CHARMED, STRANGE MESONS ($C = S = \pm1$)

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

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

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

Mass $m = 1968.3 \pm 0.5$ MeV (S = 1.2)
$m_{D_s^\pm} - m_{D^\pm} = 98.87 \pm 0.31$ MeV (S = 1.4)
Mean life $\tau = (490 \pm 9) \times 10^{-15}$ s (S = 1.1)
$c\tau = 147.0$ μm

D_s^+ form factors

$r_2 = 1.60 \pm 0.24$
$r_v = 1.92 \pm 0.32$
$\Gamma_L/\Gamma_T = 0.72 \pm 0.18$

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				
$\mu^+\nu_\mu$		$(5.0 \pm 1.9) \times 10^{-3}$	S=1.3	981
$\tau^+\nu_\tau$		(6.4 ± 1.5) %		182
$\phi\ell^+\nu_\ell$	[a]	(2.0 ± 0.5) %		720
$\eta\ell^+\nu_\ell$ + $\eta'(958)\ell^+\nu_\ell$	[a]	(3.4 ± 1.0) %		–
$\eta\ell^+\nu_\ell$	[a]	(2.5 ± 0.7) %		908
$\eta'(958)\ell^+\nu_\ell$	[a]	$(8.9 \pm 3.3) \times 10^{-3}$		751

Hadronic modes with a $K\overline{K}$ pair (including from a ϕ)

$K^+\overline{K}^0$		$(3.6 \pm 1.1)\%$		850
$K^+K^-\pi^+$	[b]	$(4.4 \pm 1.2)\%$		805
$\phi\pi^+$	[c]	$(3.6 \pm 0.9)\%$		712
$K^+\overline{K}^*(892)^0$	[c]	$(3.3 \pm 0.9)\%$		685
$f_0(980)\pi^+ \times B(f_0 \to K^+K^-)$	[d]	$(4.9 \pm 2.3) \times 10^{-3}$		732
$K^+\overline{K}^*_0(1430)^0$	[c]	$(7 \pm 4) \times 10^{-3}$		218
$K^+K^-\pi^+$ nonresonant		$(9 \pm 4) \times 10^{-3}$		805
$K^0\overline{K}^0\pi^+$		—		802
$K^*(892)^+\overline{K}^0$	[c]	$(4.3 \pm 1.4)\%$		683
$K^+K^-\pi^+\pi^0$		—		748
$\phi\pi^+\pi^0$	[c]	$(9 \pm 5)\%$		686
$\phi\rho^+$	[c]	$(6.7 \pm 2.3)\%$		400
$\phi\pi^+\pi^0$ 3-body	[c]	$< 2.6\%$	CL=90%	686
$K^+K^-\pi^+\pi^0$ non-ϕ		$< 9\%$	CL=90%	748
$K^+\overline{K}^0\pi^+\pi^-$		$(2.5 \pm 0.9)\%$		744
$K^0K^-\pi^+\pi^+$		$(4.3 \pm 1.5)\%$		744
$K^*(892)^+\overline{K}^*(892)^0$	[c]	$(5.8 \pm 2.5)\%$		416
$K^0K^-\pi^+\pi^+$ (non-$K^{*+}\overline{K}^{*0}$)		$< 2.9\%$	CL=90%	744
$K^+K^-\pi^+\pi^+\pi^-$		$(7.1 \pm 2.2) \times 10^{-3}$		673
$\phi\pi^+\pi^+\pi^-$	[c]	$(9.7 \pm 2.6) \times 10^{-3}$		640
$K^+K^-\rho^0\pi^+$ non-ϕ		$< 2.1 \times 10^{-4}$	CL=90%	248
$\phi\rho^0\pi^+$	[c]	$(1.06 \pm 0.35)\%$		180
$\phi a_1(1260)^+$	[c]	$(2.5 \pm 0.8)\%$		†
$K^+K^-\pi^+\pi^+\pi^-$ nonresonant		$(7 \pm 6) \times 10^{-4}$		673

