D99 051101	M. Ablikim <i>et al.</i>	(BESIII Collab.)
LU	19	PR D99 032003	P.-C. Lu <i>et al.</i>	(BELLE Collab.)
ABLIKIM	18D	PRL 121 022001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	18V	PR D97 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PDG	18	PR D98 030001	M. Tanabashi <i>et al.</i>	(PDG Collab.)
AAIJ	17BB	EPJ C77 609	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17BI	PRL 119 221801	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	17AE	PR D96 092007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17I	PRL 118 221802	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17K	PR D95 032002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17N	PR D95 072004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	17U	PR D96 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
PDG	16	CP C40 100001	C. Patrignani <i>et al.</i>	(PDG Collab.)
ABLIKIM	15I	PR D91 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	15M	PR D91 112008	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	14J	PR D89 074030	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13B	PR D87 012002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13D	PR D87 012007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13H	PR D87 032007	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	13V	PR D88 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12I	PR D86 052004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12J	PR D86 052011	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	12O	PRL 109 172002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11A	PR D83 012006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11D	PR D83 032003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11E	PR D83 112005	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11F	PR D83 112009	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	11K	PRL 107 092001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ONYISI	10	PR D82 011103	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)
ARTUSO	09	PR D80 112003	M. Artuso <i>et al.</i>	(CLEO Collab.)
BENNETT	08A	PRL 101 151801	J.V. Bennett <i>et al.</i>	(CLEO Collab.)
ECKLUND	08A	PR D78 091501	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)
HE	08B	PR D78 092004	Q. He <i>et al.</i>	(CLEO Collab.)
MENDEZ	08	PR D78 011102	H. Mendez <i>et al.</i>	(CLEO Collab.)
NAIK	08	PR D78 031101	P. Naik <i>et al.</i>	(CLEO Collab.)
ATHAR	07	PR D75 032002	S.B. Athar <i>et al.</i>	(CLEO Collab.)
ABLIKIM	06D	PR D73 052006	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	06R	PR D74 072001	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	06T	PL B642 197	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	05G	PR D71 092002	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	05O	PL B630 21	M. Ablikim <i>et al.</i>	(BES Collab.)
ADAM	05A	PRL 94 232002	N.E. Adam <i>et al.</i>	(CLEO Collab.)

ANDREOTTI	05A	NP B717 34	M. Andreotti <i>et al.</i>	(FNAL E835 Collab.)
ABLIKIM	04B	PR D70 012003	M. Ablikim <i>et al.</i>	(BES Collab.)
ABLIKIM	04H	PR D70 092003	M. Ablikim <i>et al.</i>	(BES Collab.)
ATHAR	04	PR D70 112002	S.B. Athar <i>et al.</i>	(CLEO Collab.)
BAI	04F	PR D69 092001	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	04I	PR D70 012006	J.Z. Bai <i>et al.</i>	(BES Collab.)
AULCHENKO	03	PL B573 63	V.M. Aulchenko <i>et al.</i>	(KEDR Collab.)
BAI	03E	PR D67 112001	J.Z. Bai <i>et al.</i>	(BES Collab.)
AMBROGIANI	02	PR D65 052002	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
BAI	99B	PR D60 072001	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	98D	PR D58 092006	J.Z. Bai <i>et al.</i>	(BES Collab.)
BAI	98I	PRL 81 3091	J.Z. Bai <i>et al.</i>	(BES Collab.)
ARMSTRONG	92	NP B373 35	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
Also		PRL 68 1468	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
BAGLIN	86B	PL B172 455	C. Baglin	(LAPP, CERN, GENO, LYON, OSLO+)
GAISER	86	PR D34 711	J. Gaiser <i>et al.</i>	(Crystal Ball Collab.)
LEMOIGNE	82	PL 113B 509	Y. Lemoigne <i>et al.</i>	(SACL, LOIC, SHMP+)
OREGLIA	82	PR D25 2259	M.J. Oreglia <i>et al.</i>	(SLAC, CIT, HARV+)
Also		Private Comm.	M.J. Oreglia	(EFI)
HIMEL	80	PRL 44 920	T. Himel <i>et al.</i>	(LBL, SLAC)
Also		Private Comm.	G. Trilling	(LBL, UCB)
BRANDELIK	79B	NP B160 426	R. Brandelik <i>et al.</i>	(DASP Collab.)
BARTEL	78B	PL 79B 492	W. Bartel <i>et al.</i>	(DESY, HEIDP)
TANENBAUM	78	PR D17 1731	W.M. Tanenbaum <i>et al.</i>	(SLAC, LBL)
Also		Private Comm.	G. Trilling	(LBL, UCB)
BIDDICK	77	PRL 38 1324	C.J. Biddick <i>et al.</i>	(UCSD, UMD, PAVI+)
FELDMAN	77	PRPL 33C 285	G.J. Feldman, M.L. Perl	(LBL, SLAC)
YAMADA	77	Hamburg Conf. 69	S. Yamada	(DASP Collab.)
WHITAKER	76	PRL 37 1596	J.S. Whitaker <i>et al.</i>	(SLAC, LBL)
TANENBAUM	75	PRL 35 1323	W.M. Tanenbaum <i>et al.</i>	(LBL, SLAC)
