$\chi_{c0}(1P)$

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

$\chi_{c0}(1P)$ MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
3415.1± 0.8 OUR AVERAGE				
3416.5± 3.0	EISENSTEIN	01	CLE2	$e^+e^- \to e^+e^-\chi_{c0}$
$3417.4^{+\ 1.8}_{-\ 1.9}\pm0.2$	AMBROGIANI	99B	E835	$\overline{p}p \to e^+e^-\gamma$
3414.1± 0.6±0.8	BAI	99B	BES	$\psi(2S) \to \gamma X$
3417.8± 0.4±4	[1] GAISER	86	CBAL	$\psi(2S) \to \gamma X$
3422 ±10	[2] BARTEL	78B	CNTR	$e^+e^- \to J/\psi 2\gamma$
3416 ± 3 ±4	[2] TANENBAUM	78	MRK1	e^+e^-
3415 ± 9	[2] BIDDICK	77	CNTR	$e^+e^- \to \gamma X$

[1] Using mass of $\psi(2S) = 3686.0$ MeV.
[2] Mass value shifted by us by amount appropriate for $\psi(2S)$ mass = 3686 MeV and $J/\psi(1S)$ mass = 3097 MeV.

$\chi_{c0}(1P)$ WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
16.2±2.3 OUR FIT				
$14.9^{+2.6}_{-2.3}$ OUR AVERAGE				
$16.6^{+5.2}_{-3.7}\pm0.1$	AMBROGIANI	99B	E835	$\overline{p}p \to e^+e^-\gamma$
14.3±2.0±3.0	BAI	98I	BES	$\psi(2S) \to \gamma\pi^+\pi^-$
13.5±3.3±4.2	GAISER	86	CBAL	$\psi(2S) \to \gamma X, \gamma\pi^0\pi^0$

$\chi_{c0}(1P)$ DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
	Hadronic decays		
Γ_1	$2(\pi^+\pi^-)$	(2.44±0.33) %	
Γ_2	$\pi^+\pi^-K^+K^-$	(1.8 ±0.6) %	S=1.9
Γ_3	$\rho^0\pi^+\pi^-$	(1.6 ±0.5) %	
Γ_4	$3(\pi^+\pi^-)$	(1.24±0.22) %	
Γ_5	$K^+\overline{K}^*(892)^0\pi^- +$ c.c.	(1.2 ±0.4) %	
Γ_6	K^+K^-	(5.9 ±0.9) $\times 10^{-3}$	
Γ_7	$\pi^+\pi^-$	(5.0 ±0.7) $\times 10^{-3}$	
Γ_8	$K^+K^-K^+K^-$	(2.1 ±0.5) $\times 10^{-3}$	
Γ_9	$K^0_SK^0_S$	(2.0 ±0.6) $\times 10^{-3}$	

Γ_{10}	$\pi^+\pi^- p\overline{p}$	$(1.8 \pm 0.9) \times 10^{-3}$	S=1.6
Γ_{11}	$\phi\phi$	$(9 \pm 5) \times 10^{-4}$	
Γ_{12}	$p\overline{p}$	$(2.2 \pm 0.5) \times 10^{-4}$	
Γ_{13}	$K^0_S K^+\pi^-$ + c.c.	$< 7.1 \times 10^{-4}$	CL=90%
Γ_{14}	$\pi^0\pi^0$		
Γ_{15}	$\eta\eta$		

Radiative decays

Γ_{16}	$\gamma J/\psi(1S)$	(1.02 ± 0.17) %	
Γ_{17}	$\gamma\gamma$	$(1.9 \pm 0.4) \times 10^{-4}$	

$\chi_{c0}(1P)$ PARTIAL WIDTHS

$\chi_{c0}(1P)$ Γ(i)$\Gamma(\gamma J/\psi(1S))/\Gamma$(total)

$\Gamma(p\overline{p}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{total}$ **$\Gamma_{12}\Gamma_{16}/\Gamma$**

VALUE (eV)	*DOCUMENT ID*		*TECN*	*COMMENT*
37 ±10 OUR FIT				
$48.7^{+11.3}_{-8.9}\pm2.4$	[3] AMBROGIANI	99B	E835	$\overline{p}p \to \gamma J/\psi$

$\Gamma(\gamma\gamma) \times \Gamma(2(\pi^+\pi^-))/\Gamma_{total}$ **$\Gamma_{17}\Gamma_1/\Gamma$**

VALUE (eV)	*DOCUMENT ID*		*TECN*	*COMMENT*
74±14 OUR FIT				
75±13±8	EISENSTEIN	01	CLE2	$e^+e^- \to e^+e^-\chi_{c0}$

[3] Calculated by us using B($J/\psi(1S) \to e^+e^-$) = 0.0593 ± 0.0010.

