

$D_{s1}(2536)^\pm$  $I(J^P) = 0(1^+)$   
 $J, P$  need confirmation.Seen in  $D^*(2010)^+ K^0$ ,  $D^*(2007)^0 K^+$ , and  $D_s^+ \pi^+ \pi^-$ . Not seen in  $D^+ K^0$  or  $D^0 K^+$ .  $J^P = 1^+$  assignment strongly favored. **$D_{s1}(2536)^\pm$  MASS**The fit includes  $D^\pm$ ,  $D^0$ ,  $D_s^\pm$ ,  $D^{*\pm}$ ,  $D^{*0}$ ,  $D_s^{*\pm}$ ,  $D_1(2420)^0$ ,  $D_2^*(2460)^0$ , and  $D_{s1}(2536)^\pm$  mass and mass difference measurements.

| VALUE (MeV)   | EVTS | DOCUMENT ID            | TECN     | COMMENT   |
|---|------|------------------------|----------|---|
| <b>2535.11 ± 0.06 OUR FIT</b>   |      |                        |          |   |
| <b>2535.21 ± 0.28 OUR AVERAGE</b>   |      |                        |          |   |
| 2537.7 ± 0.5 ± 3.1  | 24   | <sup>1</sup> ABLIKIM   | 19P BES3 | 4.6 $e^+ e^- \rightarrow D_s^+ \bar{D}^0 K^-$                   |
| 2535.7 ± 0.6 ± 0.5  | 46   | <sup>2</sup> ABAZOV    | 09G D0   | $B_s^0 \rightarrow D_{s1}^- \mu^+ \nu_\mu X$                    |
| 2534.78 ± 0.31 ± 0.40   | 182  | AUBERT                 | 08B BABR | $B \rightarrow \bar{D}^{(*)} D^* K$                             |
| 2534.6 ± 0.3 ± 0.7  | 193  | AUBERT                 | 06P BABR | 10.6 $e^+ e^- \rightarrow D_s^+ \pi^+ \pi^- X$                  |
| 2535.3 ± 0.7  | 92   | <sup>3</sup> HEISTER   | 02B ALEP | $e^+ e^- \rightarrow D^{*+} K^0 X$ ,<br>$D^{*0} K^+ X$          |
| 2534.2 ± 1.2  | 9    | ASRATYAN               | 94 BEBC  | $\nu N \rightarrow D^* K^0 X, D^{*0} K^\pm X$                   |
| 2535 ± 0.6 ± 1  | 75   | FRABETTI               | 94B E687 | $\gamma \text{Be} \rightarrow D^{*+} K^0 X$ ,<br>$D^{*0} K^+ X$ |
| 2535.2 ± 0.5 ± 1.5  | 28   | ALBRECHT               | 92R ARG  | 10.4 $e^+ e^- \rightarrow D^{*0} K^+ X$                         |
| 2536.6 ± 0.7 ± 0.4  |      | AVERY                  | 90 CLEO  | $e^+ e^- \rightarrow D^{*+} K^0 X$                              |
| 2535.9 ± 0.6 ± 2.0  |      | ALBRECHT               | 89E ARG  | $D_{s1}^* \rightarrow D^*(2010) K^0$                            |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |      |                        |          |   |
| 2534.1 ± 0.6  | 116  | <sup>4</sup> AUSHEV    | 11 BELL  | $B \rightarrow D_{s1}(2536)^+ D^{(*)}$                          |
| 2535.08 ± 0.01 ± 0.15   | 8038 | <sup>5</sup> LEES      | 11B BABR | 10.6 $e^+ e^- \rightarrow D^{*+} K_S^0 X$                       |
| 2535.57 <sup>+0.44</sup> <sub>-0.41</sub> ± 0.10                              | 236  | <sup>6</sup> CHEKANOV  | 09 ZEUS  | $e^\pm p \rightarrow D^{*+} K_S^0 X$ ,<br>$D^{*0} K^+ X$        |
| 2535.3 ± 0.2 ± 0.5  | 134  | <sup>7</sup> ALEXANDER | 93 CLE2  | $e^+ e^- \rightarrow D^{*0} K^+ X$                              |
| 2534.8 ± 0.6 ± 0.6  | 44   | <sup>8</sup> ALEXANDER | 93 CLE2  | $e^+ e^- \rightarrow D^{*+} K^0 X$                              |
| 2535 ± 28   |      | <sup>9</sup> ASRATYAN  | 88 HLBC  | $\nu N \rightarrow D_s \gamma \gamma X$                         |

