$\chi_{c0}(1P)$

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

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

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
3415.0± 0.8 OUR AVERAGE				
$3417.4^{+\ 1.8}_{-\ 1.9} \pm 0.2$	AMBROGIANI	99B	E835	$\overline{p}p \rightarrow e^+e^-\gamma$
3414.1± 0.6± 0.8	BAI	99B	BES	$\psi(2S) \rightarrow \gamma X$
3417.8± 0.4± 4	[1] GAISER	86	CBAL	$\psi(2S) \rightarrow \gamma X$
3422 ±10	[2] BARTEL	78B	CNTR	$e^+e^- \rightarrow J/\psi 2\gamma$
3416 ± 3 ±4	[2] TANENBAUM	78	MRK1	e^+e^-
3415 ± 9	[2] BIDDICK	77	CNTR	$e^+e^- \rightarrow \gamma X$

[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*
$\mathbf{14.9^{+2.6}_{-2.3}}$ **OUR AVERAGE**				
$16.6^{+5.2}_{-3.7} \pm 0.1$	AMBROGIANI	99B	E835	$\overline{p}p \rightarrow e^+e^-\gamma$
14.3±2.0±3.0	BAI	98I	BES	$\psi(2S) \rightarrow \gamma\pi^+\pi^-$
13.5±3.3±4.2	GAISER	86	CBAL	$\psi(2S) \rightarrow \gamma X$, $\gamma\pi^0\pi^0$

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

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
	Hadronic decays		
Γ_1	$2(\pi^+\pi^-)$	(2.0 ±0.9) %	S=2.7
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	$\pi^+\pi^-$	(5.0 ±0.7) $\times 10^{-3}$	
Γ_7	K^+K^-	(5.9 ±0.9) $\times 10^{-3}$	
Γ_8	$\pi^+\pi^-p\overline{p}$	(1.8 ±0.9) $\times 10^{-3}$	S=1.6
Γ_9	$K^+K^-K^+K^-$	(2.1 ±0.5) $\times 10^{-3}$	
Γ_{10}	$K^0_SK^0_S$	(2.0 ±0.6) $\times 10^{-3}$	
Γ_{11}	$\phi\phi$	(9 ±5) $\times 10^{-4}$	
Γ_{12}	$\pi^0\pi^0$		
Γ_{13}	$\eta\eta$		
Γ_{14}	$K^0_SK^+\pi^-$ + c.c.	< 7.1 $\times 10^{-4}$	CL=90%
Γ_{15}	$p\overline{p}$	(2.2 ±1.3) $\times 10^{-4}$	S=2.1

Radiative decays

Γ_{16}	$\gamma J/\psi(1S)$	$(6.6 \pm 1.8) \times 10^{-3}$
Γ_{17}	$\gamma\gamma$	$(10 \pm 6) \times 10^{-5}$

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

$\Gamma(\gamma\gamma)$ Γ_{17}

VALUE (keV)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.0±2.8		LEE	85	CBAL	$\psi' \rightarrow$ photons
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 5.5	95	ACCIARRI	99T	L3	$\gamma\gamma$
< 6.2	95	CHEN	90B	CLEO	$e^+e^- \rightarrow e^+e^-\chi_{c0}$
<17	95	AIHARA	88D	TPC	$e^+e^- \rightarrow e^+e^-$X

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

HADRONIC DECAYS

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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.020 ±0.009 OUR AVERAGE	Error includes scale factor of 2.7.			
0.0154±0.0005±0.0037	[3] BAI	99B	BES	$\psi(2S) \rightarrow \gamma\chi_{c0}$
0.037 ±0.007	[4] TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.018 ±0.006 OUR AVERAGE	Error includes scale factor of 1.9.			
0.0147±0.0007±0.0038	[3] BAI	99B	BES	$\psi(2S) \rightarrow \gamma\chi_{c0}$
0.030 ±0.007	[4] TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.016±0.005	[4] TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.0124±0.0022 OUR AVERAGE				
0.0117±0.0010±0.0023	[3] BAI	99B	BES	$\psi(2S) \rightarrow \gamma\chi_{c0}$
0.015 ±0.005	[4] TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.012±0.004	[4] TANENBAUM	78	MRK1	$\psi(2S) \rightarrow \gamma\chi_{c0}$

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

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

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

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

$\Gamma(\pi^+\pi^- p\bar{p})/\Gamma_{total}$ — Γ_8/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	[3] BAI	99B	BES	$\psi(2S) \to \gamma\chi_{c0}$
5 ±2	[4] TANENBAUM	78	MRK1	$\psi(2S) \to \gamma\chi_{c0}$

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

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

$\Gamma(K^0_S K^0_S)/\Gamma_{total}$ — Γ_{10}/Γ

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

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

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

$\Gamma(\pi^0\pi^0)/\Gamma_{total}$ — Γ_{12}/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	[3] LEE	85	CBAL	$\psi' \to$ photons

$\Gamma(\eta\eta)/\Gamma_{total}$ — Γ_{13}/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	[3] LEE	85	CBAL	$\psi' \to$ photons

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

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

$\Gamma(p\bar{p})/\Gamma_{total}$ — Γ_{15}/Γ

VALUE (units 10^{-3})	CL%	DOCUMENT ID		TECN	COMMENT
0.22 ±0.13 OUR AVERAGE Error includes scale factor of 2.1.					
$0.48\ ^{+0.09}_{-0.08}\ ^{+0.21}_{-0.11}$		[5] AMBROGIANI	99B	E835	$\bar{p}p \to e^+e^-\gamma$
0.159±0.043±0.053		[3] BAI	98I	BES	$\psi(2S) \to \gamma\chi_{c0}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.9	90	[4] BRANDELIK	79B	DASP	$\psi(2S) \to \gamma\chi_{c0}$

[3] Calculated using $B(\psi(2S) \to \gamma\chi_{c0}(1P)) = 0.093 \pm 0.008$.
[4] Calculated using $B(\psi(2S) \to \gamma\chi_{c0}(1P)) = 0.094$; the errors do not contain the uncertainty in the $\psi(2S)$ decay.
[5] Estimated using $B(\chi_{c0} \to \gamma J/\psi) = (6.0 \pm 1.8) \times 10^{-3}$ and $B(J/\psi \to e^+e^-) = (6.02 \pm 0.19) \times 10^{-2}$.

RADIATIVE DECAYS

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

VALUE (units 10^{-4})	*DOCUMENT ID*		*TECN*	*COMMENT*
66± 18 OUR AVERAGE				
60± 18	GAISER	86	CBAL	$\psi(2S) \to \gamma\chi_{c0}$
320±210	[6] BRANDELIK	79B	DASP	$\psi(2S) \to \gamma\chi_{c0}$
150±100	[6] BARTEL	78B	CNTR	$\psi(2S) \to \gamma\chi_{c0}$
210±210	[6] TANENBAUM	78	MRK1	$\psi(2S) \to \gamma\chi_{c0}$

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

VALUE (units 10^{-4})	*DOCUMENT ID*		*TECN*	*COMMENT*
0.97±0.50±0.28	[7] AMBROGIANI	00B	E835	$\overline{p}p \to \gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
4.0 ±2.0 ±1.1	[3] LEE	85	CBAL	$\psi' \to$ photons

[6] Calculated using $B(\psi(2S) \to \gamma\chi_{c0}(1P)) = 0.094$; the errors do not contain the uncertainty in the $\psi(2S)$ decay.
[7] Estimated using $B(\chi_{c0} \to \gamma J/\psi \to \gamma e^+e^-) = (3.97 \pm 1.15) \times 10^{-4}$.

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

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