$\chi_{c0}(1P)$ BRANCHING RATIOS

HADRONIC DECAYS

$\Gamma(2(\pi^+\pi^-))/\Gamma_{total}$ **Γ_1/Γ**

VALUE	*DOCUMENT ID*
0.0244±0.0033 OUR FIT	

$\Gamma(\pi^+\pi^- K^+K^-)/\Gamma_{total}$ **Γ_2/Γ**

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.018 ±0.006 OUR AVERAGE	Error includes scale factor of 1.9.			
$0.0147\pm0.0007\pm0.0038$	[4] BAI	99B	BES	$\psi(2S) \to \gamma\chi_{c0}$
0.030 ± 0.007	[5] TANENBAUM	78	MRK1	$\psi(2S) \to \gamma\chi_{c0}$

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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.016±0.005	[5] TANENBAUM	78	MRK1	$\psi(2S) \to \gamma\chi_{c0}$

$\Gamma(3(\pi^+\pi^-))/\Gamma_{total}$ **Γ_4/Γ**

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.0124±0.0022 OUR AVERAGE				
$0.0117\pm0.0010\pm0.0023$	[4] BAI	99B	BES	$\psi(2S) \to \gamma\chi_{c0}$
0.015 ± 0.005	[5] TANENBAUM	78	MRK1	$\psi(2S) \to \gamma\chi_{c0}$

$\Gamma(K^+\overline{K}^*(892)^0\pi^- + \text{c.c.})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.012±0.004	[5] TANENBAUM	78	MRK1	$\psi(2S) \to \gamma\chi_{c0}$

$\Gamma(K^+K^-)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
5.9 ±0.9 OUR AVERAGE					
5.68±0.35±0.85	774±38	[4] BAI	98I	BES	$\psi(2S) \to \gamma\chi_{c0}$
6 ±3		[5] BRANDELIK	79B	DASP	$\psi(2S) \to \gamma\chi_{c0}$
9 ±4		[5] TANENBAUM	78	MRK1	$\psi(2S) \to \gamma\chi_{c0}$

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
5.0 ±0.7 OUR AVERAGE					
4.68±0.26±0.65	720±32	[4] BAI	98I	BES	$\psi(2S) \to \gamma\chi_{c0}$
7 ±3		[5] BRANDELIK	79B	DASP	$\psi(2S) \to \gamma\chi_{c0}$
8 ±3		[5] TANENBAUM	78	MRK1	$\psi(2S) \to \gamma\chi_{c0}$

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

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
2.14±0.26±0.40	[4] BAI	99B	BES	$\psi(2S) \to \gamma\chi_{c0}$

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

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
1.96±0.28±0.52	[4] BAI	99B	BES	$\psi(2S) \to \gamma\chi_{c0}$

$\Gamma(\pi^+\pi^- p\overline{p})/\Gamma_{\text{total}}$ Γ_{10}/Γ

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
1.8 ±0.9 OUR AVERAGE Error includes scale factor of 1.6.				
1.57±0.21±0.54	[4] BAI	99B	BES	$\psi(2S) \to \gamma\chi_{c0}$
5 ±2	[5] TANENBAUM	78	MRK1	$\psi(2S) \to \gamma\chi_{c0}$

$\Gamma(\phi\phi)/\Gamma_{\text{total}}$ Γ_{11}/Γ

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
0.92±0.34±0.38	[4] BAI	99B	BES	$\psi(2S) \to \gamma\chi_{c0}$

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

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3.1±0.4±0.5	[4] LEE	85	CBAL	$\psi' \to$ photons

$\Gamma(\eta\eta)/\Gamma_{\text{total}}$ Γ_{15}/Γ

VALUE (units 10^{-3})	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.5±0.8±0.8	[4] LEE	85	CBAL	$\psi' \to$ photons

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

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
<0.71	90	[4] BAI	99B	BES	$\psi(2S) \to \gamma\chi_{c0}$

$\Gamma(p\overline{p})/\Gamma_{\text{total}}$ Γ_{12}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
2.2±0.5 OUR FIT	

[4] Calculated using $B(\psi(2S) \to \gamma\chi_{c0}(1P)) = 0.093 \pm 0.008$.
[5] Calculated using $B(\psi(2S) \to \gamma\chi_{c0}(1P)) = 0.094$; the errors do not contain the uncertainty in the $\psi(2S)$ decay.

