

**X(3915)**

$$I^G(J^{PC}) = 0^+(0 \text{ or } 2^{++})$$

was  $\chi_{c0}(3915)$ 

The experimental analysis prefers  $J^{PC} = 0^{++}$ . However, a re-analysis presented in ZHOU 15C shows that if helicity-2 dominance assumption is abandoned and a sizable helicity-0 component is allowed, a  $J^{PC} = 2^{++}$  assignment is possible.

**X(3915) MASS**

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>3918.4 ± 1.9 OUR AVERAGE</b>				
3919.4 ± 2.2 ± 1.6	59 ± 10	LEES	12AD BABR	$e^+e^- \rightarrow e^+e^-\omega J/\psi$
3919.1 <sup>+</sup> <sub>-</sub> 3.8 ± 2.0 3.4 ± 2.0		DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
3915 ± 3 ± 2	49 ± 15	UEHARA	10 BELL	10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$
3943 ± 11 ± 13	58 ± 11	<sup>1</sup> CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3926.4 ± 2.2 ± 1.2		<sup>2</sup> ABLIKIM	19V BES	$e^+e^- \rightarrow \gamma\omega J/\psi$
3914.6 <sup>+</sup> <sub>-</sub> 3.8 ± 2.0 3.4 ± 2.0		<sup>1</sup> AUBERT	08W BABR	Superseded by DEL-AMO-SANCHEZ 10B

<sup>1</sup>  $\omega J/\psi$  threshold enhancement fitted as an S-wave Breit-Wigner resonance.

<sup>2</sup> Could also be X(3940). Significance  $3.1\sigma$ . Fit with additional resonance at  $3963.7 \pm 5.7$  MeV, significance  $3.4\sigma$ .

**X(3915) WIDTH**

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>20 ± 5 OUR AVERAGE</b>				Error includes scale factor of 1.1.
13 ± 6 ± 3	59	LEES	12AD BABR	$e^+e^- \rightarrow e^+e^-\omega J/\psi$
31 <sup>+</sup> <sub>-</sub> 10 ± 5 8 ± 5		DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$
17 ± 10 ± 3	49	UEHARA	10 BELL	10.6 $e^+e^- \rightarrow e^+e^-\omega J/\psi$
87 ± 22 ± 26	58	<sup>3</sup> CHOI	05 BELL	$B \rightarrow \omega J/\psi K$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
3.8 ± 7.5 ± 2.6		<sup>4</sup> ABLIKIM	19V BES	$e^+e^- \rightarrow \gamma\omega J/\psi$
34 <sup>+</sup> <sub>-</sub> 12 ± 5 8 ± 5		<sup>3</sup> AUBERT	08W BABR	Superseded by DEL-AMO-SANCHEZ 10B

<sup>3</sup>  $\omega J/\psi$  threshold enhancement fitted as an S-wave Breit-Wigner resonance.

<sup>4</sup> Could also be X(3940). Significance  $3.1\sigma$ . Fit with additional resonance at  $3963.7 \pm 5.7$  MeV, significance  $3.4\sigma$ .

## X(3915) DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $\omega J/\psi$	seen
$\Gamma_2$ $\overline{D}^{*0} D^0$	
$\Gamma_3$ $\pi^+ \pi^- \eta_c(1S)$	not seen
$\Gamma_4$ $\eta_c \eta$	not seen
$\Gamma_5$ $\eta_c \pi^0$	not seen
$\Gamma_6$ $K \overline{K}$	not seen
$\Gamma_7$ $\gamma \gamma$	seen
$\Gamma_8$ $\pi^0 \chi_{c1}$	

### X(3915) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\omega J/\psi) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_1\Gamma_7/\Gamma$
VALUE (eV)	EVTS	DOCUMENT ID	TECN	COMMENT	
<b>54 ± 9 OUR AVERAGE</b>					
52 ± 10 ± 3	59 ± 10	<sup>5</sup> LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$	
61 ± 17 ± 8	49 ± 15	<sup>5</sup> UEHARA	10 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \omega J/\psi$	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
18 ± 5 ± 2	49 ± 15	<sup>6</sup> UEHARA	10 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \omega J/\psi$	
<sup>5</sup> For $J^P = 0^+$ .					
<sup>6</sup> For $J^P = 2^+$ , helicity-2.					