<sup>1</sup> From a fit of the  $D_s^+$  recoil mass distribution with an incoherent sum of the  $S$ -wave and  $D$ -wave Breit-Wigner line shapes.<sup>2</sup> Using the  $D^*(2010)^\pm$  mass of  $2010.0 \pm 0.4$  MeV from PDG 06.<sup>3</sup> Calculated using  $m(D^*(2010)^\pm) = 2010.0 \pm 0.5$  MeV,  $m(D^*(2007)^0) = 2006.7 \pm 0.5$  MeV, and the mass difference below.<sup>4</sup> Systematic uncertainties not evaluated.<sup>5</sup> Calculated using the mass difference  $m(D_{s1}^+) - m(D^{*+})_{PDG}$  below and  $m(D^{*+})_{PDG} = 2010.25 \pm 0.14$  MeV. Assuming  $S$ -wave decay of the  $D_{s1}(2536)$  to  $D^{*+} K_S^0$ , using a Breit-Wigner line shape corresponding to  $L=0$ .

- <sup>6</sup> Calculated using the mass difference  $m(D_{S1}^+) - m(D^{*+})_{PDG}$  reported below and  $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$  MeV.  
<sup>7</sup> Calculated using  $m(D^*(2007)^0) = 2006.6 \pm 0.5$  MeV and the mass difference below.  
<sup>8</sup> Calculated using  $m(D^*(2010)^\pm) = 2010.1 \pm 0.6$  MeV and the mass difference below.  
<sup>9</sup> Not seen in  $D^* K$ .

### $m_{D_{S1}(2536)^\pm} - m_{D_s^*(2111)}$

The fit includes  $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$ , and  $D_{S1}(2536)^\pm$  mass and mass difference measurements.

| VALUE (MeV)                | DOCUMENT ID | TECN | COMMENT                  |
|----------------------------|-------------|------|--------------------------|
| <b>422.9 ± 0.4 OUR FIT</b> |             |      |                          |
| <b>424 ± 28</b>            | ASRATYAN    | 88   | HLBC $D_s^{*\pm} \gamma$ |

### $m_{D_{S1}(2536)^\pm} - m_{D^*(2010)^\pm}$

The fit includes  $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$ , and  $D_{S1}(2536)^\pm$  mass and mass difference measurements.

| VALUE (MeV)                        | EVTS     | DOCUMENT ID        | TECN | COMMENT  |
|------------------------------------|----------|--------------------|------|--|
| <b>524.85 ± 0.04 OUR FIT</b>       |          |                    |      |  |
| <b>524.84 ± 0.04 OUR AVERAGE</b>   |          |                    |      |  |
| 524.83 ± 0.01 ± 0.04               | 8038     | <sup>10</sup> LEES | 11B  | BABR $10.6 e^+ e^- \rightarrow D^{*+} K_S^0 X$               |
| 525.30 $^{+0.44}_{-0.41} \pm 0.10$ | 236 ± 30 | CHEKANOV           | 09   | ZEUS $e^\pm p \rightarrow D^{*+} K_S^0 X,$<br>$D^{*0} K^+ X$ |
| 525.3 ± 0.6 ± 0.1                  | 41       | HEISTER            | 02B  | ALEP $e^+ e^- \rightarrow D^{*+} K^0 X$                      |
| 524.7 ± 0.6 ± 0.2                  | 44       | ALEXANDER93        | CLE2 | $e^+ e^- \rightarrow D^{*+} K_S^0 X$                         |

<sup>10</sup> Assuming  $S$ -wave decay of the  $D_{S1}(2536)$  to  $D^{*+} K_S^0$ , using a Breit-Wigner line shape corresponding to  $L=0$ .