RADIATIVE DECAYS

$\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}$ Γ_{16}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
102±17 OUR FIT	

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{17}/Γ

VALUE (units 10^{-4})	DOCUMENT ID
1.9±0.4 OUR FIT	

$\Gamma(\gamma\gamma)/\Gamma(\gamma J/\psi(1S))$ Γ_{17}/Γ_{16}

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
1.8 ±0.6 OUR FIT				
1.45±0.74	[6] AMBROGIANI	00B	E835	$\overline{p}p \to \chi_{c2} \to \gamma\gamma$, $\gamma J/\psi$

[6] Calculated by us using $B(J/\psi(1S) \to e^+ e^-) = 0.0593 \pm 0.0010$.

$\chi_{c0}(1P)$ CROSS-PARTICLE BRANCHING RATIOS

$B(\chi_{c0}(1P) \to > p\overline{p}) \times \frac{\Gamma(\psi(2S) \to \gamma\chi_{c0}(1P))}{\Gamma(\psi(2S) \to J/\psi(1S)\pi^+\pi^-)}$

VALUE (units 10^{-5})	DOCUMENT ID		TECN	COMMENT
6.4±1.6 OUR FIT				
4.6±1.9	[7] BAI	98I	BES	$\psi(2S) \to \gamma\chi_{c0} \to \gamma\overline{p}p$

$B(\chi_{c0}(1P) \to \gamma J/\psi(1S)) \times B(\psi(2S) \to \gamma\chi_{c0}(1P))$

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
0.089±0.015 OUR FIT				
0.073±0.018 OUR AVERAGE				
0.069±0.018	[8] OREGLIA	82	CBAL	$\psi(2S) \to \gamma\chi_{c0}$
0.4 ±0.3	[9] BRANDELIK	79B	DASP	$\psi(2S) \to \gamma\chi_{c0}$
0.16 ±0.11	[9] BARTEL	78B	CNTR	$\psi(2S) \to \gamma\chi_{c0}$
3.3 ±1.7	[10] BIDDICK	77	CNTR	$e^+ e^- \to \gamma X$

$B(\chi_{c0}(1P) \rightarrow \gamma\gamma) \times B(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))$

VALUE (units 10^{-5})	*DOCUMENT ID*		*TECN*	*COMMENT*
1.6±0.4 OUR FIT				
3.7±1.8±1.0	LEE	85	CBAL	$\psi(2S) \rightarrow \gamma\chi_{c0}$

$B(\chi_{c0}(1P) \rightarrow 2(\pi^+\pi^-)) \times \frac{\Gamma(\psi(2S) \rightarrow \gamma\chi_{c0}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-)}$

VALUE (units 10^{-3})	*DOCUMENT ID*		*TECN*	*COMMENT*
7.0±1.0 OUR FIT				
6.9±2.4 OUR AVERAGE Error includes scale factor of 3.8.				
4.4±0.1±0.9	[11] BAI	99B	BES	$\psi(2S) \rightarrow \gamma\chi_{c0}$
9.3±0.9	[12] TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

[7] Calculated by us. The value for $B(\chi_{c0} \rightarrow p\overline{p})$ reported in BAI 98I is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

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

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

[10] Assumes isotropic gamma distribution.

[11] Calculated by us. The value for $B(\chi_{c0} \rightarrow 2\pi^+2\pi^-)$ reported in BAI 99B is derived using $B(\psi(2S) \rightarrow \gamma\chi_{c0}) = (9.3 \pm 0.8)\%$ and $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = (32.4 \pm 2.6)\%$ [BAI 98D].

[12] The value $B(\psi(1S) \rightarrow \gamma\chi_{c0}) \times B(\chi_{c0} \rightarrow 2\pi^+2\pi^-)$ reported in TANENBAUM 78 is derived using $B(\psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) \times B(J/\psi(1S) \rightarrow \ell^+\ell^-) = (4.6 \pm 0.7)\%$. Calculated by us using $B(J/\psi(1S) \rightarrow \ell^+\ell^-) = 0.1181 \pm 0.0020$.

$\chi_{c0}(1P)$ REFERENCES

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