

**X(4140)**

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

Seen by AALTONEN 09AH, ABAZOV 14A, CHATRCHYAN 14M, AAIJ 17C in  $B^+ \rightarrow XK^+$ ,  $X \rightarrow J/\psi\phi$ , and by ABAZOV 15M separately in both prompt ( $4.7\sigma$ ) and non-prompt ( $5.6\sigma$ ) production in  $p\bar{p} \rightarrow J/\psi\phi + \text{anything}$ . Not seen by SHEN 10 in  $\gamma\gamma \rightarrow J/\psi\phi$  and ABLIKIM 15 in  $e^+e^- \rightarrow \gamma J/\psi\phi$  at  $\sqrt{s} = 4.23, 4.26, 4.36$  GeV.

**X(4140) MASS**

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>4146.8 ± 2.5 OUR AVERAGE</b>		Error includes scale factor of 1.1.		
4146.5 ± 4.5 <sup>+4.6</sup> <sub>-2.8</sub>	4289	1 AAIJ	17C LHCB	$B^+ \rightarrow J/\psi\phi K^+$
4152.5 ± 1.7 <sup>+6.2</sup> <sub>-5.4</sub>	616	2 ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi\phi + \text{anything}$
4159.0 ± 4.3 ± 6.6	52	3 ABAZOV	14A D0	$B^+ \rightarrow J/\psi\phi K^+$
4148.0 ± 2.4 ± 6.3	0.3k	4 CHATRCHYAN 14M	CMS	$B^+ \rightarrow J/\psi\phi K^+$
4143.0 ± 2.9 ± 1.2	14	5 AALTONEN 09AH	CDF	$B^+ \rightarrow J/\psi\phi K^+$

<sup>1</sup> From an amplitude analysis of the decay  $B^+ \rightarrow J/\psi\phi K^+$  with a significance of  $8.4\sigma$ .

<sup>2</sup> Statistical significance of more than  $6\sigma$ .

<sup>3</sup> Statistical significance of  $3.1\sigma$ .

<sup>4</sup> From a fit assuming an S-wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than  $5\sigma$ .

<sup>5</sup> Statistical significance of  $3.8\sigma$ .

**X(4140) WIDTH**

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<b>19<sup>+8</sup><sub>-7</sub> OUR AVERAGE</b>		Error includes scale factor of 1.4. See the ideogram below.		
83 ± 21 <sup>+21</sup> <sub>-14</sub>	4289	1 AAIJ	17C LHCB	$B^+ \rightarrow J/\psi\phi K^+$
16.3 ± 5.6 ± 11.4	616	2 ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi\phi + \text{anything}$
20 ± 13 <sup>+3</sup> <sub>-8</sub>	52	3 ABAZOV	14A D0	$B^+ \rightarrow J/\psi\phi K^+$
28 <sup>+15</sup> <sub>-11</sub> ± 19	0.3k	4 CHATRCHYAN 14M	CMS	$B^+ \rightarrow J/\psi\phi K^+$
11.7 <sup>+8.3</sup> <sub>-5.0</sub> ± 3.7	14	5 AALTONEN 09AH	CDF	$B^+ \rightarrow J/\psi\phi K^+$

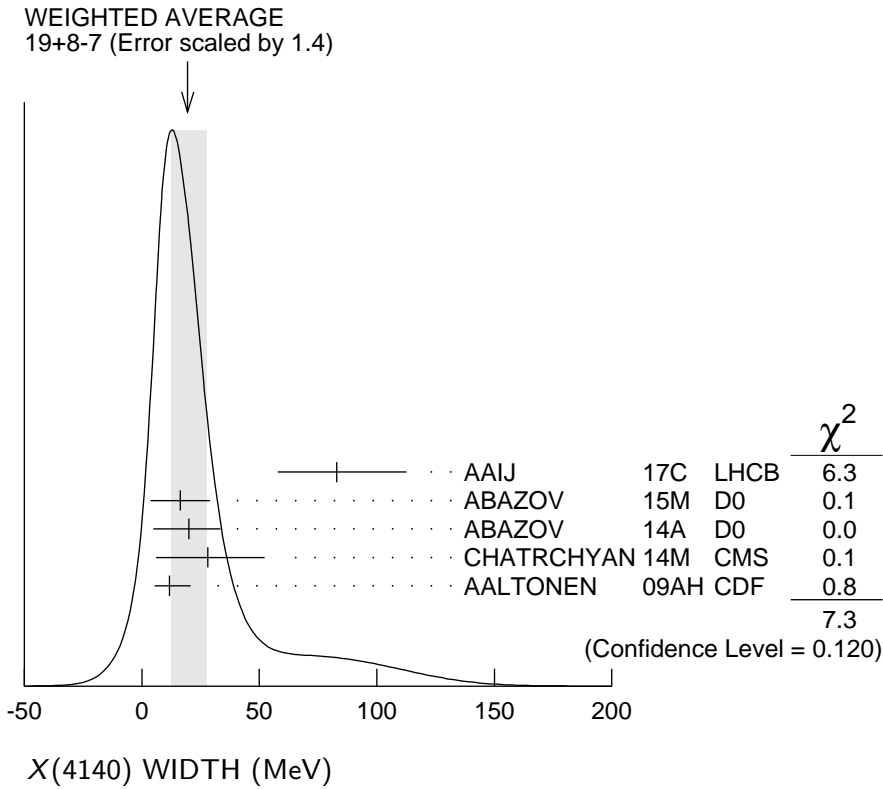
<sup>1</sup> From an amplitude analysis of the decay  $B^+ \rightarrow J/\psi\phi K^+$  with a significance of  $8.4\sigma$ .

