# $h_c(1P)$

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

Quantum numbers are quark model prediction, $C = -$ established by $\eta_c \gamma$ decay.

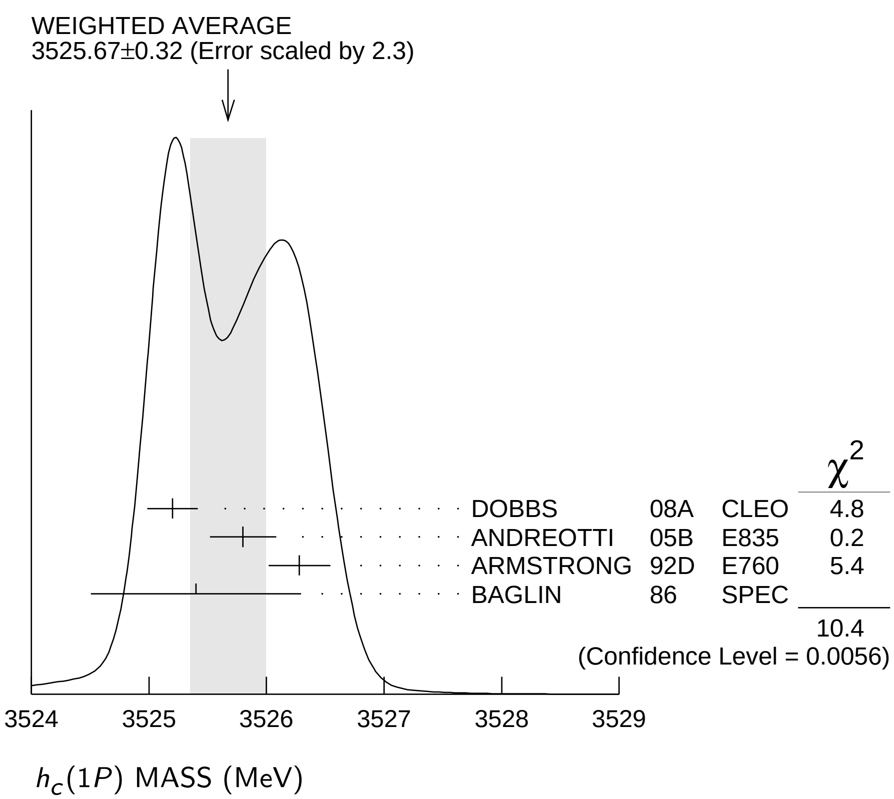
## $h_c(1P)$ MASS

| *VALUE* (MeV) | *EVTS* | *DOCUMENT ID* | | *TECN* | *COMMENT* |
|---|---|---|---|---|---|
| **3525.67±0.32 OUR AVERAGE** | | Error includes scale factor of 2.3. See the ideogram below. | | | |
| 3525.20±0.18±0.12 | 1282 | [1] DOBBS | 08A | CLEO | $\psi(2S) \to \pi^0 \eta_c \gamma$ |
| 3525.8 ±0.2 ±0.2 | 13 | ANDREOTTI | 05B | E835 | $\overline{p}p \to \eta_c \gamma$ |
| 3526.28±0.18±0.19 | 59 | [2] ARMSTRONG | 92D | E760 | $\overline{p}p \to J/\psi \pi^0$ |
| 3525.4 ±0.8 ±0.4 | 5 | BAGLIN | 86 | SPEC | $\overline{p}p \to J/\psi X$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 3524.4 ±0.6 ±0.4 | 168 ± 40 | [3] ROSNER | 05 | CLEO | $\psi(2S) \to \pi^0 \eta_c \gamma$ |
| 3527 ±8 | 42 | ANTONIAZZI | 94 | E705 | $300\ \pi^\pm,\ p\text{Li} \to J/\psi \pi^0 X$ |

[1] Combination of exclusive and inclusive analyses for the reaction $\psi(2S) \to \pi^0 h_c \to \pi^0 \eta_c \gamma$. This result is the average of DOBBS 08A and ROSNER 05.

[2] Mass central value and systematic error recalculated by us according to Eq. (16) in ARMSTRONG 93B, using the value for the $\psi(2S)$ mass from AULCHENKO 03.

[3] Superseded by DOBBS 08A.



