CHARMED, STRANGE MESONS ($C = S = \pm 1$)

$D_s^+ = c\overline{s}$, $D_s^- = \overline{c}s$, similarly for D_s^*'s

$D_s^\pm$ was $F^\pm$

$I(J^P) = 0(0^-)$

Mass $m = 1968.2 \pm 0.5$ MeV (S = 1.1)
$m_{D_s^\pm} - m_{D^\pm} = 98.85 \pm 0.30$ MeV (S = 1.4)
Mean life $\tau = (500 \pm 7) \times 10^{-15}$ s (S = 1.3)
$c\tau = 149.9$ μm

T-violation decay-rate asymmetry

$A_T(K_S^0 K^\pm \pi^+ \pi^-) = -0.04 \pm 0.07$

D_s^+ form factors

$r_2 = 1.32 \pm 0.24$ (S = 1.2)
$r_v = 1.72 \pm 0.21$
$\Gamma_L/\Gamma_T = 0.72 \pm 0.18$

Unless otherwise noted, the branching fractions for modes with a resonance in the final state include all the decay modes of the resonance. D_s^- modes are charge conjugates of the modes below.

D_s^+ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Inclusive modes			
K^- anything	(13 $^{+14}_{-12}$) %		–
$\overline{K}^0$ anything + K^0 anything	(39 ± 28) %		–
K^+ anything	(20 $^{+18}_{-14}$) %		–
(non-K $\overline{K}$) anything	(64 ± 17) %		–
e^+ anything	(8 $^{+\ 6}_{-\ 5}$) %		–
ϕ anything	(18 $^{+15}_{-10}$) %		–

Leptonic and semileptonic modes

$\mu^+\nu_\mu$		(6.1 ± 1.9) × 10^{-3}	S=1.4	981
$\tau^+\nu_\tau$		(6.4 ± 1.5) %		182
$\phi\ell^+\nu_\ell$	[a]	(2.4 ± 0.4) %	S=1.1	720
$\eta\ell^+\nu_\ell$ + $\eta'(958)\ell^+\nu_\ell$	[a]	(4.2 ± 0.8) %		–
$\eta\ell^+\nu_\ell$	[a]	(3.1 ± 0.6) %		908
$\eta'(958)\ell^+\nu_\ell$	[a]	(1.08± 0.35) %		751

Hadronic modes with a $K\overline{K}$ pair

$K^+\overline{K}^0$		(4.4 ± 0.9) %		850
$K^+K^-\pi^+$	[b]	(5.2 ± 0.9) %	S=1.1	805
$\phi\pi^+$	[c]	(4.4 ± 0.6) %	S=1.1	711
$\phi\pi^+$, $\phi\to K^+K^-$		(2.16± 0.28) %	S=1.1	712
$K^+\overline{K}^*(892)^0$, $\overline{K}^{*0}\to K^-\pi^+$		(2.5 ± 0.5) %		416
$f_0(980)\pi^+$, $f_0\to K^+K^-$		(5.7 ± 2.5) × 10^{-3}		732
$K^+\overline{K}_0^*(1430)^0$, $\overline{K}_0^*\to K^-\pi^+$		(4.8 ± 2.5) × 10^{-3}		218
$K^0\overline{K}^0\pi^+$		—		802
$K^*(892)^+\overline{K}^0$	[c]	(5.3 ± 1.3) %		683
$K^+K^-\pi^+\pi^0$		—		748
$\phi\pi^+\pi^0$	[c]	(11 ± 5) %		686
$\phi\rho^+$	[c]	(8.2 $^{+\ 2.0}_{-\ 2.4}$) %		401
$\phi\pi^+\pi^0$ 3-body	[c]	< 3.1 %	CL=90%	686
$K^+K^-\pi^+\pi^0$ non-ϕ		< 11 %	CL=90%	748
$K^+\overline{K}^0\pi^+\pi^-$		(3.1 ± 0.9) %		744
$K^0K^-\pi^+\pi^+$		(5.3 ± 1.4) %		744
$K^*(892)^+\overline{K}^*(892)^0$	[c]	(7.0 ± 2.7) %		416
$K^0K^-\pi^+\pi^+$ (non-$K^{*+}\overline{K}^{*0}$)		< 3.5 %	CL=90%	744
$K^+K^-\pi^+\pi^+\pi^-$		(8.3 ± 2.0) × 10^{-3}		673
$\phi\pi^+\pi^+\pi^-$	[c]	(1.18± 0.20) %		640
$K^+K^-\rho^0\pi^+$ non-ϕ		< 2.5 × 10^{-4}	CL=90%	248
$\phi\rho^0\pi^+$	[c]	(1.24± 0.33) %		181
$\phi a_1(1260)^+$	[c]	(2.9 ± 0.7) %		†
$K^+K^-\pi^+\pi^+\pi^-$ nonresonant		(8 ± 7) × 10^{-4}		673
$K_S^0K_S^0\pi^+\pi^+\pi^-$		(2.7 ± 1.3) × 10^{-3}		669

