

$\psi(4230)$

$$I^G(J^{PC}) = 0^-(1^{--})$$

OMITTED FROM SUMMARY TABLE
was $X(4230)$ This state shows properties different from a conventional $q\bar{q}$ state.
A candidate for an exotic structure. See the review on non- $q\bar{q}$ states.Enhancement reported by ABLIKIM 15C in $e^+e^- \rightarrow \omega\chi_{c0}$ at $\sqrt{s} = 4.23\text{--}4.26$ GeV at 9σ significance. Lineshape found to be inconsistent with origination from $\psi(4260)$. Needs confirmation. **$\psi(4230)$ MASS**

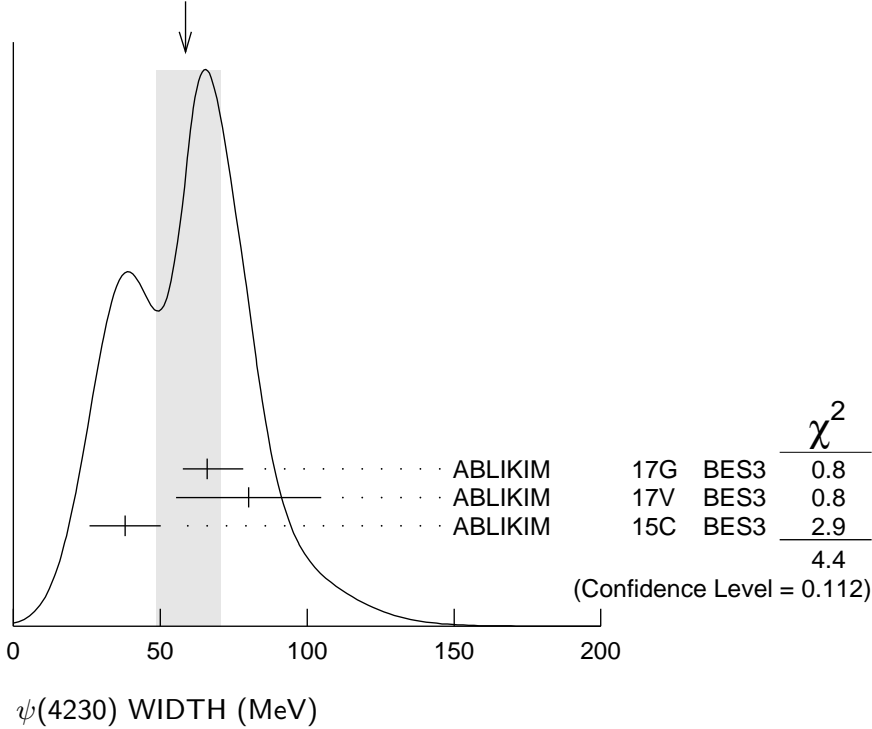
VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
4218 $\begin{smallmatrix} +5 \\ -4 \end{smallmatrix}$	OUR AVERAGE	Error includes scale factor of 1.2.		
4218 $\begin{smallmatrix} +5.5 \\ -4.5 \end{smallmatrix} \pm 0.9$		ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^-h_c$
4209.5 $\pm 7.4 \pm 1.4$		¹ ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
4230 $\pm 8 \pm 6$	180	² ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega\chi_{c0}$

¹ From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^-\psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} .² From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$. **$\psi(4230)$ WIDTH**

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
59 $\begin{smallmatrix} +12 \\ -10 \end{smallmatrix}$	OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.		
66.0 $\begin{smallmatrix} +12.3 \\ -8.3 \end{smallmatrix} \pm 0.4$		ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^-h_c$
80.1 $\pm 24.6 \pm 2.9$		¹ ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$
38 $\pm 12 \pm 2$	180	² ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega\chi_{c0}$

¹ From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^-\psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} .² From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.

WEIGHTED AVERAGE
59±12-10 (Error scaled by 1.5)



$\psi(4230)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 $e^+ e^-$	
Γ_2 $\omega \chi_{c0}$	seen
Γ_3 $\pi^+ \pi^- h_c$	seen
Γ_4 $\pi^+ \pi^- \psi(2S)$	seen

$\psi(4230)$ $\Gamma(i)\Gamma(e^+ e^-)/\Gamma(\text{total})$

$\Gamma(\omega \chi_{c0}) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_2\Gamma_1/\Gamma$

VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT
2.7±0.5±0.4	180	¹ ABLIKIM	15C BES3	$e^+ e^- \rightarrow \omega \chi_{c0}$

¹ From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+ \pi^-$, $\chi_{c0} \rightarrow K^+ K^-$, and $\omega \rightarrow \pi^+ \pi^- \pi^0$.

$\Gamma(\pi^+ \pi^- \psi(2S)) \times \Gamma(e^+ e^-)/\Gamma_{\text{total}}$ $\Gamma_4\Gamma_1/\Gamma$

VALUE (eV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.6±1.3	¹ ABLIKIM	19K BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$
1.8±1.4	² ABLIKIM	19K BES3	$e^+ e^- \rightarrow \pi^+ \pi^- \psi(2S)$

¹ Solution I of two equivalent solutions in a fit using two interfering resonances.

² Solution II of two equivalent solutions in a fit using two interfering resonances.

$\psi(4230)$ BRANCHING RATIOS

$\Gamma(\omega\chi_{c0})/\Gamma_{\text{total}}$ Γ_2/Γ

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
seen	180	¹ ABLIKIM	15C BES3	$e^+e^- \rightarrow \omega\chi_{c0}$

¹ From a 3-parameter fit of measured cross sections from $\sqrt{s} = 4.21\text{--}4.42$ GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \rightarrow \pi^+\pi^-$, $\chi_{c0} \rightarrow K^+K^-$, and $\omega \rightarrow \pi^+\pi^-\pi^0$.

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

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
seen	ABLIKIM	17G BES3	$e^+e^- \rightarrow \pi^+\pi^-h_c$

$\Gamma(\pi^+\pi^-\psi(2S))/\Gamma_{\text{total}}$ Γ_4/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
seen	¹ ABLIKIM	17V BES3	$e^+e^- \rightarrow \pi^+\pi^-\psi(2S)$

¹ From a fit to the cross section for $e^+e^- \rightarrow \pi^+\pi^-\psi(2S) \rightarrow 2(\pi^+\pi^-)\ell^+\ell^-$ obtained from 16 center-of-mass energies between 4.008 and 4.600 GeV and comprising 5.1 fb^{-1} .

$\psi(4230)$ REFERENCES

ABLIKIM	19K	PR D99 019903 (errat.)	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	17G	PRL 118 092002	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	17V	PR D96 032004	M. Ablikim <i>et al.</i>	(BES III Collab.)
Also		PR D99 019903 (errat.)	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	15C	PRL 114 092003	M. Ablikim <i>et al.</i>	(BES III Collab.)