\( \chi_c(1P) \)

\( I^G(J^PC) = 0^+(1++) \)

See the Review on “\( \psi(2S) \) and \( \chi_c \) branching ratios” before the \( \chi_{c0}(1P) \) Listings.

<table>
<thead>
<tr>
<th>( \chi_c(1P) ) MASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALUE (MeV)</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>3510.66 ± 0.07 OUR AVERAGE</td>
</tr>
<tr>
<td>3510.30 ± 0.14 ± 0.16</td>
</tr>
<tr>
<td>3510.719 ± 0.051 ± 0.019</td>
</tr>
<tr>
<td>3509.4 ± 0.9</td>
</tr>
<tr>
<td>3510.60 ± 0.087 ± 0.019</td>
</tr>
<tr>
<td>3511.3 ± 0.4 ± 0.4</td>
</tr>
<tr>
<td>3512.3 ± 0.3 ± 4.0</td>
</tr>
<tr>
<td>3507.4 ± 1.7</td>
</tr>
<tr>
<td>3510.4 ± 0.6</td>
</tr>
<tr>
<td>3510.1 ± 1.1</td>
</tr>
<tr>
<td>3509 ± 11</td>
</tr>
<tr>
<td>3507 ± 3</td>
</tr>
<tr>
<td>3505.0 ± 4 ± 4</td>
</tr>
<tr>
<td>3513 ± 7</td>
</tr>
</tbody>
</table>

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

3500 ± 10 | | TANENBAUM 75 MRK1 | | Hadrons \( \gamma \)

1 Recalculated by ANDREOTTI 05A, using the value of \( \psi(2S) \) mass from AULCHENKO 03.
2 Using mass of \( \psi(2S) = 3686.0 \) MeV.
3 \( J/\psi(1S) \) mass constrained to 3097 MeV.
4 Mass value shifted by us by amount appropriate for \( \psi(2S) \) mass = 3686 MeV and \( J/\psi(1S) \) mass = 3097 MeV.
5 From a simultaneous fit to radiative and hadronic decay channels.
WEIGHTED AVERAGE
3510.66 ± 0.07 (Error scaled by 1.5)

χ²
7.9
(Confidence Level = 0.162)

χ₁(1P) mass (MeV)

χ₁(1P) WIDTH

<table>
<thead>
<tr>
<th>VALUE (MeV)</th>
<th>CL%</th>
<th>EVTS</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.89 ± 0.05</td>
<td>OUR FIT</td>
<td>EVTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.88 ± 0.05</td>
<td>OUR AVERAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.39 ± 0.40</td>
<td>95</td>
<td>BAGLIN</td>
<td>86B</td>
<td>SPEC</td>
<td>p + p → e⁺e⁻γ</td>
</tr>
<tr>
<td>0.87 ± 0.035</td>
<td>90</td>
<td>GAISER</td>
<td>86</td>
<td>CBAL</td>
<td>p⁻p → e⁺e⁻X</td>
</tr>
<tr>
<td>0.87 ± 0.038</td>
<td>6 ARMSTRONG</td>
<td>92</td>
<td>E760</td>
<td></td>
<td>p⁻p → e⁺e⁻X</td>
</tr>
</tbody>
</table>

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

χ₁(1P) DECAY MODES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Fraction (Γᵢ/Γ)</th>
<th>Scale factor/Confidence level</th>
</tr>
</thead>
</table>

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Hadronic decays

\(\Gamma_1\) \(3(\pi^+ \pi^-)\) \(5.8 \pm 1.4 \times 10^{-3}\) S=1.2

\(\Gamma_2\) \(2(\pi^+ \pi^-)\) \(7.6 \pm 2.6 \times 10^{-3}\)

\(\Gamma_3\) \(\pi^+ \pi^- K^+ K^-\) \(4.5 \pm 1.0 \times 10^{-3}\)

\(\Gamma_4\) \(\rho^0 \pi^+ \pi^-\) \(3.9 \pm 3.5 \times 10^{-3}\)

\(\Gamma_5\) \(K^+ \bar{K}^*(892)^0 \pi^- + \text{c.c.}\) \(3.2 \pm 2.1 \times 10^{-3}\)

\(\Gamma_6\) \(K^*(892)^0 \bar{K}^*(892)^0\) \(1.6 \pm 0.4 \times 10^{-3}\)

