

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

$I(J^P) = 0(1^+)$   
 $J, P$  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	$e^+ e^- \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
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	$\gamma \text{Be} \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
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	$e^\pm p \rightarrow D^{*+} K_S^0 X,$ $D^{*0} K^+ X$
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 <sup>+0.44</sup> <sub>-0.41</sub> ± 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	$e^+ e^- \rightarrow D^{*+} K_S^0 X$

<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	$\gamma Be \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
< 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	$e^\pm p \rightarrow D^{*+} K_S^0 X,$ $D^{*0} K^+ X$	
1.32±0.47±0.23	92	<sup>14</sup> HEISTER	02B	ALEP	$e^+ e^- \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$	
1.9 <sup>+1.1</sup> / <sub>-0.9</sub> ± 0.4	35	<sup>14</sup> ACKERSTAFF	97W	OPAL	$e^+ e^- \rightarrow D^{*0} K^+ X,$ $D^{*+} K^0 X$	
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>	(BES III 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)