

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

$I(J^P) = 0(1^+)$
 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 |
|-------------------------------------------------------------------------------|------|------------------------|----------|----------------------------------------------------|
| 2535.11 ± 0.06 OUR FIT | | | | |
| 2535.21 ± 0.28 OUR AVERAGE | | | | |
| 2537.7 ± 0.5 ± 3.1 | 24 | ¹ ABLIKIM | 19P BES3 | 4.6 $e^+ e^- \rightarrow D_s^+ \bar{D}^0 K^-$ |
| 2535.7 ± 0.6 ± 0.5 | 46 | ² 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 | ³ HEISTER | 02B ALEP | $e^+ e^- \rightarrow D^{*+} K^0 X, D^{*0} K^+ X$ |
| 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 | $\gamma Be \rightarrow D^{*+} K^0 X, D^{*0} K^+ X$ |
| 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 | ⁴ AUSHEV | 11 BELL | $B \rightarrow D_{s1}(2536)^+ D^{(*)}$ |
| 2535.08 ± 0.01 ± 0.15 | 8038 | ⁵ LEES | 11B BABR | 10.6 $e^+ e^- \rightarrow D^{*+} K_S^0 X$ |
| 2535.57 ^{+0.44} _{-0.41} ± 0.10 | 236 | ⁶ CHEKANOV | 09 ZEUS | $e^\pm p \rightarrow D^{*+} K_S^0 X, D^{*0} K^+ X$ |
| 2535.3 ± 0.2 ± 0.5 | 134 | ⁷ ALEXANDER | 93 CLE2 | $e^+ e^- \rightarrow D^{*0} K^+ X$ |
| 2534.8 ± 0.6 ± 0.6 | 44 | ⁸ ALEXANDER | 93 CLE2 | $e^+ e^- \rightarrow D^{*+} K^0 X$ |
| 2535 ± 28 | | ⁹ ASRATYAN | 88 HLBC | $\nu N \rightarrow D_s \gamma \gamma X$ |

¹ 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.

² Using the $D^*(2010)^\pm$ mass of 2010.0 ± 0.4 MeV from PDG 06.

³ 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.

⁴ Systematic uncertainties not evaluated.

⁵ 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 $L=0$.

- ⁶ Calculated using the mass difference $m(D_{s1}^+) - m(D^{*+})_{PDG}$ reported below and $m(D^{*+})_{PDG} = 2010.27 \pm 0.17$ MeV.
⁷ Calculated using $m(D^*(2007)^0) = 2006.6 \pm 0.5$ MeV and the mass difference below.
⁸ Calculated using $m(D^*(2010)^\pm) = 2010.1 \pm 0.6$ MeV and the mass difference below.
⁹ 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 |
|----------------------------|-------------|------|--------------------------|
| 422.9 ± 0.4 OUR FIT | | | |
| 424 ± 28 | 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 |
|------------------------------------|----------|--------------------|------|--------------------------------------------------------------|
| 524.85 ± 0.04 OUR FIT | | | | |
| 524.84 ± 0.04 OUR AVERAGE | | | | |
| 524.83 ± 0.01 ± 0.04 | 8038 | ¹⁰ 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 $e^\pm p \rightarrow D^{*+} K_S^0 X,$ $D^{*0} K^+ X$ |
| 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 | $e^+ e^- \rightarrow D^{*+} K_S^0 X$ |

¹⁰ 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 |
|----------------------------------|-------------------------------------|-------------|------|-----------------------------------------|
| 528.26 ± 0.05 OUR FIT | Error includes scale factor of 1.1. | | | |
| 528.68 ± 0.28 OUR AVERAGE | | | | |
| 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 |
|--------------------------------|----------|-----------------------|------|----------------------------------------------------|
| 0.92 ± 0.05 OUR AVERAGE | | | | |
| 1.7 ± 1.2 ± 0.6 | 24 | ¹¹ ABLIKIM | 19P | BES3 $4.6 e^+ e^- \rightarrow D_s^+ \bar{D}^0 K^-$ |
| 0.92 ± 0.03 ± 0.04 | 8038 | ¹² 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 | ¹³ | 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 | $\gamma Be \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$ |
| < 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 | $D_{s1}^* \rightarrow D^*(2010) K^0$ |

¹¹ 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.

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

¹³ Systematic uncertainties not evaluated.

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

Branching fractions are given relative to the one **DEFINED AS 1**.

