NODE=M210

$Z_c(3900)$

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

was $X(3900)$

Properties incompatible with a $q\overline{q}$ structure (exotic state). See the review on non-$q\overline{q}$ states. NODE=M210

Charged $Z_c(3900)$ seen as a peak in the invariant mass distribution of the $J/\psi\pi^\pm$ system by BES III (ABLIKIM 13T) in $e^+e^- \to \pi^+\pi^- J/\psi$ at c.m. energy of 4.26 GeV and by radiative return from e^+e^- collisions at $\sqrt{s}$ from 9.46 to 10.86 GeV at Belle (LIU 13B). Partial wave analysis of ABLIKIM 17J determines $J^P = 1^+$ with more than 7σ significance. Neutral $Z_c(3900)$ seen in the $J/\psi\pi^0$ invariant mass distribution in $e^+e^- \to \pi^0\pi^0 J/\psi$ at c.m. energies of 4.23, 4.26, and 4.36 GeV by BES III (ABLIKIM 15U) and at 4.17 GeV by XIAO 13A. Peaks in $(D\overline{D}^*)^{0,\pm}$ reported by BES III (ABLIKIM 14A, ABLIKIM 15AB) are assumed to be related.

$Z_c(3900)$ MASS

NODE=M210M

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
3887.1±2.6 OUR AVERAGE Error includes scale factor of 1.7. See the ideogram below. [3888.4 ± 2.5 MeV OUR 2020 AVERAGE Scale factor = 1.7]						
$3893.1 \pm 2.2 \pm 3.0$		[1] ABLIKIM	20N	BES3	0	$e^+e^- \to \pi^0\pi^0 J/\psi$
$3902.6^{+5.2}_{-5.0} {}^{+3.3}_{-1.4}$		[2,3] ABAZOV	19	D0	±	1.96 TeV $p\overline{p} \to J/\psi\pi^+\pi^- X$
$3881.2 \pm 4.2 \pm 2.7$	6k	[4] ABLIKIM	17J	BES3	±	$e^+e^- \to \pi^+\pi^- J/\psi$
$3885.7^{+4.3}_{-5.7} \pm 8.4$		[2,4] ABLIKIM	15AB	BES3	0	$e^+e^- \to \pi^0(D\overline{D}^*)^0$
$3881.7 \pm 1.6 \pm 1.6$	1.2k	[2,4] ABLIKIM	15AC	BES3	±	$e^+e^- \to \pi^\pm(D\overline{D}^*)^\mp$
$3883.9 \pm 1.5 \pm 4.2$	1.2k	[2,4] ABLIKIM	14A	BES3	±	$e^+e^- \to \pi^\pm(D\overline{D}^*)^\mp$
$3894.5 \pm 6.6 \pm 4.5$	159	[2] LIU	13B	BELL	±	$e^+e^- \to \gamma\pi^+\pi^- J/\psi$
$3886 \pm 4 \pm 2$	81	[2,5] XIAO	13A		±	4.17 $e^+e^- \to \pi^+\pi^- J/\psi$
$3904 \pm 9 \pm 5$	25	[2,5] XIAO	13A		0	4.17 $e^+e^- \to \pi^0\pi^0 J/\psi$ OCCUR=2
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$3895.0 \pm 5.2^{+4.0}_{-2.7}$	502	[2,6] ABAZOV	18B	D0	±	1.96 TeV $p\overline{p} \to J/\psi\pi^+\pi^- X$
$3894.8 \pm 2.3 \pm 3.2$	356	[2,7] ABLIKIM	15U	BES3	0	$e^+e^- \to \pi^0\pi^0 J/\psi$
$3899.0 \pm 3.6 \pm 4.9$	307	[2,8] ABLIKIM	13T	BES3	±	$e^+e^- \to \pi^+\pi^- J/\psi$

[1] Pole mass obtained from a fit to a relativistic Breit-Wigner. NODE=M210M;LINKAGE=L

[2] Neglecting interference between the $Z_c(3900)$ and other processes. NODE=M210M;LINKAGE=A

[3] Measured in weak decays of b-flavored hadrons (nonprompt). NODE=M210M;LINKAGE=G