### $m_{D_{S1}(2536)^\pm} - m_{D^*(2007)^0}$

The fit includes  $D^\pm, D^0, D_s^\pm, D^{*\pm}, D^{*0}, D_s^{*\pm}, D_1(2420)^0, D_2^*(2460)^0$ , and  $D_{S1}(2536)^\pm$  mass and mass difference measurements.

| VALUE (MeV)                      | EVTS                                | DOCUMENT ID | TECN | COMMENT                                 |
|----------------------------------|-------------------------------------|-------------|------|---|
| <b>528.26 ± 0.05 OUR FIT</b>     | Error includes scale factor of 1.2. |             |      |   |
| <b>528.68 ± 0.28 OUR AVERAGE</b> |                                     |             |      |   |
| 528.7 ± 1.9 ± 0.5                | 51                                  | HEISTER     | 02B  | ALEP $e^+ e^- \rightarrow D^{*0} K^+ X$ |
| 527.3 ± 2.2                      | 29                                  | ACKERSTAFF  | 97W  | OPAL $e^+ e^- \rightarrow D^{*0} K^+ X$ |
| 528.7 ± 0.2 ± 0.2                | 134                                 | ALEXANDER   | 93   | CLE2 $e^+ e^- \rightarrow D^{*0} K^+ X$ |

### $D_{S1}(2536)^\pm$ WIDTH

| VALUE (MeV)                    | CL% EVTS | DOCUMENT ID           | TECN | COMMENT  |
|--------------------------------|----------|-----------------------|------|--|
| <b>0.92 ± 0.05 OUR AVERAGE</b> |          |                       |      |  |
| 1.7 ± 1.2 ± 0.6                | 24       | <sup>11</sup> ABLIKIM | 19P  | BES3 $4.6 e^+ e^- \rightarrow D_S^+ \bar{D}^0 K^-$ |
| 0.92 ± 0.03 ± 0.04             | 8038     | <sup>12</sup> LEES    | 11B  | BABR $10.6 e^+ e^- \rightarrow D^{*+} K_S^0 X$     |

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

|           |     |               |           |     |      |   |
|-----------|-----|---------------|-----------|-----|------|---|
| 0.75±0.23 | 116 | <sup>13</sup> | AUSHEV    | 11  | BELL | $B \rightarrow D_{s1}(2536)^+ D^{(*)}$                  |
| < 2.5     | 95  | 193           | AUBERT    | 06P | BABR | $10.6 e^+ e^- \rightarrow D_S^+ \pi^+ \pi^- X$          |
| < 3.2     | 90  | 75            | FRABETTI  | 94B | E687 | $\gamma Be \rightarrow D^{*+} K^0 X,$<br>$D^{*0} K^+ X$ |
| < 2.3     | 90  |               | ALEXANDER | 93  | CLEO | $e^+ e^- \rightarrow D^{*0} K^+ X$                      |
| < 3.9     | 90  |               | ALBRECHT  | 92R | ARG  | $10.4 e^+ e^- \rightarrow D^{*0} K^+ X$                 |
| < 5.44    | 90  |               | AVERY     | 90  | CLEO | $e^+ e^- \rightarrow D^{*+} K^0 X$                      |
| < 4.6     | 90  |               | ALBRECHT  | 89E | ARG  | $D_{s1}^* \rightarrow D^*(2010) K^0$                    |

<sup>11</sup> From a fit of the  $D_S^+$  recoil mass distribution with an incoherent sum of the S-wave and S-wave Breit-Wigner line shapes.

<sup>12</sup> Assuming S-wave decay of the  $D_{s1}(2536)$  to  $D^{*+} K_S^0$ , using a Breit-Wigner line shape corresponding to L=0.

<sup>13</sup> Systematic uncertainties not evaluated.

### $D_{s1}(2536)^+$ DECAY MODES

$D_{s1}(2536)^-$  modes are charge conjugates of the modes below.

| Mode                                    | Fraction ( $\Gamma_i/\Gamma$ ) | Confidence level |
|---|--------------------------------|------------------|
| $\Gamma_1$ $D^*(2010)^+ K^0$            | 0.85 ± 0.12                    |                  |
| $\Gamma_2$ $(D^*(2010)^+ K^0)_{S-wave}$ | 0.61 ± 0.09                    |                  |
| $\Gamma_3$ $(D^*(2010)^+ K^0)_{D-wave}$ |                                |                  |
| $\Gamma_4$ $D^+ \pi^- K^+$              | 0.028 ± 0.005                  |                  |
| $\Gamma_5$ $D^*(2007)^0 K^+$            | <b>DEFINED AS 1</b>            |                  |
| $\Gamma_6$ $D^+ K^0$                    | < 0.34                         | 90%              |
| $\Gamma_7$ $D^0 K^+$                    | < 0.12                         | 90%              |
| $\Gamma_8$ $D_S^{*+} \gamma$            | possibly seen                  |                  |
| $\Gamma_9$ $D_S^+ \pi^+ \pi^-$          | seen                           |                  |

