

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

$$I(J^P) = 0(1^+)^{\pm}$$

 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	$\nu N \rightarrow D^{*+} K^0 X, D^{*0} K^+ X$
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	$10.4 e^+ e^- \rightarrow D^{*+} K^0 X$, $D^{*0} K^+ X$
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	$\gamma \text{Be} \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
< 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 $D^*(2010)^+ K^0$	$(31 \pm 7) \%$	
Γ_2 $(D^*(2010)^+ K^0)_{S\text{-wave}}$	$(22 \pm 5) \%$	
Γ_3 $(D^*(2010)^+ K^0)_{D\text{-wave}}$		
Γ_4 $K_S^0 D^*(2010)^+$	$(17 \pm 4) \%$	
Γ_5 $D^+ \pi^- K^+$	$(10.0 \pm 2.5) \times 10^{-3}$	
Γ_6 $D^*(2007)^0 K^+$	$(36 \pm 6) \%$	
Γ_7 $D^+ K^0$	$< 12 \%$	90%
Γ_8 $D^0 K^+$	$< 4 \%$	90%
Γ_9 $D_s^{*+} \gamma$	possibly seen	
Γ_{10} $D_s^+ \pi^+ \pi^-$	seen	

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

$\Gamma((D^*(2010)^+ K^0)_{S\text{-wave}})/\Gamma(D^*(2010)^+ K^0)$					Γ_2/Γ_1
VALUE	EVTS	DOCUMENT ID	TECN	COMMENT	
$0.72 \pm 0.05 \pm 0.01$	5485	BALAGURA	08	BELL	$10.6 e^+ e^- \rightarrow D^{*+} K^0 X$

$\Gamma(K_S^0 D^*(2010)^+)/\Gamma(D^*(2007)^0 K^+)$					Γ_4/Γ_6
VALUE	DOCUMENT ID	TECN	COMMENT		
$0.48 \pm 0.07 \pm 0.02$	GAO	23	BELL	$e^+ e^-$ at 10.52 GeV	

$\Gamma(D^+ \pi^- K^+)/\Gamma(D^*(2010)^+ K^0)$					Γ_5/Γ_1
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT	
$3.27 \pm 0.18 \pm 0.37$	1264	BALAGURA	08	BELL	$10.6 e^+ e^- \rightarrow D^+ \pi^- K^+ X$

$\Gamma(D^*(2007)^0 K^+)/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE (%)		DOCUMENT ID	TECN	COMMENT
35.9±4.8±3.5	14	ABLIKIM	24BN BES3	$e^+ e^- \rightarrow D_s^+ D_{s1}(2536)^-$

¹⁴ Determined as ratio of exclusive $e^+ e^- \rightarrow D_s^+ [\bar{D}^{*0} K^-]$ and inclusive $e^+ e^- \rightarrow D_s^+ X$ measurements.

 $\Gamma(D^*(2007)^0 K^+)/\Gamma(D^*(2010)^+ K^0)$ Γ_6/Γ_1

VALUE	EVS	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	¹⁵ HEISTER	02B ALEP	$e^+ e^- \rightarrow D^{*+} K^0 X,$ $D^{*0} K^+ X$
1.9 ^{+1.1} _{-0.9} ±0.4	35	¹⁵ 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		¹⁶ ALBRECHT	92R ARG	10.4 $e^+ e^- \rightarrow$ $D^{*0} K^+ X, D^{*+} K^0 X$

¹⁵ Ratio of the production rates measured in Z^0 decays.

¹⁶ Evaluated by us from published inclusive cross-sections.

 $\Gamma(D^+ K^0)/\Gamma(D^*(2010)^+ K^0)$ 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. • • •				
<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	$e^+ e^- \rightarrow D^{*0} K^+ X$

 $\Gamma(D_s^{*+} \gamma)/\Gamma_{\text{total}}$ 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	$e^+ e^- \rightarrow D^{*0} K^+ X$

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

ABLIKIM	24BN	PRL 133 171903	M. Ablikim <i>et al.</i>	(BESIII Collab.)
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)