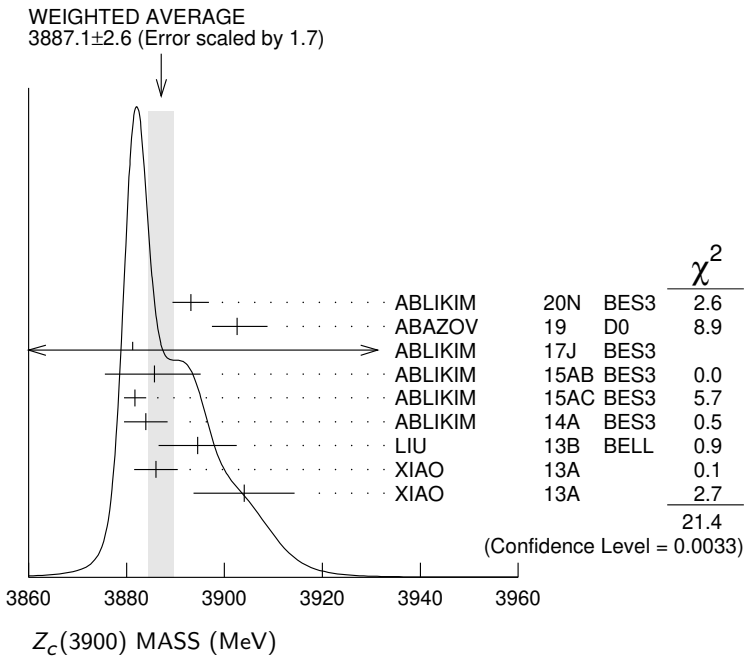
[4] Pole mass obtained from a fit to a Flatte-like formula. NODE=M210M;LINKAGE=E

[5] For $M^2(\pi^+\pi^-) < 0.65$ GeV^2. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration. NODE=M210M;LINKAGE=B

[6] The signal of the $Z_c(3900)$ is correlated with a parent $J/\psi\pi^+\pi^-$ system in the invariant mass range 4.2–4.7 GeV. Superseded by ABAZOV 19. NODE=M210M;LINKAGE=F

[7] Superseded by ABLIKIM 20N. NODE=M210M;LINKAGE=J

[8] Superseded by ABLIKIM 17J. NODE=M210M;LINKAGE=K



$Z_c(3900)$ WIDTH

NODE=M210W

NODE=M210W

VALUE (MeV)	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
28.4± 2.6 OUR AVERAGE						NEW
[28.3 ± 2.5 MeV OUR 2020 AVERAGE]						
44.4± 5.2±14.0		[1] ABLIKIM	20N	BES3	0	$e^+e^- \to \pi^0\pi^0 J/\psi$
$32^{+28}_{-21}{}^{+26}_{-7}$		[2,3] ABAZOV	19	D0	±	1.96 TeV $p\overline{p} \to \pi^+\pi^- J/\psi X$ (non-prompt)
51.8± 4.6±36.0	6 k	[4] ABLIKIM	17J	BES3	±	$e^+e^- \to \pi^+\pi^- J/\psi$
35^{+11}_{-12} ±15		[2,4] ABLIKIM	15AB	BES3	0	$e^+e^- \to \pi^0(D\overline{D}^*)^0$
26.6± 2.0± 2.1	1248	[2,4] ABLIKIM	15AC	BES3	±	$e^+e^- \to \pi^\pm(D\overline{D}^*)^\mp$
24.8± 3.3±11.0	1212	[2,4] ABLIKIM	14A	BES3	±	$e^+e^- \to \pi^\pm(D\overline{D}^*)^\mp$
63 ±24 ±26	159	[2] LIU	13B	BELL	±	$e^+e^- \to \gamma\pi^+\pi^- J/\psi$
37 ± 4 ± 8	81	[2,5] XIAO	13A		±	4.17 $e^+e^- \to \pi^+\pi^- J/\psi$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
29.6± 8.2± 8.2	356	[2,6] ABLIKIM	15U	BES3	0	$e^+e^- \to \pi^0\pi^0 J/\psi$
46 ±10 ±20	307	[2,7] ABLIKIM	13T	BES3	±	$e^+e^- \to \pi^+\pi^- J/\psi$

[1] Pole width obtained from a fit to a relativistic Breit-Wigner. NODE=M210W;LINKAGE=G

[2] Neglecting interference between the $Z_c(3900)$ and other processes. NODE=M210W;LINKAGE=A

[3] Measured in weak decays of b-flavored hadrons (nonprompt). NODE=M210W;LINKAGE=F

[4] Pole width obtained from a fit to a Flatte-like formula. NODE=M210W;LINKAGE=E

[5] For $M^2(\pi^+\pi^-) < 0.65$ GeV^2. Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration. NODE=M210W;LINKAGE=B