\(\Gamma_7\) \(K_S^0 K^+ \pi^- + \text{c.c.}\) \(2.3 \pm 0.7 \times 10^{-3}\)

\(\Gamma_8\) \(\pi^+ \pi^- K_S^0 K_S^0\) \(7.7 \pm 3.3 \times 10^{-4}\)

\(\Gamma_9\) \(K^+ K^- K_S^0 K_S^0\)

\(\Gamma_{10}\) \(\pi^+ \pi^- \rho \bar{\rho}\) \(4.9 \pm 1.9 \times 10^{-4}\)

\(\Gamma_{11}\) \(K^+ K^- K^+ K^-\) \(3.9 \pm 1.7 \times 10^{-4}\)

\(\Gamma_{12}\) \(\rho \bar{\rho}\) \(6.7 \pm 0.5 \times 10^{-5}\)

\(\Gamma_{13}\) \(\Lambda \bar{\Lambda}\) \(2.4 \pm 1.0 \times 10^{-4}\)

\(\Gamma_{14}\) \(\Lambda \bar{\Lambda} \pi^+ \pi^-\) \(< 1.5 \times 10^{-3}\) CL=90%

\(\Gamma_{15}\) \(K_S^0 K_S^0 \rho \bar{\rho}\) \(< 4.5 \times 10^{-4}\) CL=90%

\(\Gamma_{16}\) \(\Xi^- \bar{\Xi}^+\) \(< 3.4 \times 10^{-4}\) CL=90%

\(\Gamma_{17}\) \(\pi^+ \pi^- + K^+ K^-\) \(< 2.1 \times 10^{-3}\)

\(\Gamma_{18}\) \(K_S^0 K_S^0\) \(< 7 \times 10^{-5}\) CL=90%

Radiative decays

\(\Gamma_{19}\) \(\gamma J/\psi(1S)\) \((35.6 \pm 1.9)\) %

\(\Gamma_{20}\) \(\gamma \gamma\)

\(\chi_{c1}(1P)\) PARTIAL WIDTHS

\(\chi_{c1}(1P)\) \(\Gamma(\gamma J/\psi(1S))/\Gamma(\text{total})\)

\(\Gamma(\rho \bar{\rho}) \times \Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}}\) \(\Gamma_{12}\) \(\Gamma_{19}/\Gamma\)

<table>
<thead>
<tr>
<th>VALUE (eV)</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.3 \pm 0.9 OUR FIT</td>
<td>7 ANDREOTTI 05A E835</td>
<td>p\bar{p} \rightarrow e^+ e^- \gamma</td>
<td></td>
</tr>
<tr>
<td>21.4 \pm 0.9 OUR AVERAGE</td>
<td>7,8 ARMSTRONG 92 E760</td>
<td>p\bar{p} \rightarrow e^+ e^- \gamma</td>
<td></td>
</tr>
</tbody>
</table>

\(7\) Calculated by us using \(B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0593 \pm 0.0010\).

