X(4020)

$I(J^P) = 1(?^?)$

Charged X(4020) seen by ABLIKIM 13X from $e^+e^- \to \pi^+\pi^- h_c(1P)$ at c.m. energy from 3.90 to 4.42 GeV as a peak in the invariant mass distribution of the $\pi^\pm h_c(1P)$ system, and by ABLIKIM 14B from $e^+e^- \to (D^*\overline{D}^*)^\pm\pi^\mp$ events in $(D^*\overline{D}^*)^\pm$ mass. A neutral X(4020) seen by ABLIKIM 14P at three c.m. energies in the same range in $e^+e^- \to \pi^0\pi^0 h_c(1P)$ as a peak in the larger of the two masses recoiling against a π^0. ABLIKIM 15AA observes a 5.9 σ signal in $(D^*\overline{D}^*)^0$ in $e^+e^- \to (D^*\overline{D}^*)^0\,\pi^0$ events using collisions at two c.m. energies. Production rates and mass values support grouping neutral and charged X(4020) together as manifestations of a single $I = 1$ particle.

X(4020) MASS

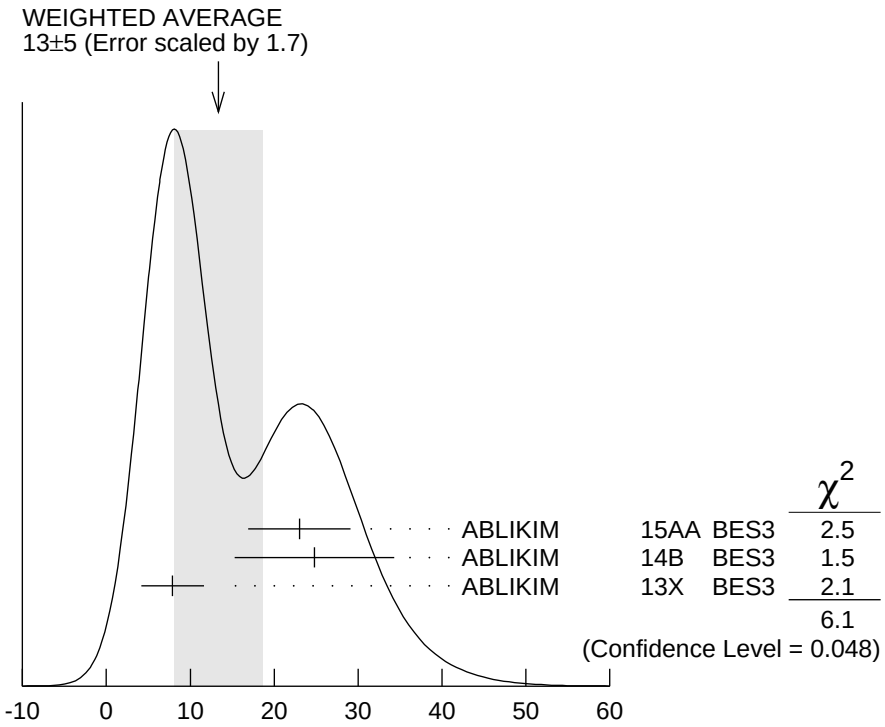
VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
4024.1±1.9 OUR AVERAGE						
$4025.5^{+2.0}_{-4.7}\pm3.1$	116	[1] ABLIKIM	15AA	BES3	0	$e^+e^- \to (D^*\overline{D}^*)^0\,\pi^0$
$4026.3\pm2.6\pm3.7$	401	[1] ABLIKIM	14B	BES3	±	$e^+e^- \to (D^*\overline{D}^*)^\pm\,\pi^\mp$
$4023.9\pm2.2\pm3.8$	61	[1,2] ABLIKIM	14P	BES3	0	$e^+e^- \to \pi^0\pi^0 h_c$
$4022.9\pm0.8\pm2.7$	253	[1] ABLIKIM	13X	BES3	±	$e^+e^- \to \pi^+\pi^- h_c$

[1] Neglecting interference between the $X(4020)$ and non-resonant continuum.
[2] Assuming $J^P = 1^+$ and width of 7.9 ± 2.6 MeV.

X(4020) WIDTH

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
13 ±5 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.				
$23.0\pm6.0\pm1.0$	116	[1] ABLIKIM	15AA	BES3	0	$e^+e^- \to (D^*\overline{D}^*)^0\,\pi^0$
$24.8\pm5.6\pm7.7$	401	[1] ABLIKIM	14B	BES3	±	$e^+e^- \to (D^*\overline{D}^*)^\pm\pi^\mp$
$7.9\pm2.7\pm2.6$	253	[1] ABLIKIM	13X	BES3	±	$e^+e^- \to \pi^+\pi^- h_c$

[1] Neglecting interference between the $X(4020)$ and non-resonant continuum.



X(4020) DECAY MODES

	Mode	Fraction (Γ_i/Γ)
Γ_1	$h_c(1P)\pi$	seen
Γ_2	$D^*\overline{D}^*$	seen
Γ_3	$D\overline{D}^*$ + c.c.	not seen
Γ_4	$\eta_c\pi^+\pi^-$	not seen

X(4020) BRANCHING RATIOS

$\Gamma(h_c(1P)\pi)/\Gamma_{total}$ Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
seen	61	ABLIKIM	14P	BES3	0	$e^+e^- \to \pi^0\pi^0 h_c$
seen	253	ABLIKIM	13X	BES3	±	$e^+e^- \to \pi^+\pi^- h_c$

$\Gamma(D^*\overline{D}^*)/\Gamma_{total}$ Γ_2/Γ

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
seen	116	[1] ABLIKIM	15AA	BES3	0	$e^+e^- \to (D^*\overline{D}^*)^0\,\pi^0$
seen	401	[1] ABLIKIM	14B	BES3	±	$e^+e^- \to (D^*\overline{D}^*)^\pm\pi^\mp$

[1] Neglecting interference between the $X(4020)$ and non-resonant continuum.

$\Gamma(D\overline{D}^* + \text{c.c.})/\Gamma_{total}$ Γ_3/Γ

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
not seen	ABLIKIM	15AC	BES3	±	$e^+e^- \to \pi^\pm(D\overline{D}^*)^\mp$

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

VALUE	*DOCUMENT ID*	*TECN*	*COMMENT*
not seen	[1] VINOKUROVA 15	BELL	$B^+ \to K^+\eta_c\pi^+\pi^-$

[1] VINOKUROVA 15 reports $B(B^+ \to K^+X(4020)^0) \times B(X \to \eta_c\pi^+\pi^-) < 1.6 \times 10^{-5}$ at 90% CL.

X(4020) REFERENCES

ABLIKIM	15AA	PRL 115 182002	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	15AC	PR D92 092006	M. Ablikim *et al.*	(BES III Collab.)
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova *et al.*	(BELLE Collab.)
ABLIKIM	14B	PRL 112 132001	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	14P	PRL 113 212002	M. Ablikim *et al.*	(BES III Collab.)
ABLIKIM	13X	PRL 111 242001	M. Ablikim *et al.*	(BES III Collab.)