## $h_c(1P)$ WIDTH

| VALUE (MeV) | CL% | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **<1** | | 13 | ANDREOTTI | 05B | E835 | $\overline{p}p \to \eta_c\gamma$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| $<1.1$ | 90 | 59 | ARMSTRONG | 92D | E760 | $\overline{p}p \to J/\psi\pi^0$ |

## $h_c(1P)$ DECAY MODES

| | Mode | Fraction ($\Gamma_i/\Gamma$) |
|---|---|---|
| $\Gamma_1$ | $J/\psi(1S)\pi^0$ | |
| $\Gamma_2$ | $J/\psi(1S)\pi\pi$ | not seen |
| $\Gamma_3$ | $p\overline{p}$ | |
| $\Gamma_4$ | $\eta_c\gamma$ | seen |

## $h_c(1P)$ PARTIAL WIDTHS

## $h_c(1P)$ $\Gamma(i)\Gamma(\overline{p}p)/\Gamma(\text{total})$

### $\Gamma(\eta_c\gamma) \times \Gamma(p\overline{p})/\Gamma_{\text{total}}$ — $\Gamma_4\Gamma_3/\Gamma$

| VALUE (eV) | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $12.0 \pm 4.5$ | 13 | [4] ANDREOTTI | 05B | E835 | $\overline{p}p \to \eta_c\gamma$ |

[4] Assuming $\Gamma = 1$ MeV.

## $h_c(1P)$ BRANCHING RATIOS

### $\Gamma(J/\psi(1S)\pi\pi)/\Gamma(J/\psi(1S)\pi^0)$ — $\Gamma_2/\Gamma_1$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| $<0.18$ | 90 | ARMSTRONG | 92D | E760 | $\overline{p}p \to J/\psi\pi^0$ |

### $\Gamma(\eta_c\gamma)/\Gamma_{\text{total}}$ — $\Gamma_4/\Gamma$

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| seen | 1282 | [5] DOBBS | 08A | CLEO | $\psi(2S) \to \pi^0\eta_c\gamma$ |
| **seen** | $168 \pm 40$ | [6] ROSNER | 05 | CLEO | $\psi(2S) \to \pi^0\eta_c\gamma$ |

[5] CLEO measures the product $B(\psi(2S) \to \pi^0 h_c) \times B(h_c \to \eta_c\gamma)$ to be $(4.19 \pm 0.32 \pm 0.45) \times 10^{-4}$ from the combination of exclusive and inclusive analyses.

[6] CLEO measures the product $B(\psi(2S) \to \pi^0 h_c) \times B(h_c \to \eta_c\gamma)$ to be $(4.0 \pm 0.8 \pm 0.7) \times 10^{-4}$.

# $h_c(1P)$ REFERENCES


| | | | | |
|---|---|---|---|---|
| DOBBS | 08A | PRL 101 182003 | S. Dobbs *et al.* | (CLEO Collab.) |
| ANDREOTTI | 05B | PR D72 032001 | M. Andreotti *et al.* | (FNAL E835 Collab.) |
| ROSNER | 05 | PRL 95 102003 | J.L. Rosner *et al.* | (CLEO Collab.) |
| AULCHENKO | 03 | PL B573 63 | V.M. Aulchenko *et al.* | (KEDR Collab.) |
| ANTONIAZZI | 94 | PR D50 4258 | L. Antoniazzi *et al.* | (E705 Collab.) |
| ARMSTRONG | 93B | PR D47 772 | T.A. Armstrong *et al.* | (FNAL E760 Collab.) |
| ARMSTRONG | 92D | PRL 69 2337 | T.A. Armstrong *et al.* | (FNAL, FERR, GENO+) |
| BAGLIN | 86 | PL B171 135 | C. Baglin *et al.* | (LAPP, CERN, TORI, STRB+) |


## OTHER RELATED PAPERS


| | | | | |
|---|---|---|---|---|
| FANG | 06 | PR D74 012007 | F. Fang *et al.* | (BELLE Collab.) |
| HAIDENBAU... | 06 | PR D74 017501 | J. Haidenbauer *et al.* | |
| SWANSON | 06 | PRPL 429 243 | E.S. Swanson | (PITT) |
| AUBERT | 05R | PR D71 071103R | B. Aubert *et al.* | (BABAR Collab.) |
| RUBIN | 05 | PR D72 092004 | P. Rubin *et al.* | (CLEO Collab.) |
| EICHTEN | 02 | PRL 89 162002 | E.J. Eichten, K. Lane, C. Quigg | |