\(8\) Recalculated by ANDREOTTI 05A.
### $\chi_c(1P)$ Branching Ratios

---

#### HADRONIC DECAYS

<table>
<thead>
<tr>
<th>$\Gamma(3(\pi^+\pi^-))/\Gamma_{\text{total}}$</th>
<th>$\Gamma_1/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE (units 10^{-3})</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>$5.8\pm1.4$ OUR EVALUATION error as correlated.</td>
<td></td>
</tr>
<tr>
<td>$5.8\pm1.1$ OUR AVERAGE</td>
<td></td>
</tr>
<tr>
<td>5.4±0.7±0.9</td>
<td>9 BAI</td>
</tr>
<tr>
<td>15.9±5.9±0.8</td>
<td>9 TANENBAUM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(2(\pi^+\pi^-))/\Gamma_{\text{total}}$</th>
<th>$\Gamma_2/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE (units 10^{-3})</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>$7.6\pm2.6$ OUR EVALUATION</td>
<td></td>
</tr>
<tr>
<td>$8\pm4$ OUR AVERAGE</td>
<td></td>
</tr>
<tr>
<td>4.6±2.0±2.6</td>
<td>9 BAI</td>
</tr>
<tr>
<td>12.4±4.1±0.6</td>
<td>9 TANENBAUM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(\pi^+\pi^- K^+K^-)/\Gamma_{\text{total}}$</th>
<th>$\Gamma_3/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE (units 10^{-3})</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>$4.5\pm1.0$ OUR EVALUATION treating systematic error as correlated.</td>
<td></td>
</tr>
<tr>
<td>$4.5\pm0.9$ OUR AVERAGE</td>
<td></td>
</tr>
<tr>
<td>4.2±0.4±0.9</td>
<td>9 BAI</td>
</tr>
<tr>
<td>7.3±3.0±0.4</td>
<td>9 TANENBAUM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(\rho^0\pi^+\pi^-)/\Gamma_{\text{total}}$</th>
<th>$\Gamma_4/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE (units 10^{-4})</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>$39\pm35$</td>
<td>10 TANENBAUM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(K^+K^*(892)^0\pi^- + \text{c.c.})/\Gamma_{\text{total}}$</th>
<th>$\Gamma_5/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE (units 10^{-4})</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>$32\pm21$</td>
<td>10 TANENBAUM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(K^<em>(892)^0K^</em>(892)^0)/\Gamma_{\text{total}}$</th>
<th>$\Gamma_6/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE (units 10^{-3})</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>$1.6\pm0.4\pm0.1$</td>
<td>28.4±5.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(K_S^0 K^+\pi^- + \text{c.c.})/\Gamma_{\text{total}}$</th>
<th>$\Gamma_7/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE (units 10^{-3})</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>$2.3\pm0.4\pm0.6$</td>
<td>9 BAI</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(\pi^+\pi^- K_S^0K_S^0)/\Gamma_{\text{total}}$</th>
<th>$\Gamma_8/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE (units 10^{-4})</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>$7.7\pm3.2\pm0.4$</td>
<td>19.8±7.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Gamma(K^+K^- K_S^0K_S^0)/\Gamma_{\text{total}}$</th>
<th>$\Gamma_9/\Gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE (units 10^{-4})</strong></td>
<td><strong>DOCUMENT ID</strong></td>
</tr>
<tr>
<td>&lt;5</td>
<td>90</td>
</tr>
</tbody>
</table>

---

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\[ \Gamma(\pi^+ \pi^- p\bar{p})/\Gamma_{\text{total}} \]  
\begin{align*}
\text{VALUE (units 10}^{-3} \text{)} & \quad \text{COMMENT} \\
0.49 \pm 0.19 \quad \text{OUR EVALUATION} & \quad \Gamma_{10}/\Gamma \\
0.50 \pm 0.19 \quad \text{OUR AVERAGE} & \quad \text{Treating systematic error as correlated.} \\
0.46 \pm 0.12 \pm 0.15 & \quad 9 \text{ BAI} \quad 99b \text{ BES} \\
1.07 \pm 0.76 \pm 0.05 & \quad 9 \text{ TANENBAUM} \quad 78 \text{ MRK1} \\
\end{align*}

\[ \Gamma(K^+ K^- K^+ K^-)/\Gamma_{\text{total}} \]  
\begin{align*}
\text{VALUE (units 10}^{-3} \text{)} & \quad \text{COMMENT} \\
0.39 \pm 0.14 \pm 0.10 & \quad \Gamma_{11}/\Gamma \\
9 \text{ BAI} & \quad \psi(2S) \rightarrow \gamma \chi_{c1} \\
\end{align*}

\[ \Gamma(p\bar{p})/\Gamma_{\text{total}} \]  
\begin{align*}
\text{VALUE (units 10}^{-4} \text{)} & \quad \text{COMMENT} \\
0.67 \pm 0.05 \quad \text{OUR FIT} & \quad \Gamma_{12}/\Gamma \\
\end{align*}

\[ \Gamma(\Lambda\bar{\Lambda})/\Gamma_{\text{total}} \]  
\begin{align*}
\text{VALUE (units 10}^{-4} \text{)} & \quad \text{COMMENT} \\
2.4 \pm 0.9 \pm 0.5 & \quad \Gamma_{13}/\Gamma \\
9.0^{+3.5}_{-3.1} & \quad 9 \text{ BAI} \quad 03e \text{ BES} \\
\end{align*}

\[ \Gamma(\Lambda\bar{\Lambda}\pi^+ \pi^-)/\Gamma_{\text{total}} \]  
\begin{align*}
\text{VALUE (units 10}^{-3} \text{)} & \quad \text{COMMENT} \\
<1.5 & \quad \Gamma_{14}/\Gamma \\
<90 & \quad 15 \text{ ABLIKIM} \quad 06d \text{ BES2} \\
\end{align*}