Hadronic modes without K's

$\pi^+\pi^+\pi^-$		(1.22± 0.23) %	S=1.2	959
$\pi^+(\pi^+\pi^-)_{S-\text{wave}}$	[d]	(1.06± 0.22) %		959
$f_2(1270)\pi^+$, $f_2\to\pi^+\pi^-$		(1.2 ± 0.7) × 10^{-3}		559
$\rho(1450)^0\pi^+$, $\rho^0\to\pi^+\pi^-$		(8 ± 7) × 10^{-4}		421
$\pi^+\pi^+\pi^-\pi^0$		< 15 %	CL=90%	935
$\eta\pi^+$	[c]	(2.11± 0.35) %		902
$\omega\pi^+$	[c]	(3.4 ± 1.2) × 10^{-3}		822

$3\pi^+2\pi^-$		(7.6 ± 1.6) $\times 10^{-3}$			899
$\pi^+\pi^+\pi^-\pi^0\pi^0$		—			902
$\eta\rho^+$	[c]	(13.1 ± 2.6) %			724
$\eta\pi^+\pi^0$ 3-body	[c]	< 5	%	CL=90%	885
$3\pi^+2\pi^-\pi^0$		(4.9 ± 3.2) %			856
$\eta'(958)\pi^+$	[c]	(4.7 ± 0.7) %			743
$3\pi^+2\pi^-2\pi^0$		—			803
$\eta'(958)\rho^+$	[c]	(12.2 ± 2.4) %			464
$\eta'(958)\pi^+\pi^0$ 3-body	[c]	< 1.8	%	CL=90%	720
Modes with one or three K's					
$K^0\pi^+$		< 9	$\times 10^{-3}$	CL=90%	916
$K^+\pi^+\pi^-$		(6.6 ± 1.4) $\times 10^{-3}$			900
$K^+\rho^0$		(2.6 ± 0.7) $\times 10^{-3}$			744
$K^+\rho(1450)^0$, $\rho^0 \to \pi^+\pi^-$		(7.0 ± 2.9) $\times 10^{-4}$			–
$K^*(892)^0\pi^+$, $K^{*0} \to K^+\pi^-$		(1.4 ± 0.4) $\times 10^{-3}$			775
$K^*(1410)^0\pi^+$, $K^{*0} \to K^+\pi^-$		(1.2 ± 0.4) $\times 10^{-3}$			–
$K^*(1430)^0\pi^+$, $K^{*0} \to K^+\pi^-$		(5 ± 4) $\times 10^{-4}$			–
$K^+\pi^+\pi^-$ nonresonant		(1.0 ± 0.4) $\times 10^{-3}$			900
$K^+K^+K^-$		(4.6 ± 1.8) $\times 10^{-4}$			627
ϕK^+	[c]	< 6	$\times 10^{-4}$	CL=90%	606
Doubly Cabibbo-suppressed modes					
$K^+K^+\pi^-$		(2.7 ± 1.2) $\times 10^{-4}$			805
$\Delta C = 1$ weak neutral current ($C1$) modes, Lepton family number (LF), or Lepton number (L) violating modes					
$\pi^+e^+e^-$		[e] < 2.7	$\times 10^{-4}$	CL=90%	979
$\pi^+\mu^+\mu^-$		[e] < 2.6	$\times 10^{-5}$	CL=90%	968
$K^+e^+e^-$	$C1$	< 1.6	$\times 10^{-3}$	CL=90%	922
$K^+\mu^+\mu^-$	$C1$	< 3.6	$\times 10^{-5}$	CL=90%	909
$K^*(892)^+\mu^+\mu^-$	$C1$	< 1.4	$\times 10^{-3}$	CL=90%	765
$\pi^+e^\pm\mu^\mp$	LF	[f] < 6.1	$\times 10^{-4}$	CL=90%	976
$K^+e^\pm\mu^\mp$	LF	[f] < 6.3	$\times 10^{-4}$	CL=90%	919
$\pi^-e^+e^+$	L	< 6.9	$\times 10^{-4}$	CL=90%	979
$\pi^-\mu^+\mu^+$	L	< 2.9	$\times 10^{-5}$	CL=90%	968
$\pi^-e^+\mu^+$	L	< 7.3	$\times 10^{-4}$	CL=90%	976
$K^-e^+e^+$	L	< 6.3	$\times 10^{-4}$	CL=90%	922
$K^-\mu^+\mu^+$	L	< 1.3	$\times 10^{-5}$	CL=90%	909
$K^-e^+\mu^+$	L	< 6.8	$\times 10^{-4}$	CL=90%	919
$K^*(892)^-\mu^+\mu^+$	L	< 1.4	$\times 10^{-3}$	CL=90%	765