Hadronic modes without K's

$\pi^+\pi^+\pi^-$		$(1.01 \pm 0.28)\%$	S=1.1	959
$\rho^0\pi^+$		$< 7 \times 10^{-4}$	CL=90%	824
$f_0(980)\pi^+ \times B(f_0 \to \pi^+\pi^-)$	[e]	$(5.7 \pm 1.7) \times 10^{-3}$		732
$f_2(1270)\pi^+$	[c]	$(3.5 \pm 1.2) \times 10^{-3}$		559
$f_0(1370)\pi^+ \times B(f_0 \to \pi^+\pi^-)$	[e]	$(3.3 \pm 1.2) \times 10^{-3}$		493
$\rho(1450)^0\pi^+ \times B(\rho^0 \to \pi^+\pi^-)$	[e]	$(4.4 \pm 2.5) \times 10^{-4}$		421
$\pi^+\pi^+\pi^-$ nonresonant		$(5 {}^{+22}_{-5}) \times 10^{-5}$		959
$\pi^+\pi^+\pi^-\pi^0$		$< 12\%$	CL=90%	935
$\eta\pi^+$	[c]	$(1.7 \pm 0.5)\%$		902
$\omega\pi^+$	[c]	$(2.8 \pm 1.1) \times 10^{-3}$		822
$3\pi^+2\pi^-$		$(6.5 \pm 1.8) \times 10^{-3}$		899
$\pi^+\pi^+\pi^-\pi^0\pi^0$		—		902

$\eta\rho^+$		[c]		(10.8 ± 3.1) %		723
$\eta\pi^+\pi^0$ 3-body		[c]	<	4 %	CL=90%	885
$3\pi^+2\pi^-\pi^0$				(4.9 ± 3.2) %		856
$\eta'(958)\pi^+$		[c]		(3.9 ± 1.0) %		743
$3\pi^+2\pi^-2\pi^0$				—		803
$\eta'(958)\rho^+$		[c]		(10.1 ± 2.8) %		464
$\eta'(958)\pi^+\pi^0$ 3-body		[c]	<	1.4 %	CL=90%	720

Modes with one or three K's

$K^0\pi^+$			<	8×10^{-3}	CL=90%	916
$K^+\pi^+\pi^-$				(1.0 ± 0.4) %		900
$K^+\rho^0$			<	2.9×10^{-3}	CL=90%	744
$K^*(892)^0\pi^+$		[c]		$(6.5 \pm 2.8) \times 10^{-3}$		775
$K^+K^+K^-$				$(4.0 \pm 1.7) \times 10^{-4}$		627
ϕK^+		[c]	<	5×10^{-4}	CL=90%	607

$\Delta C = 1$ weak neutral current ($C1$) modes, Lepton family number (LF), or Lepton number (L) violating modes

$\pi^+e^+e^-$		[f]	<	2.7×10^{-4}	CL=90%	979
$\pi^+\mu^+\mu^-$		[f]	<	2.6×10^{-5}	CL=90%	968
$K^+e^+e^-$	C1		<	1.6×10^{-3}	CL=90%	922
$K^+\mu^+\mu^-$	C1		<	3.6×10^{-5}	CL=90%	909
$K^*(892)^+\mu^+\mu^-$	C1		<	1.4×10^{-3}	CL=90%	765
$\pi^+e^\pm\mu^\mp$	LF	[g]	<	6.1×10^{-4}	CL=90%	976
$K^+e^\pm\mu^\mp$	LF	[g]	<	6.3×10^{-4}	CL=90%	919
$\pi^-e^+e^+$	L		<	6.9×10^{-4}	CL=90%	979
$\pi^-\mu^+\mu^+$	L		<	2.9×10^{-5}	CL=90%	968
$\pi^-e^+\mu^+$	L		<	7.3×10^{-4}	CL=90%	976
$K^-e^+e^+$	L		<	6.3×10^{-4}	CL=90%	922
$K^-\mu^+\mu^+$	L		<	1.3×10^{-5}	CL=90%	909
$K^-e^+\mu^+$	L		<	6.8×10^{-4}	CL=90%	919
$K^*(892)^-\mu^+\mu^+$	L		<	1.4×10^{-3}	CL=90%	765

$D_s^{*\pm}$

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

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

Mass $m = 2112.1 \pm 0.7$ 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±2.5) %	139
$D_s^+ \pi^0$	(5.8±2.5) %	48

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

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

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

Mass $m = 2317.4 \pm 0.9$ MeV (S = 1.1)
$m_{D_{sJ}^*(2317)^\pm} - m_{D_s^\pm} = 349.2 \pm 0.7$ MeV
Full width $\Gamma < 4.6$ MeV, CL = 90%

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

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

Mass $m = 2459.3 \pm 1.3$ MeV (S = 1.3)
$m_{D_{sJ}^*(2460)^\pm} - m_{D_s^{*\pm}} = 347.2 \pm 1.2$ MeV (S = 1.3)
$m_{D_{sJ}^*(2460)^\pm} - m_{D_s^\pm} = 491.0 \pm 1.2$ MeV (S = 1.3)
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 $m = 2572.4 \pm 1.5$ 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	435
$D^*(2007)^0 K^+$	not seen	244

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 value includes only $K^+ K^-$ decays of the intermediate resonance, because branching fractions of this resonance are not known.

[*e*] This value includes only $\pi^+ \pi^-$ decays of the intermediate resonance, because branching fractions of this resonance are not known.

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

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