\[ \Gamma(K^0_S K^0_S p\bar{p})/\Gamma_{\text{total}} \]  
\begin{align*}
\text{VALUE (units 10}^{-4} \text{)} & \quad \text{COMMENT} \\
<4.5 & \quad \Gamma_{15}/\Gamma \\
<90 & \quad 15 \text{ ABLIKIM} \quad 06d \text{ BES2} \\
\end{align*}

\[ \Gamma(\Xi^- \Xi^+)/\Gamma_{\text{total}} \]  
\begin{align*}
\text{VALUE (units 10}^{-4} \text{)} & \quad \text{COMMENT} \\
<3.4 & \quad \Gamma_{16}/\Gamma \\
<90 & \quad 15 \text{ ABLIKIM} \quad 06d \text{ BES2} \\
\end{align*}

\[ \left[ \Gamma(\pi^+ \pi^-) + \Gamma(K^+ K^-) \right]/\Gamma_{\text{total}} \]  
\begin{align*}
\text{VALUE (units 10}^{-4} \text{)} & \quad \text{COMMENT} \\
<21 & \quad \Gamma_{17}/\Gamma \\
\cdot \cdot \cdot \text{ We do not use the following data for averages, fits, limits, etc.} \cdot \cdot \cdot \\
<38 & \quad 10 \text{ FELDMAN} \quad 77 \text{ MRK1} \\
\psi(2S) \rightarrow \gamma \chi_{c1} & \quad \psi(2S) \rightarrow \gamma \chi_{c1} \\
\end{align*}

\[ \Gamma(K^0_S K^0_S)/\Gamma_{\text{total}} \]  
\begin{align*}
\text{VALUE (units 10}^{-4} \text{)} & \quad \text{COMMENT} \\
<0.7 & \quad \Gamma_{18}/\Gamma \\
<90 & \quad 16 \text{ ABLIKIM} \quad 05o \text{ BES2} \\
\psi(2S) \rightarrow \chi_{c1} \gamma & \quad \psi(2S) \rightarrow \gamma \chi_{c1} \\
\end{align*}
Rescaled by us using \( B(\psi(2S) \to \gamma \chi_{c1}) = (8.7 \pm 0.4)\% \) and \( B(\psi(2S) \to J/\psi(1S)\pi^+\pi^-) = 0.318 \pm 0.006 \).

10 Estimated using \( B(\psi(2S) \to \gamma \chi_{c1}(1P)) = 0.087 \). The errors do not contain the uncertainty in the \( \psi(2S) \) decay.

11 ABLIKIM 04H reports \( [B(\chi_{c1}(1P) \to K^+(892)^0 K^- S^0 S^0) \times B(\psi(2S) \to \gamma \chi_{c1}(1P))] = (1.40 \pm 0.27 \pm 0.22) \times 10^{-4} \). We divide by our best value \( B(\psi(2S) \to \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2} \). Our first error is their experiment’s error and our second error is the systematic error from using our best value.

12 Assumes \( B(K^+(892)^0 \to K^- \pi^+) = 2/3 \).

13 ABLIKIM 05O reports \( [B(\chi_{c1}(1P) \to J^+ \pi^- K^0 S^0 K^0 S^0) \times B(\psi(2S) \to \gamma \chi_{c1}(1P))] = (0.67 \pm 0.26 \pm 0.11) \times 10^{-4} \). We divide by our best value \( B(\psi(2S) \to \gamma \chi_{c1}(1P)) = (8.7 \pm 0.4) \times 10^{-2} \). Our first error is their experiment’s error and our second error is the systematic error from using our best value.

14 ABLIKIM 05O reports \( [B(\chi_{c1}(1P) \to K^+ K^- K^0 S^0 S^0) \times B(\psi(2S) \to \gamma \chi_{c1}(1P))] = < 4.2 \times 10^{-5} \). We divide by our best value \( B(\psi(2S) \to \gamma \chi_{c1}(1P)) = 0.087 \).

