

$\eta_c(2S)$

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

Quantum numbers are quark model predictions.

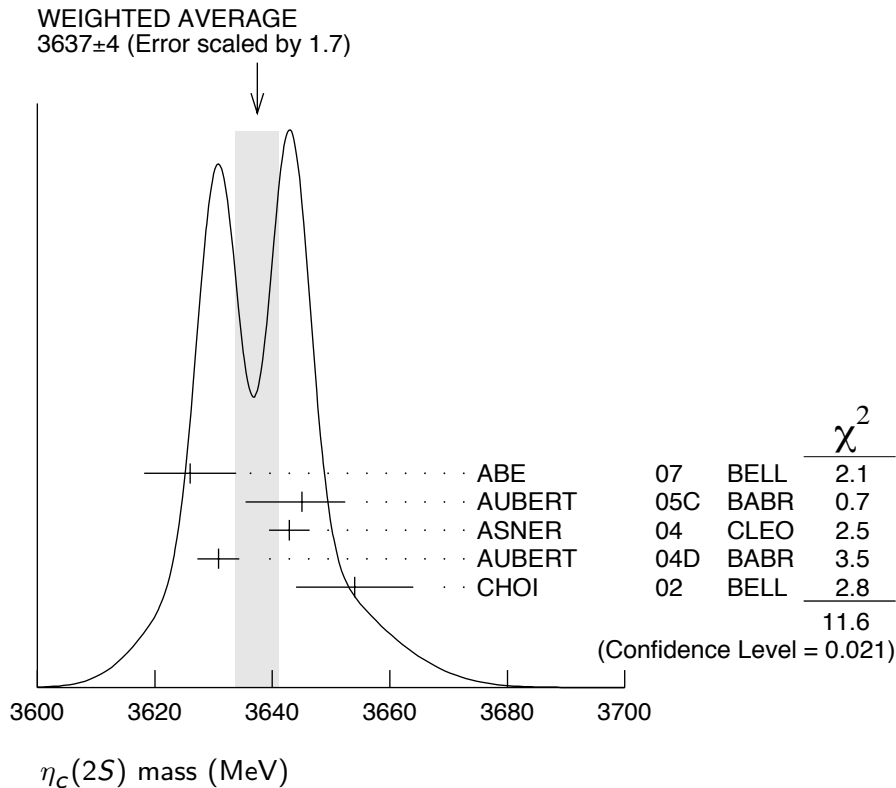
$\eta_c(2S)$ MASS

| VALUE (MeV) | EVTS | DOCUMENT ID | TECN | COMMENT |
|---|--------------------|---|----------|---|
| 3637 ±4 | OUR AVERAGE | Error includes scale factor of 1.7. See the ideogram below. | | |
| 3626 ±5 ±6 | 311 | ¹ ABE | 07 BELL | $e^+e^- \rightarrow J/\psi(c\bar{c})$ |
| 3645.0 ± 5.5 ^{+4.9} _{-7.8} | 121 ± 27 | AUBERT | 05C BABR | $e^+e^- \rightarrow J/\psi c\bar{c}$ |
| 3642.9 ± 3.1 ± 1.5 | 61 | ASNER | 04 CLEO | $\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ |
| 3630.8 ± 3.4 ± 1.0 | 112 ± 24 | AUBERT | 04D BABR | $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$ |
| 3654 ±6 ±8 | 39 ± 11 | CHOI | 02 BELL | $B \rightarrow K K_S K^- \pi^+$ |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | | |
| 3639 ±7 | 98 ± 52 | ² AUBERT | 06E BABR | $B^\pm \rightarrow K^\pm X_{c\bar{c}}$ |
| 3594 ±5 | | ³ EDWARDS | 82C CBAL | $e^+e^- \rightarrow \gamma X$ |

¹ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.

² From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

³ Assuming mass of $\psi(2S) = 3686$ MeV.