[6] Superseded by ABLIKIM 20N. NODE=M210W;LINKAGE=H

[7] Superseded by ABLIKIM 17J. NODE=M210W;LINKAGE=I

$Z_c(3900)$ DECAY MODES

NODE=M210215;NODE=M210

	Mode	Fraction (Γ_i/Γ)	
Γ_1	$J/\psi\pi$	seen	DESIG=1
Γ_2	$h_c\pi^\pm$	not seen	DESIG=2
Γ_3	$\eta_c\pi^+\pi^-$	not seen	DESIG=10
Γ_4	$\eta_c(1S)\rho(770)^\pm$		DESIG=11
Γ_5	$(D\overline{D}^*)^\pm$	seen	DESIG=3;OUR EVAL;→ UNCHECKED ←
Γ_6	D^0D^{*-} + c.c.	seen	DESIG=8
Γ_7	D^-D^{*0} + c.c.	seen	DESIG=9
Γ_8	$\omega\pi^\pm$	not seen	DESIG=4
Γ_9	$J/\psi\eta$	not seen	DESIG=5
Γ_{10}	D^+D^{*-} + c.c	seen	DESIG=6
Γ_{11}	$D^0\overline{D}^{*0}$ + c.c	seen	DESIG=7

$Z_c(3900)$ BRANCHING RATIOS

NODE=M210225

$\Gamma(J/\psi\pi)/\Gamma_{total}$ — Γ_1/Γ

NODE=M210R01
NODE=M210R01

VALUE	EVTS	DOCUMENT ID		TECN	CHG	COMMENT
seen		ABLIKIM	20N	BES3	0	$e^+e^- \to \pi^0\pi^0 J/\psi$
seen		[1] ABAZOV	19	D0	±	1.96 TeV $p\overline{p} \to \pi^+\pi^- J/\psi X$ (prompt)
seen		ABLIKIM	17J	BES3	±	$e^+e^- \to \pi^+\pi^- J/\psi$
seen	356	ABLIKIM	15U	BES3	0	$e^+e^- \to \pi^0\pi^0 J/\psi$
not seen		[2] ADOLPH	15D	COMP	±	$\gamma N \to J/\psi\pi^\pm N$
seen	307	ABLIKIM	13T	BES3	±	$e^+e^- \to \pi^+\pi^- J/\psi$
seen	25	[3] XIAO	13A		0	4.17 $e^+e^- \to \pi^0\pi^0 J/\psi$

[1] But not seen in the "prompt" sample (no b-hadron enhancement). NODE=M210R01;LINKAGE=C

[2] ADOLPH 15D measure $B(Z_c(3900)^\pm \to J/\psi\pi^\pm)\ \sigma(\gamma N \to Z_c(3900)^\pm N)/\sigma(\gamma N \to J/\psi N) < 3.7 \times 10^{-3}$ at 90% CL. NODE=M210R01;LINKAGE=A

[3] Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration. NODE=M210R01;LINKAGE=XI

$\Gamma(h_c\pi^\pm)/\Gamma_{total}$ — Γ_2/Γ

NODE=M210R02
NODE=M210R02

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
not seen	ABLIKIM	13X	BES3	±	$e^+e^- \to h_c\pi^+\pi^-$

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

NODE=M210R11
NODE=M210R11

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
not seen	[1] VINOKUROVA	15	BELL	0	$B^+ \to K^+\eta_c\pi^+\pi^-$

[1] VINOKUROVA 15 reports $B(B^+ \to K^+ Z_c(3900)^0) \times B(X \to \eta_c\pi^+\pi^-) < 4.7 \times 10^{-5}$ at 90% CL. NODE=M210R11;LINKAGE=VI

$\Gamma((D\overline{D}^*)^\pm)/\Gamma(J/\psi\pi)$ — Γ_5/Γ_1

NODE=M210R03
NODE=M210R03

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
6.2±1.1±2.7	[1] ABLIKIM	14A	BES3	±	$e^+e^- \to \pi^\pm (D\overline{D}^*)^\mp$

[1] Assuming the same origin of the $(D\overline{D}^*)^\pm$ and $\pi^\pm J/\psi$ decay modes. NODE=M210R03;LINKAGE=A

$\Gamma(D^0 D^{*-} + c.c.)/\Gamma_{total}$ — Γ_6/Γ

NODE=M210R09
NODE=M210R09

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
seen	ABLIKIM	15AC	BES3	±	$e^+e^- \to \pi^+ D^0 D^{*-}$ + c.c.
seen	ABLIKIM	14A	BES3	±	$e^+e^- \to \pi^+ D^0 D^{*-}$ + c.c.

$\Gamma(D^- D^{*0} + c.c.)/\Gamma_{total}$ — Γ_7/Γ

NODE=M210R10
NODE=M210R10

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
seen	ABLIKIM	15AC	BES3	±	$e^+e^- \to \pi^+ D^- D^{*0}$ + c.c.
seen	ABLIKIM	14A	BES3	±	$e^+e^- \to \pi^+ D^- D^{*0}$ + c.c.