15 Using \( B(\psi(2S) \to \chi_{c1}(\gamma)) = (9.1 \pm 0.6)\% \).

16 ABLIKIM 05O reports \( [B(\chi_{c1}(1P) \to K^0 S^0 S^0 S^0) \times B(\psi(2S) \to \gamma \chi_{c1}(1P))] = < 0.6 \times 10^{-5} \). We divide by our best value \( B(\psi(2S) \to \gamma \chi_{c1}(1P)) = 0.087 \).

**RADIATIVE DECAYS**

\[
\Gamma(\gamma J/\psi(1S))/\Gamma_{\text{total}} \quad \text{\( \gamma_{19}/\Gamma \)}
\]

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.356 \pm 0.019 OUR FIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.379 \pm 0.008 \pm 0.021</td>
<td>17 ADAM</td>
<td>CLEO</td>
<td>e^+ e^- \to \psi(2S) \to \gamma \chi_{c1}</td>
</tr>
</tbody>
</table>

\[
\Gamma(\gamma \gamma)/\Gamma_{\text{total}} \quad \text{\( \gamma_{20}/\Gamma \)}
\]

<table>
<thead>
<tr>
<th>VALUE</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.0015</td>
<td>90</td>
<td>18 YAMADA</td>
<td>77 DASP</td>
</tr>
</tbody>
</table>

17 Uses \( B(\psi(2S) \to \gamma \chi_{c1} \to \gamma J/\psi) \) from ADAM 05A and \( B(\psi(2S) \to \gamma \chi_{c1}) \) from ATHAR 04.

18 Estimated using \( B(\psi(2S) \to \gamma \chi_{c1}(1P)) = 0.087 \). The errors do not contain the uncertainty in the \( \psi(2S) \) decay.

\[\chi_{c1}(1P) \text{ CROSS-PARTICLE BRANCHING RATIOS}\]

\[B(\chi_{c1}(1P) \to pp) \times \frac{\Gamma(\psi(2S) \to \gamma \chi_{c1}(1P))}{\Gamma(\psi(2S) \to J/\psi(1S)\pi^+\pi^-)}\]

<table>
<thead>
<tr>
<th>VALUE (units ( 10^{-5} ))</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.85 \pm 0.20 OUR FIT</td>
<td>19 BAI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 \pm 1.0</td>
<td>98i BES</td>
<td></td>
<td>\psi(2S) \to \gamma \chi_{c1} \to \gamma pp</td>
</tr>
</tbody>
</table>
\[ B(x_{c1}(1P) \rightarrow \gamma J/\psi(1S)) \times B(\psi(2S) \rightarrow \gamma x_{c1}(1P)) \]

<table>
<thead>
<tr>
<th>VALUE (units 10^{-2})</th>
<th>EVTS</th>
<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3.11 \pm 0.08) OUR FIT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.70 \pm 0.13) OUR AVERAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.81 \pm 0.05 \pm 0.23</td>
<td>13k</td>
<td>BAI 04i BES2</td>
<td>(\psi(2S) \rightarrow J/\psi \gamma \gamma)</td>
<td></td>
</tr>
<tr>
<td>2.56 \pm 0.12 \pm 0.20</td>
<td></td>
<td>Gaiser 86 CBAL</td>
<td>(\psi(2S) \rightarrow \gamma X)</td>
<td></td>
</tr>
<tr>
<td>2.78 \pm 0.30</td>
<td>20</td>
<td>Oreglia 82 CBAL</td>
<td>(\psi(2S) \rightarrow \gamma x_{c1})</td>
<td></td>
</tr>
<tr>
<td>2.2 \pm 0.5</td>
<td>21</td>
<td>Brandelik 79b Dasp</td>
<td>(\psi(2S) \rightarrow \gamma x_{c1})</td>
<td></td>
</tr>
<tr>
<td>2.9 \pm 0.5</td>
<td>21</td>
<td>Bartel 78b CNTR</td>
<td>(\psi(2S) \rightarrow \gamma x_{c1})</td>
<td></td>
</tr>
<tr>
<td>5.0 \pm 1.5</td>
<td>22</td>
<td>Biddick 77 CNTR</td>
<td>(e^+ e^- \rightarrow \gamma X)</td>
<td></td>
</tr>
<tr>
<td>2.8 \pm 0.9</td>
<td>20</td>
<td>Whitaker 76 MRK1</td>
<td>(x_{c1})</td>
<td></td>
</tr>
</tbody>
</table>