<sup>2</sup> Statistical significance of more than  $6\sigma$ .

<sup>3</sup> Statistical significance of  $3.1\sigma$ .

<sup>4</sup> From a fit assuming an S-wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than  $5\sigma$ .

<sup>5</sup> Statistical significance of  $3.8\sigma$ .



### X(4140) DECAY MODES

Mode	Fraction ( $\Gamma_i/\Gamma$ )
$\Gamma_1$ $J/\psi\phi$	seen
$\Gamma_2$ $\gamma\gamma$	not seen

### X(4140) $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma(\text{total})$

$\Gamma(\gamma\gamma) \times \Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					$\Gamma_2\Gamma_1/\Gamma$
VALUE (eV)	CL%	DOCUMENT ID	TECN	COMMENT	
<b>&lt;41</b>	90	<sup>1</sup> SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
< 6	90	<sup>2</sup> SHEN	10	BELL 10.6 $e^+e^- \rightarrow e^+e^- J/\psi\phi$	
<sup>1</sup> For $J^P = 0^+$ .					
<sup>2</sup> For $J^P = 2^+$ .					

### X(4140) BRANCHING RATIOS

$\Gamma(J/\psi\phi)/\Gamma_{\text{total}}$					$\Gamma_1/\Gamma$
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
seen	4289	<sup>1</sup> AAIJ	17C LHCb	$B^+ \rightarrow J/\psi\phi K^+$	
seen	616	<sup>2</sup> ABAZOV	15M D0	$p\bar{p} \rightarrow J/\psi\phi + \text{anything}$	
<b>seen</b>	52	<sup>3</sup> ABAZOV	14A D0	$B^+ \rightarrow J/\psi\phi K^+$	

<b>seen</b>	0.3k	<sup>4</sup> CHATRCHYAN 14M	CMS	$B^+ \rightarrow J/\psi \phi K^+$
<b>seen</b>	14	<sup>5</sup> AALTONEN 09AH	CDF	$B^+ \rightarrow J/\psi \phi K^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		<sup>6</sup> ABLIKIM 15	BES3	$e^+ e^- \rightarrow \gamma \phi J/\psi$
not seen		<sup>7</sup> AAIJ 12AA	LHCB	$pp \rightarrow B^+ X$ at 7 TeV

<sup>1</sup> From an amplitude analysis of the decay  $B^+ \rightarrow J/\psi \phi K^+$  with a significance of  $8.4 \sigma$ .

<sup>2</sup> Statistical significance of more than  $6 \sigma$ .

<sup>3</sup> ABAZOV 14A reports  $B(B^+ \rightarrow X(4140) K^+ \rightarrow J/\psi \phi K^+)/B(B^+ \rightarrow J/\psi \phi K^+) = (19 \pm 7 \pm 4)\%$  with  $3.1 \sigma$  significance.

<sup>4</sup> From a fit assuming an *S*-wave relativistic Breit-Wigner shape above a three-body phase-space non-resonant component with statistical significance of more than  $5 \sigma$ .

<sup>5</sup> Statistical significance of  $3.8 \sigma$ .

<sup>6</sup> Reported  $\sigma(e^+ e^- \rightarrow \gamma X(4140)) \cdot B(X(4140) \rightarrow J/\psi \phi) < 0.35, 0.28,$  and  $0.33$  pb at 4.23, 4.26, and 4.36 GeV, respectively, at 90% CL.

<sup>7</sup> Reported  $B(B^+ \rightarrow X(4140) K^+) \cdot B(X(4140) \rightarrow J/\psi \phi)/B(B^+ \rightarrow J/\psi \phi K^+) < 0.07$  at 90% CL.

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$				$\Gamma_2/\Gamma$
<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
<b>not seen</b>	SHEN	10	BELL	$10.6 e^+ e^- \rightarrow e^+ e^- J/\psi \phi$

### X(4140) REFERENCES

AAIJ	17C	PRL 118 022003	R. Aaij <i>et al.</i>	(LHCb Collab.) JP
Also		PR D95 012002	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	15M	PRL 115 232001	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ABLIKIM	15	PR D91 032002	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABAZOV	14A	PR D89 012004	V.M. Abazov <i>et al.</i>	(D0 Collab.)
CHATRCHYAN	14M	PL B734 261	S. Chatrchyan <i>et al.</i>	(CMS Collab.)
AAIJ	12AA	PR D85 091103	R. Aaij <i>et al.</i>	(LHCb Collab.)
SHEN	10	PRL 104 112004	C.P. Shen <i>et al.</i>	(BELLE Collab.)
AALTONEN	09AH	PRL 102 242002	T. Aaltonen <i>et al.</i>	(CDF Collab.)