### $D_{s1}(2536)^+$ BRANCHING RATIOS

| $\Gamma(D^*(2007)^0 K^+)/\Gamma(D^*(2010)^+ K^0)$ |          |                          |      |         |   | $\Gamma_5/\Gamma_1$ |
|---|----------|--------------------------|------|---------|---|---------------------|
| VALUE   | EVTS     | DOCUMENT ID              | TECN | COMMENT |   |                     |
| <b>1.18 ± 0.16 OUR AVERAGE</b>                    |          |                          |      |         |   |                     |
| 0.88 ± 0.24 ± 0.08                                | 116      | AUSHEV                   | 11   | BELL    | $B \rightarrow D_{s1}(2536)^+ D^{(*)}$                  |                     |
| 2.3 ± 0.6 ± 0.3                                   | 236 ± 30 | CHEKANOV                 | 09   | ZEUS    | $e^\pm p \rightarrow D^{*+} K_S^0 X,$<br>$D^{*0} K^+ X$ |                     |
| 1.32 ± 0.47 ± 0.23                                | 92       | <sup>14</sup> HEISTER    | 02B  | ALEP    | $e^+ e^- \rightarrow D^{*+} K^0 X,$<br>$D^{*0} K^+ X$   |                     |
| 1.9 <sup>+1.1</sup> / <sub>-0.9</sub> ± 0.4       | 35       | <sup>14</sup> ACKERSTAFF | 97W  | OPAL    | $e^+ e^- \rightarrow D^{*0} K^+ X,$<br>$D^{*+} K^0 X$   |                     |
| 1.1 ± 0.3   |          | ALEXANDER                | 93   | CLEO    | $e^+ e^- \rightarrow D^{*0} K^+ X, D^{*+} K^0 X$        |                     |
| 1.4 ± 0.3 ± 0.2                                   |          | <sup>15</sup> ALBRECHT   | 92R  | ARG     | $10.4 e^+ e^- \rightarrow D^{*0} K^+ X, D^{*+} K^0 X$   |                     |

<sup>14</sup> Ratio of the production rates measured in  $Z^0$  decays.

<sup>15</sup> Evaluated by us from published inclusive cross-sections.

$\Gamma((D^*(2010)^+ K^0)_{S\text{-wave}})/\Gamma(D^*(2010)^+ K^0)$   $\Gamma_2/\Gamma_1$

| VALUE                 | EVTS | DOCUMENT ID | TECN | COMMENT                                    |
|-----------------------|------|-------------|------|--|
| <b>0.72±0.05±0.01</b> | 5485 | BALAGURA    | 08   | BELL 10.6 $e^+e^- \rightarrow D^{*+}K^0 X$ |

$\Gamma(D^+ \pi^- K^+)/\Gamma(D^*(2010)^+ K^0)$   $\Gamma_4/\Gamma_1$

| VALUE (units $10^{-2}$ ) | EVTS | DOCUMENT ID | TECN | COMMENT  |
|--------------------------|------|-------------|------|--|
| <b>3.27±0.18±0.37</b>    | 1264 | BALAGURA    | 08   | BELL 10.6 $e^+e^- \rightarrow D^+ \pi^- K^+ X$ |

$\Gamma(D^+ K^0)/\Gamma(D^*(2010)^+ K^0)$   $\Gamma_6/\Gamma_1$

| VALUE   | CL% | DOCUMENT ID | TECN | COMMENT                                 |
|---|-----|-------------|------|---|
| <b>&lt;0.40</b>   | 90  | ALEXANDER   | 93   | CLEO $e^+e^- \rightarrow D^{*+}K^0 X$   |
| ● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ● |     |             |      |   |
| <0.43   | 90  | ALBRECHT    | 89E  | ARG $D_{s1}^+ \rightarrow D^*(2010)K^0$ |