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

\[ B(x_{c1}(1P) \rightarrow J/\psi(1S)) \times \frac{\Gamma(\psi(2S) \rightarrow \gamma x_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \text{anything})} \]

<table>
<thead>
<tr>
<th>VALUE (units 10^{-2})</th>
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<th>DOCUMENT ID</th>
<th>TECN</th>
<th>COMMENT</th>
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<tbody>
<tr>
<td>(5.54 \pm 0.09) OUR FIT</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(5.77 \pm 0.10) OUR AVERAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.44 \pm 0.06 \pm 0.13</td>
<td>3.7k</td>
<td>Adam 05a Cleo</td>
<td>(\psi(2S) \rightarrow J/\psi \gamma \gamma)</td>
<td></td>
</tr>
</tbody>
</table>

\[ B(x_{c1}(1P) \rightarrow \gamma J/\psi(1S)) \times \frac{\Gamma(\psi(2S) \rightarrow \gamma x_{c1}(1P))}{\Gamma(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-)} \]

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<tr>
<td>(9.77 \pm 0.35) OUR FIT</td>
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<tr>
<td>(9.5 \pm 1.8) OUR AVERAGE</td>
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<tr>
<td>12.6 \pm 0.3 \pm 3.8</td>
<td>3k</td>
<td>Ablikim 04b Bes</td>
<td>(\psi(2S) \rightarrow J/\psi X)</td>
<td></td>
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<tr>
<td>8.5 \pm 2.1</td>
<td>25</td>
<td>Himel 80 Mrk2</td>
<td>(\psi(2S) \rightarrow \gamma x_{c1})</td>
<td></td>
</tr>
</tbody>
</table>

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

\[ B(x_{c1}(1P) \rightarrow \rho \pi) \times B(\psi(2S) \rightarrow \gamma x_{c1}(1P)) \]

<table>
<thead>
<tr>
<th>VALUE (units 10^{-6})</th>
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<tr>
<td>(5.9 \pm 0.6) OUR FIT</td>
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<tr>
<td>4.8^{+1.4}_{-1.3} \pm 0.6</td>
<td>18.2^{+5.5}_{-4.9}</td>
<td>BAI 04f Bes</td>
<td>(\psi(2S) \rightarrow \gamma x_{c1}(1P) \rightarrow \pi \pi)</td>
<td></td>
</tr>
</tbody>
</table>

19 Calculated by us. The value for \(B(x_{c1} \rightarrow \rho \pi)\) reported in BAI 98i is derived using \(B(\psi(2S) \rightarrow \gamma x_{c1}) = (8.7 \pm 0.8)\%\) and \(B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (32.4 \pm 2.6)\%\) [BAI 98o].

20 Recalculated by us using \(B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020\).

21 Recalculated by us using \(B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.0588 \pm 0.0010\).

22 Assumes isotropic gamma distribution.

23 Not independent from other values reported by Adam 05a.

24 From a fit to the \(J/\psi\) recoil mass spectra.

25 The value for \(B(\psi(2S) \rightarrow \gamma x_{c1}) \times B(x_{c1} \rightarrow \gamma J/\psi(1S))\) quoted in Himel 80 is derived using \(B(\psi(2S) \rightarrow J/\psi(1S) \pi^+ \pi^-) = (33 \pm 3)\%\) and \(B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.138 \pm 0.018\). Calculated by us using \(B(J/\psi(1S) \rightarrow \ell^+ \ell^-) = 0.1181 \pm 0.0020\).
MULTIPOLE AMPLITUDES IN $\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)$

$$a_2 = \frac{M_2}{\sqrt{E_1^2 + M_2^2}}$$ Magnetic quadrupole fractional transition amplitude

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<tbody>
<tr>
<td>$-0.002^{+0.008}_{-0.017}$ OUR AVERAGE</td>
<td></td>
<td>AMBROGIANI 02 E835</td>
<td></td>
<td>$p\bar{p} \rightarrow \chi_{c1} \rightarrow J/\psi\gamma$</td>
</tr>
<tr>
<td>0.002±0.032±0.004</td>
<td>2090</td>
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<td></td>
<td>$\psi(2S) \rightarrow \chi_{c1}\gamma \rightarrow J/\psi\gamma\gamma$</td>
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<tr>
<td>$-0.002^{+0.008}_{-0.020}$</td>
<td>921</td>
<td>OREGLIA 82 CBAL</td>
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<td></td>
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</table>

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