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

| Mode | Fraction (Γ_i/Γ) | Confidence level |
|-----------------------------------------|--------------------------------|------------------|
| Γ_1 $D^*(2010)^+ K^0$ | 0.85 ± 0.12 | |
| Γ_2 $(D^*(2010)^+ K^0)_{S-wave}$ | 0.61 ± 0.09 | |
| Γ_3 $(D^*(2010)^+ K^0)_{D-wave}$ | | |
| Γ_4 $K_S^0 D^*(2010)^+$ | 0.48 ± 0.07 | |
| Γ_5 $D^+ \pi^- K^+$ | 0.028 ± 0.005 | |
| Γ_6 $D^*(2007)^0 K^+$ | DEFINED AS 1 | |
| Γ_7 $D^+ K^0$ | < 0.34 | 90% |
| Γ_8 $D^0 K^+$ | < 0.12 | 90% |
| Γ_9 $D_S^{*+} \gamma$ | possibly seen | |
| Γ_{10} $D_S^+ \pi^+ \pi^-$ | seen | |

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

| $\Gamma(D^*(2007)^0 K^+)/\Gamma(D^*(2010)^+ K^0)$ | | | | | | Γ_6/Γ_1 |
|---------------------------------------------------|----------|-----------------------|------|---------|---------------------------------------------------------|---------------------|
| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT | | |
| 1.18 ± 0.16 OUR AVERAGE | | | | | | |
| 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 | $e^\pm p \rightarrow D^{*+} K_S^0 X,$ $D^{*0} K^+ X$ | |
| 1.32 ± 0.47 ± 0.23 | 92 | ¹⁴ HEISTER | 02B | ALEP | $e^+ e^- \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$ | |

| | | | | | |
|------------------------------|----|--------------------------|-----|------|------------------------------------------------------------|
| 1.9 $^{+1.1}_{-0.9} \pm 0.4$ | 35 | ¹⁴ ACKERSTAFF | 97W | OPAL | $e^+ e^- \rightarrow D^{*0} K^+ X,$ $D^{*+} K^0 X$ |
| 1.1 ± 0.3 | | ALEXANDER | 93 | CLEO | $e^+ e^- \rightarrow$ $D^{*0} K^+ X, D^{*+} K^0 X$ |
| 1.4 $\pm 0.3 \pm 0.2$ | 15 | ALBRECHT | 92R | ARG | 10.4 $e^+ e^- \rightarrow$ $D^{*0} K^+ X, D^{*+} K^0 X$ |

¹⁴ Ratio of the production rates measured in Z^0 decays.

¹⁵ Evaluated by us from published inclusive cross-sections.

$\Gamma(K_S^0 D^*(2010)^+)/\Gamma(D^*(2007)^0 K^+)$ Γ_4/Γ_6

| VALUE | DOCUMENT ID | TECN | COMMENT |
|-----------------------------------------------------|-------------|------|-----------------------------|
| 0.48\pm0.07\pm0.02 | GAO | 23 | BELL $e^+ e^-$ at 10.52 GeV |

$\Gamma((D^*(2010)^+ K^0)_{S-wave})/\Gamma(D^*(2010)^+ K^0)$ Γ_2/Γ_1

| VALUE | EVTS | DOCUMENT ID | TECN | COMMENT |
|-----------------------------------------------------|------|-------------|------|----------------------------------------------|
| 0.72\pm0.05\pm0.01 | 5485 | BALAGURA | 08 | BELL 10.6 $e^+ e^- \rightarrow D^{*+} K^0 X$ |

$\Gamma(D^+ \pi^- K^+)/\Gamma(D^*(2010)^+ K^0)$ Γ_5/Γ_1

| VALUE (units 10^{-2}) | EVTS | DOCUMENT ID | TECN | COMMENT |
|-----------------------------------------------------|------|-------------|------|-------------------------------------------------|
| 3.27\pm0.18\pm0.37 | 1264 | BALAGURA | 08 | BELL 10.6 $e^+ e^- \rightarrow D^+ \pi^- K^+ X$ |

$\Gamma(D^+ K^0)/\Gamma(D^*(2010)^+ K^0)$ Γ_7/Γ_1

| VALUE | CL% | DOCUMENT ID | TECN | COMMENT |
|-----------------|-----|-------------|------|-----------------------------------------|
| <0.40 | 90 | ALEXANDER | 93 | CLEO $e^+ e^- \rightarrow D^{*+} K^0 X$ |

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

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|-------|----|----------|-----|------------------------------------------|
| <0.43 | 90 | ALBRECHT | 89E | ARG $D_{s1}^* \rightarrow D^*(2010) K^0$ |
|-------|----|----------|-----|------------------------------------------|

$\Gamma(D^0 K^+)/\Gamma(D^*(2007)^0 K^+)$ Γ_8/Γ_6

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

$\Gamma(D_s^{*+} \gamma)/\Gamma_{total}$ Γ_9/Γ

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

$\Gamma(D_s^{*+} \gamma)/\Gamma(D^*(2007)^0 K^+)$ Γ_9/Γ_6

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

$\Gamma(D_s^+ \pi^+ \pi^-)/\Gamma_{total}$ Γ_{10}/Γ

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

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

| | | | | |
|------------|-----|----------------|-----------------------------|---------------------|
| GAO | 23 | PR D108 112015 | B.S. Gao <i>et al.</i> | (BELLE Collab.) |
| 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) |
