$\psi(4230)$

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

OMITTED FROM SUMMARY TABLE
was $X(4230)$

This state shows properties different from a conventional $q\overline{q}$ state. A candidate for an exotic structure. See the review on non-$q\overline{q}$ states.

Enhancement reported by ABLIKIM 15C in $e^+e^- \to \omega\chi_{c0}$ at $\sqrt{s}$ = 4.23–4.26 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 $^{+5}_{-4}$ OUR AVERAGE		Error includes scale factor of 1.2.			
$4218\ ^{+5.5}_{-4.5}\pm0.9$		ABLIKIM	17G	BES3	$e^+e^- \to \pi^+\pi^- h_c$
$4209.5\pm7.4\pm1.4$		[1] ABLIKIM	17V	BES3	$e^+e^- \to \pi^+\pi^-\psi(2S)$
$4230\ \pm8\ \pm6$	180	[2] ABLIKIM	15C	BES3	$e^+e^- \to \omega\chi_{c0}$

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

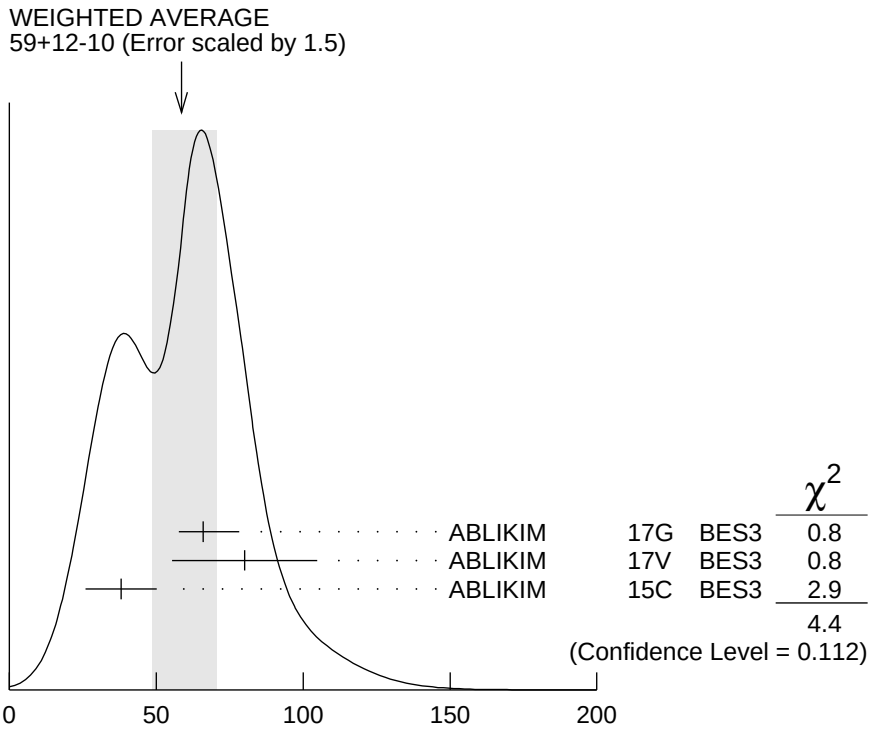
[2] From a 3-parameter fit of measured cross sections from $\sqrt{s}$ = 4.21–4.42 GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \to \pi^+\pi^-$, $\chi_{c0} \to K^+K^-$, and $\omega \to \pi^+\pi^-\pi^0$.

$\psi(4230)$ WIDTH

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
59 $^{+12}_{-10}$ OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.			
$66.0^{+12.3}_{-8.3}\pm0.4$		ABLIKIM	17G	BES3	$e^+e^- \to \pi^+\pi^- h_c$
$80.1\pm24.6\pm2.9$		[1] ABLIKIM	17V	BES3	$e^+e^- \to \pi^+\pi^-\psi(2S)$
$38\ \pm12\ \pm2$	180	[2] ABLIKIM	15C	BES3	$e^+e^- \to \omega\chi_{c0}$

[1] From a fit to the cross section for $e^+e^- \to \pi^+\pi^-\psi(2S) \to 2(\pi^+\pi^-)\ell^+\ell^-$ 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 $\sqrt{s}$ = 4.21–4.42 GeV to a phase-space modified Breit-Wigner function, using the decays $\chi_{c0} \to \pi^+\pi^-$, $\chi_{c0} \to K^+K^-$, and $\omega \to \pi^+\pi^-\pi^0$.



$\psi(4230)$ 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

$\psi(4230)$ Γ(i)$\Gamma(e^+e^-)/\Gamma$(total)

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

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

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

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

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	$e^+e^- \to \pi^+\pi^-\psi(2S)$
1.8±1.4	[2] ABLIKIM	19K	BES3	$e^+e^- \to \pi^+\pi^-\psi(2S)$

[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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
seen	180	[1] ABLIKIM	15C	BES3	$e^+e^- \to \omega\chi_{c0}$

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

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

VALUE	DOCUMENT ID		TECN	COMMENT
seen	ABLIKIM	17G	BES3	$e^+e^- \to \pi^+\pi^- h_c$

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

VALUE	DOCUMENT ID		TECN	COMMENT
seen	[1] ABLIKIM	17V	BES3	$e^+e^- \to \pi^+\pi^-\psi(2S)$

[1] From a fit to the cross section for $e^+e^- \to \pi^+\pi^-\psi(2S) \to 2(\pi^+\pi^-)\ell^+\ell^-$ 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 *et al.*	(BES III Collab.)
ABLIKIM	17G	PRL 118 092002	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	17V	PR D96 032004	M. Ablikim *et al.*	(BES III Collab.)
Also		PR D99 019903 (errat.)	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	15C	PRL 114 092003	M. Ablikim *et al.*	(BES III Collab.)