$\eta_c(2S)$ WIDTH

| VALUE (MeV) | CL% | EVTS | DOCUMENT ID | TECN | COMMENT |
|---|-----|----------|----------------------|----------|---|
| 14 ± 7 OUR AVERAGE | | | | | |
| 6.3 ± 12.4 ± 4.0 | | 61 | ASNER | 04 CLEO | $\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ |
| 17.0 ± 8.3 ± 2.5 | | 112 ± 24 | AUBERT | 04D BABR | $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$ |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | | | |
| <23 | 90 | 98 ± 52 | ⁴ AUBERT | 06E BABR | $B^\pm \rightarrow K^\pm X_{c\bar{c}}$ |
| 22 ± 14 | | 121 ± 27 | AUBERT | 05C BABR | $e^+e^- \rightarrow J/\psi c\bar{c}$ |
| <55 | 90 | 39 ± 11 | ⁵ CHOI | 02 BELL | $B \rightarrow K K_S K^- \pi^+$ |
| <8.0 | 95 | | ⁶ EDWARDS | 82C CBAL | $e^+e^- \rightarrow \gamma X$ |
| ⁴ From the fit of the kaon momentum spectrum. Systematic errors not evaluated. | | | | | |
| ⁵ For a mass value of 3654 ± 6 MeV | | | | | |
| ⁶ For a mass value of 3594 ± 5 MeV | | | | | |

$\eta_c(2S)$ DECAY MODES

| Mode | Fraction (Γ_i/Γ) |
|---------------------------|--------------------------------|
| Γ_1 hadrons | |
| Γ_2 $K\bar{K}\pi$ | seen |
| Γ_3 $p\bar{p}$ | |
| Γ_4 $\gamma\gamma$ | seen |

$\eta_c(2S)$ PARTIAL WIDTHS

| $\Gamma(\gamma\gamma)$ Γ_4 | | | | |
|---|--------------------|---------|---|--|
| VALUE (keV) | DOCUMENT ID | TECN | COMMENT | |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | | |
| 1.3 ± 0.6 | ⁷ ASNER | 04 CLEO | $\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$ | |
| ⁷ They measure $\Gamma(\eta_c(2S)\gamma\gamma) B(\eta_c(2S) \rightarrow K\bar{K}\pi) = (0.18 \pm 0.05 \pm 0.02) \Gamma(\eta_c(1S)\gamma\gamma) B(\eta_c(1S) \rightarrow K\bar{K}\pi)$. The value for $\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)$ is derived assuming that the branching fractions for $\eta_c(2S)$ and $\eta_c(1S)$ decays to $K_S K\pi$ are equal and using $\Gamma(\eta_c(1S) \rightarrow \gamma\gamma) = 7.4 \pm 0.4 \pm 2.3$ keV. | | | | |

$\eta_c(2S)$ $\Gamma(i)\Gamma(\gamma\gamma)/\Gamma^2(\text{total})$

| $\Gamma(p\bar{p}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}^2$ $\Gamma_3\Gamma_4/\Gamma^2$ | | | | |
|--|-----|---------------------------------|------|-------------------------------------|
| VALUE (units 10 ⁻⁸) | CL% | DOCUMENT ID | TECN | COMMENT |
| < 5.6 | 90 | ^{8,9,10} AMBROGIANI 01 | E835 | $\bar{p}p \rightarrow \gamma\gamma$ |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | | |
| < 8.0 | 90 | ^{8,9,11} AMBROGIANI 01 | E835 | $\bar{p}p \rightarrow \gamma\gamma$ |
| < 12.0 | 90 | ^{9,11} AMBROGIANI 01 | E835 | $\bar{p}p \rightarrow \gamma\gamma$ |
| ⁸ Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis. | | | | |
| ⁹ For a total width $\Gamma=5$ MeV. | | | | |
| ¹⁰ For the resonance mass region 3589–3599 MeV/ c^2 . | | | | |
| ¹¹ For the resonance mass region 3575–3660 MeV/ c^2 . | | | | |

$\eta_c(2S)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$ Γ_1/Γ

| <u>VALUE</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|-----------------------|-------------|---|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | |
| not seen | ABREU | 980 DLPH | $e^+e^- \rightarrow e^+e^-$ +hadrons |
| seen | ¹² EDWARDS | 82C CBAL | $e^+e^- \rightarrow \gamma X$ |

$\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

| <u>VALUE</u> | <u>EVTS</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|--------------|-------------|--------------------|-------------|---------------------------------|
| seen | 39 ± 11 | ¹³ CHOI | 02 BELL | $B \rightarrow K K_S K^- \pi^+$ |

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$ Γ_4/Γ

| <u>VALUE</u> | <u>CL%</u> | <u>DOCUMENT ID</u> | <u>TECN</u> | <u>COMMENT</u> |
|---|------------|--------------------|-------------|------------------------------------|
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● | | | | |
| <0.01 | 90 | LEE | 85 CBAL | $\psi' \rightarrow \text{photons}$ |
| ¹² For a mass value of 3594 ± 5 MeV | | | | |
| ¹³ For a mass value of 3654 ± 6 MeV | | | | |

$\eta_c(2S)$ REFERENCES

| | | | | |
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