$\Gamma(D^0 K^+)/\Gamma(D^*(2007)^0 K^+)$   $\Gamma_7/\Gamma_5$

| VALUE           | CL% | DOCUMENT ID | TECN | COMMENT                               |
|-----------------|-----|-------------|------|---------------------------------------|
| <b>&lt;0.12</b> | 90  | ALEXANDER   | 93   | CLEO $e^+e^- \rightarrow D^{*0}K^+ X$ |

$\Gamma(D_s^{*+} \gamma)/\Gamma_{\text{total}}$   $\Gamma_8/\Gamma$

| VALUE                | DOCUMENT ID | TECN | COMMENT                                      |
|----------------------|-------------|------|--|
| <b>possibly seen</b> | ASRATYAN    | 88   | HLBC $\nu N \rightarrow D_s \gamma \gamma X$ |

$\Gamma(D_s^{*+} \gamma)/\Gamma(D^*(2007)^0 K^+)$   $\Gamma_8/\Gamma_5$

| VALUE           | CL% | DOCUMENT ID | TECN | COMMENT                               |
|-----------------|-----|-------------|------|---------------------------------------|
| <b>&lt;0.42</b> | 90  | ALEXANDER   | 93   | CLEO $e^+e^- \rightarrow D^{*0}K^+ X$ |

$\Gamma(D_s^+ \pi^+ \pi^-)/\Gamma_{\text{total}}$   $\Gamma_9/\Gamma$

| VALUE       | DOCUMENT ID | TECN | COMMENT  |
|-------------|-------------|------|--|
| <b>seen</b> | AUBERT      | 06P  | BABR 10.6 $e^+e^- \rightarrow D_s^+ \pi^+ \pi^- X$ |

**$D_{s1}(2536)^\pm$  REFERENCES**

|            |     |                |                             |                     |
|------------|-----|----------------|-----------------------------|---------------------|
| ABLIKIM    | 19P | CP C43 031001  | M. Ablikim <i>et al.</i>    | (BESIII Collab.)    |
| AUSHEV     | 11  | PR D83 051102  | T. Aushev <i>et al.</i>     | (BELLE Collab.)     |
| LEES       | 11B | PR D83 072003  | J.P. Lees <i>et al.</i>     | (BABAR Collab.)     |
| ABAZOV     | 09G | PRL 102 051801 | V.M. Abazov <i>et al.</i>   | (D0 Collab.)        |
| CHEKANOV   | 09  | EPJ C60 25     | S. Chekanov <i>et al.</i>   | (ZEUS Collab.)      |
| AUBERT     | 08B | PR D77 011102  | B. Aubert <i>et al.</i>     | (BABAR Collab.)     |
| BALAGURA   | 08  | PR D77 032001  | V. Balagura <i>et al.</i>   | (BELLE Collab.)     |
| AUBERT     | 06P | PR D74 032007  | B. Aubert <i>et al.</i>     | (BABAR Collab.)     |
| PDG        | 06  | JP G33 1       | W.-M. Yao <i>et al.</i>     | (PDG Collab.)       |
| HEISTER    | 02B | PL B526 34     | A. Heister <i>et al.</i>    | (ALEPH Collab.)     |
| ACKERSTAFF | 97W | ZPHY C76 425   | K. Ackerstaff <i>et al.</i> | (OPAL Collab.)      |
| ASRATYAN   | 94  | ZPHY C61 563   | A.E. Asratyan <i>et al.</i> | (BIRM, BELG, CERN+) |
| FRABETTI   | 94B | PRL 72 324     | P.L. Frabetti <i>et al.</i> | (FNAL E687 Collab.) |
| ALEXANDER  | 93  | PL B303 377    | J. Alexander <i>et al.</i>  | (CLEO Collab.)      |
| ALBRECHT   | 92R | PL B297 425    | H. Albrecht <i>et al.</i>   | (ARGUS Collab.)     |
| AVERY      | 90  | PR D41 774     | P. Avery, D. Besson         | (CLEO Collab.)      |
| ALBRECHT   | 89E | PL B230 162    | H. Albrecht <i>et al.</i>   | (ARGUS Collab.)     |
| ASRATYAN   | 88  | ZPHY C40 483   | A.E. Asratyan <i>et al.</i> | (ITEP, SERP)        |