$D_s^{*\pm}$

$I(J^P) = 0(?^?)$

J^P is natural, width and decay modes consistent with 1^-.

Mass $m = 2112.0 \pm 0.6$ MeV (S = 1.1)
$m_{D_s^{*\pm}} - m_{D_s^{\pm}} = 143.8 \pm 0.4$ MeV
Full width $\Gamma < 1.9$ MeV, CL = 90%

D_s^{*-} modes are charge conjugates of the modes below.

D_s^{*+} DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D_s^+\gamma$	(94.2±0.7) %	139
$D_s^+\pi^0$	(5.8±0.7) %	48

$D_{s0}^*(2317)^{\pm}$

$I(J^P) = 0(0^+)$
J, P need confirmation.

J^P is natural, low mass consistent with 0^+.

Mass $m = 2317.3 \pm 0.6$ MeV
$m_{D_{s0}^*(2317)^{\pm}} - m_{D_s^{\pm}} = 349.1 \pm 0.6$ MeV
Full width $\Gamma < 4.6$ MeV, CL = 90%

$D_{s1}(2460)^{\pm}$

$I(J^P) = 0(1^+)$

Mass $m = 2458.9 \pm 0.9$ MeV (S = 1.1)
$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{*\pm}} = 346.9 \pm 1.0$ MeV (S = 1.2)
$m_{D_{s1}(2460)^{\pm}} - m_{D_s^{\pm}} = 490.7 \pm 0.9$ MeV (S = 1.2)
Full width $\Gamma < 5.5$ MeV, CL = 90%

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

$I(J^P) = 0(1^+)$
J, P need confirmation.

Mass $m = 2535.35 \pm 0.34 \pm 0.5$ MeV
Full width $\Gamma < 2.3$ MeV, CL = 90%

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

$D_{s1}(2536)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^*(2010)^+ K^0$	seen	150
$D^*(2007)^0 K^+$	seen	168
$D^+ K^0$	not seen	382
$D^0 K^+$	not seen	392
$D_s^{*+}\gamma$	possibly seen	388

$D_{s2}(2573)^{\pm}$

$I(J^P) = 0(?^?)$

J^P is natural, width and decay modes consistent with 2^+.

Mass $m = 2573.5 \pm 1.7$ MeV
Full width $\Gamma = 15^{+5}_{-4}$ MeV

$D_{s2}(2573)^-$ modes are charge conjugates of the modes below.

$D_{s2}(2573)^+$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$D^0 K^+$	seen	436
$D^*(2007)^0 K^+$	not seen	246

NOTES

[a] For now, we average together measurements of the $X e^+ \nu_e$ and $X \mu^+ \nu_\mu$ branching fractions. This is the *average*, not the *sum*.

[b] The branching fraction for this mode may differ from the sum of the submodes that contribute to it, due to interference effects. See the relevant papers in the Particle Listings.

[c] This branching fraction includes all the decay modes of the final-state resonance.

[d] This comes from a K-matrix parametrization of the $\pi^+\pi^-$ S-wave and is a sum over the $f_0(980)$, $f_0(1300)$, $f_0(1200$–$1600)$, $f_0(1500)$, and $f_0(1750)$. Not all of these correspond to particles in our Tables.

[e] This mode is not a useful test for a ΔC=1 weak neutral current because both quarks must change flavor in this decay.

[f] The value is for the sum of the charge states or particle/antiparticle states indicated.