$\Gamma(\omega\pi^\pm)/\Gamma_{total}$ — Γ_8/Γ

NODE=M210R00
NODE=M210R00

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
not seen	ABLIKIM	15R	BES3	±	$e^+e^- \to \omega\pi^+\pi^-$

$\Gamma(J/\psi\eta)/\Gamma_{total}$ — Γ_9/Γ

NODE=M210R04
NODE=M210R04

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
not seen	ABLIKIM	15Q	BES3	0	4.0–4.6 $e^+e^- \to J/\psi\eta\pi^0$

$\Gamma(J/\psi\eta)/\Gamma(J/\psi\pi)$ — Γ_9/Γ_1

NODE=M210R05
NODE=M210R05

VALUE	CL%	DOCUMENT ID		TECN	CHG	COMMENT
<0.15	90	ABLIKIM	15Q	BES3	0	4.226 $e^+e^- \to J/\psi\eta\pi^0$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.65	90	ABLIKIM	15Q	BES3	0	4.257 $e^+e^- \to J/\psi\eta\pi^0$

OCCUR=2

$\Gamma(\eta_c(1S)\rho(770)^\pm)/\Gamma(J/\psi\pi)$ — Γ_4/Γ_1

NODE=M210R12
NODE=M210R12

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
2.3±0.8	332	[1] ABLIKIM	19BC	BES3	$e^+e^- \to \pi^+\pi^-\pi^0\eta_c(1S)$

[1] Using $e^+e^- \to \pi^\mp(Z_c(3900)^\pm \to J/\psi\pi^\pm)$ cross section at 4.23 and 4.26 GeV from ABLIKIM 17J. NODE=M210R12;LINKAGE=A

$\Gamma(D^+ D^{*-} + c.c)/\Gamma_{total}$ — Γ_{10}/Γ

NODE=M210R06
NODE=M210R06

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
seen	ABLIKIM	15AB	BES3	0	$e^+e^- \to \pi^0(D\overline{D}^*)^0$

$\Gamma(D^0\overline{D}^{*0}+c.c)/\Gamma_{total}$ — Γ_{11}/Γ

NODE=M210R07
NODE=M210R07

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
seen	ABLIKIM	15AB	BES3	0	$e^+e^- \rightarrow \pi^0(D\overline{D}^*)^0$

$\Gamma(D^+D^{*-}+c.c)/\Gamma(D^0\overline{D}^{*0}+c.c)$ — Γ_{10}/Γ_{11}

NODE=M210R08
NODE=M210R08

VALUE	DOCUMENT ID		TECN	CHG	COMMENT
0.96±0.18±0.12	ABLIKIM	15AB	BES3	0	$e^+e^- \rightarrow \pi^0(D\overline{D}^*)^0$

$Z_c(3900)$ REFERENCES

NODE=M210

ABLIKIM	20N	PR D102 012009	M. Ablikim *et al.*	(BESIII Collab.) JP	REFID=60338
ABAZOV	19	PR D100 012005	V.M. Abazov *et al.*	(D0 Collab.)	REFID=59903
ABLIKIM	19BC	PR D100 111102	M. Ablikim *et al.*	(BESIII Collab.)	REFID=60036
ABAZOV	18B	PR D98 052010	V.M. Abazov *et al.*	(D0 Collab.)	REFID=59442
ABLIKIM	17J	PRL 119 072001	M. Ablikim *et al.*	(BESIII Collab.) JP	REFID=57950
ABLIKIM	15AB	PRL 115 222002	M. Ablikim *et al.*	(BESIII Collab.)	REFID=56954
ABLIKIM	15AC	PR D92 092006	M. Ablikim *et al.*	(BESIII Collab.) JP	REFID=56967
ABLIKIM	15Q	PR D92 012008	M. Ablikim *et al.*	(BESIII Collab.)	REFID=56782
ABLIKIM	15R	PR D92 032009	M. Ablikim *et al.*	(BESIII Collab.)	REFID=56783
ABLIKIM	15U	PRL 115 112003	M. Ablikim *et al.*	(BESIII Collab.)	REFID=56786
ADOLPH	15D	PL B742 330	C. Adolph *et al.*	(COMPASS Collab.)	REFID=56791
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova *et al.*	(BELLE Collab.)	REFID=56706
Also		JHEP 1702 088 (errat.)	A. Vinokurava *et al.*	(BELLE Collab.)	REFID=57795
ABLIKIM	14A	PRL 112 022001	M. Ablikim *et al.*	(BESIII Collab.) JP	REFID=55648
ABLIKIM	13T	PRL 110 252001	M. Ablikim *et al.*	(BESIII Collab.)	REFID=55409
ABLIKIM	13X	PRL 111 242001	M. Ablikim *et al.*	(BESIII Collab.)	REFID=55635
LIU	13B	PRL 110 252002	Z.Q. Liu *et al.*	(BELLE Collab.)	REFID=55410
XIAO	13A	PL B727 366	T. Xiao *et al.*	(NWES)	REFID=55593