$\Gamma(\pi^+ \pi^- \eta_c(1S)) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_3\Gamma_7/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<16	90	LEES	12AE BABR	$e^+ e^- \rightarrow e^+ e^- \pi^+ \pi^- \eta_c$	

$\Gamma(K \overline{K}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}$					$\Gamma_6\Gamma_7/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<1.96	90	UEHARA	13 BELL	$\gamma\gamma \rightarrow K_S^0 K_S^0$	

### X(3915) BRANCHING RATIOS

$\Gamma(\omega J/\psi)/\Gamma_{\text{total}}$					$\Gamma_1/\Gamma$
VALUE		DOCUMENT ID	TECN	COMMENT	
seen		<sup>7</sup> DEL-AMO-SA..10B	BABR	$B \rightarrow \omega J/\psi K$	
seen		<sup>8</sup> CHOI	05 BELL	$B \rightarrow \omega J/\psi K$	
<sup>7</sup> DEL-AMO-SANCHEZ 10B reports $B(B^\pm \rightarrow X(3915)K^\pm) \times B(X(3915) \rightarrow J/\psi\omega) = (3.0^{+0.7+0.5}_{-0.6-0.3}) \times 10^{-5}$ and $B(B^0 \rightarrow X(3915)K^0) \times B(X(3915) \rightarrow J/\psi\omega) = (2.1 \pm 0.9 \pm 0.3) \times 10^{-5}$ .					
<sup>8</sup> CHOI 05 reports $B(B \rightarrow X(3915)K) \times B(X(3915) \rightarrow J/\psi\omega) = (7.1 \pm 1.3 \pm 3.1) \times 10^{-5}$ .					

$\Gamma(\omega J/\psi)/\Gamma(\bar{D}^{*0} D^0)$   $\Gamma_1/\Gamma_2$ 

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
>0.71	90	<sup>9</sup> AUSHEV	10	BELL $B \rightarrow \bar{D}^{*0} D^0 K$

<sup>9</sup> By combining the upper limit  $B(B \rightarrow X(3915) K) \times B(X(3915) \rightarrow D^{*0} \bar{D}^0) < 0.67 \times 10^{-4}$  from AUSHEV 10 with the average of CHOI 05 and AUBERT 08W measurements  $B(B \rightarrow X(3915) K) \times B(X(3915) \rightarrow \omega J/\psi) = (0.51 \pm 0.11) \times 10^{-4}$ .

 $\Gamma(\eta_c \eta)/\Gamma_{\text{total}}$   $\Gamma_4/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	<sup>10</sup> VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \eta$

<sup>10</sup> VINOKUROVA 15 reports  $B(B^+ \rightarrow K^+ X(3915)^0) \times B(X \rightarrow \eta_c \eta) < 3.3 \times 10^{-5}$  at 90% CL.

 $\Gamma(\eta_c \pi^0)/\Gamma_{\text{total}}$   $\Gamma_5/\Gamma$ 

VALUE	DOCUMENT ID	TECN	COMMENT
not seen	<sup>11</sup> VINOKUROVA 15	BELL	$B^+ \rightarrow K^+ \eta_c \pi^0$

<sup>11</sup> VINOKUROVA 15 reports  $B(B^+ \rightarrow K^+ X(3915)^0) \times B(X \rightarrow \eta_c \pi^0) < 1.8 \times 10^{-5}$  at 90% CL.

 $\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$   $\Gamma_7/\Gamma$ 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	59 ± 10	LEES	12AD BABR	$e^+ e^- \rightarrow e^+ e^- \omega J/\psi$
seen		UEHARA	10 BELL	10.6 $e^+ e^- \rightarrow e^+ e^- \omega J/\psi$

 $\Gamma(\pi^0 \chi_{c1})/\Gamma_{\text{total}}$   $\Gamma_8/\Gamma$ 

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
not seen	42 ± 14	<sup>12</sup> BHARDWAJ 19	BELL	$B^\pm \rightarrow \chi_{c1} \pi^0 K^\pm$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<sup>12</sup> BHARDWAJ 19 reports  $B(B^+ \rightarrow K^+ X(3915)) \times B(X(3915) \rightarrow \chi_{c1} \pi^0) < 3.8 \times 10^{-5}$  at 90% CL. A signal significance 2.3 standard deviations.

**X(3915) REFERENCES**

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BHARDWAJ	19	PR D99 111101	V. Bhardwaj <i>et al.</i>	(BELLE Collab.)
VINOKUROVA	15	JHEP 1506 132	A. Vinokurova <i>et al.</i>	(BELLE Collab.)
Also		JHEP 1702 088 (errat.)	A. Vinokurava <i>et al.</i>	(BELLE Collab.)
ZHOU	15C	PRL 115 022001	Z.-Y. Zhou, Z. Xiao, H.-Q. Zhou	(BEIJT, NANJ)
UEHARA	13	PTEP 2013 123C01	S. Uehara <i>et al.</i>	(BELLE Collab.)
LEES	12AD	PR D86 072002	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	12AE	PR D86 092005	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AUSHEV	10	PR D81 031103	T. Aushev <i>et al.</i>	(BELLE Collab.)
DEL-AMO-SA...	10B	PR D82 011101	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
UEHARA	10	PRL 104 092001	S. Uehara <i>et al.</i>	(BELLE Collab.)
AUBERT	08W	PRL 101 082001	B. Aubert <i>et al.</i>	(BABAR Collab.)
CHOI	05	PRL 94 182002	S.-K. Choi <i>et al.</i>	(BELLE Collab.)