LIGHT UNFLAVORED MESONS ($S = C = B = 0$)

For $I = 1$ (π, b, ρ, a): $u\overline{d}$, $(u\overline{u}-d\overline{d})/\sqrt{2}$, $d\overline{u}$;
for $I = 0$ (η, η', h, h', ω, ϕ, f, f'): $c_1(u\overline{u} + d\overline{d}) + c_2(s\overline{s})$

$\pi^{\pm}$

$I^G(J^P) = 1^-(0^-)$

Mass $m = 139.57039 \pm 0.00018$ MeV (S = 1.8)
Mean life $\tau = (2.6033 \pm 0.0005) \times 10^{-8}$ s (S = 1.2)
$c\tau = 7.8045$ m

$\pi^{\pm} \to \ell^{\pm}\nu\gamma$ form factors [a]

$F_V = 0.0254 \pm 0.0017$
$F_A = 0.0119 \pm 0.0001$
F_V slope parameter $a = 0.10 \pm 0.06$
$R = 0.059^{+0.009}_{-0.008}$

π^- modes are charge conjugates of the modes below.

For decay limits to particles which are not established, see the section on Searches for Axions and Other Very Light Bosons.

π^+ DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\mu^+\nu_\mu$	[b]	(99.98770 ± 0.00004) %		30
$\mu^+\nu_\mu\gamma$	[c]	$(2.00 \pm 0.25) \times 10^{-4}$		30
$e^+\nu_e$	[b]	$(1.230 \pm 0.004) \times 10^{-4}$		70
$e^+\nu_e\gamma$	[c]	$(7.39 \pm 0.05) \times 10^{-7}$		70
$e^+\nu_e\pi^0$		$(1.036 \pm 0.006) \times 10^{-8}$		4
$e^+\nu_e e^+e^-$		$(3.2 \pm 0.5) \times 10^{-9}$		70
$\mu^+\nu_\mu\nu\overline{\nu}$		$< 9 \times 10^{-6}$	90%	30
$e^+\nu_e\nu\overline{\nu}$		$< 1.6 \times 10^{-7}$	90%	70
Lepton Family number (LF) or Lepton number (L) violating modes				
$\mu^+\overline{\nu}_e$	L	[d] $< 1.5 \times 10^{-3}$	90%	30
$\mu^+\nu_e$	LF	[d] $< 8.0 \times 10^{-3}$	90%	30
$\mu^-e^+e^+\nu$	LF	$< 1.6 \times 10^{-6}$	90%	30

π^0

$I^G(J^{PC}) = 1^-(0^{-+})$

Mass $m = 134.9768 \pm 0.0005$ MeV (S = 1.1)
$m_{\pi^\pm} - m_{\pi^0} = 4.5936 \pm 0.0005$ MeV
Mean life $\tau = (8.43 \pm 0.13) \times 10^{-17}$ s (S = 1.2)
$c\tau = 25.3$ nm

For decay limits to particles which are not established, see the appropriate Search sections (A^0 (axion) and Other Light Boson (X^0) Searches, etc.).

π^0 DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
2γ		(98.823 ± 0.034) %	S=1.5	67
$e^+ e^- \gamma$		(1.174 ± 0.035) %	S=1.5	67
γ positronium		$(1.82 \pm 0.29) \times 10^{-9}$		67
$e^+ e^+ e^- e^-$		$(3.34 \pm 0.16) \times 10^{-5}$		67
$e^+ e^-$		$(6.46 \pm 0.33) \times 10^{-8}$		67
4γ		$< 2 \times 10^{-8}$	CL=90%	67
invisible		$< 4.4 \times 10^{-9}$	CL=90%	–
$\nu_e \overline{\nu}_e$		$< 1.7 \times 10^{-6}$	CL=90%	67
$\nu_\mu \overline{\nu}_\mu$		$< 1.6 \times 10^{-6}$	CL=90%	67
$\nu_\tau \overline{\nu}_\tau$		$< 2.1 \times 10^{-6}$	CL=90%	67
$\gamma \nu \overline{\nu}$		$< 1.9 \times 10^{-7}$	CL=90%	67
Charge conjugation (C) or Lepton Family number (LF) violating modes				
3γ	C	$< 3.1 \times 10^{-8}$	CL=90%	67
$\mu^+ e^-$	LF	$< 3.8 \times 10^{-10}$	CL=90%	26
$\mu^- e^+$	LF	$< 3.2 \times 10^{-10}$	CL=90%	26
$\mu^+ e^- + \mu^- e^+$	LF	$< 3.6 \times 10^{-10}$	CL=90%	26

η

$I^G(J^{PC}) = 0^+(0^{-+})$

Mass $m = 547.862 \pm 0.017$ MeV
Full width $\Gamma = 1.31 \pm 0.05$ keV

C-nonconserving decay parameters

$\pi^+ \pi^- \pi^0$ left-right asymmetry $= (0.09^{+0.11}_{-0.12}) \times 10^{-2}$
$\pi^+ \pi^- \pi^0$ sextant asymmetry $= (0.12^{+0.10}_{-0.11}) \times 10^{-2}$
$\pi^+ \pi^- \pi^0$ quadrant asymmetry $= (-0.09 \pm 0.09) \times 10^{-2}$
$\pi^+ \pi^- \gamma$ left-right asymmetry $= (0.9 \pm 0.4) \times 10^{-2}$
$\pi^+ \pi^- \gamma$ β (D-wave) $= -0.02 \pm 0.07$ (S = 1.3)

CP-nonconserving decay parameters

$\pi^+ \pi^- e^+ e^-$ decay-plane asymmetry $A_\phi = (-0.6 \pm 3.1) \times 10^{-2}$

Other decay parameters

$\pi^0\pi^0\pi^0$ Dalitz plot $\alpha = -0.0296 \pm 0.0016$ (S = 1.7)
Parameter Λ in $\eta \to \ell^+\ell^-\gamma$ decay = 0.721 ± 0.011 GeV/c^2

η DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
Neutral modes			
neutral modes	(71.95±0.29) %	S=1.3	–
2γ	(39.36±0.18) %	S=1.1	274
$3\pi^0$	(32.56±0.21) %	S=1.2	179
$\pi^0 2\gamma$	(2.55±0.22) $\times 10^{-4}$		257
$2\pi^0 2\gamma$	< 1.2 $\times 10^{-3}$	CL=90%	238
4γ	< 2.8 $\times 10^{-4}$	CL=90%	274
invisible	< 1.0 $\times 10^{-4}$	CL=90%	–
Charged modes			
charged modes	(28.05±0.29) %	S=1.3	–
$\pi^+\pi^-\pi^0$	(23.02±0.25) %	S=1.2	174
$\pi^+\pi^-\gamma$	(4.28±0.07) %	S=1.1	236
$e^+e^-\gamma$	(7.00±0.22) $\times 10^{-3}$	S=1.1	274
$\mu^+\mu^-\gamma$	(3.1 ±0.4) $\times 10^{-4}$		253
e^+e^-	< 7 $\times 10^{-7}$	CL=90%	274
$\mu^+\mu^-$	(5.8 ±0.8) $\times 10^{-6}$		253
$2e^+2e^-$	(2.40±0.22) $\times 10^{-5}$		274
$\pi^+\pi^-e^+e^-(\gamma)$	(2.68±0.11) $\times 10^{-4}$		235
$e^+e^-\mu^+\mu^-$	< 1.6 $\times 10^{-4}$	CL=90%	253
$2\mu^+2\mu^-$	(5.0 ±1.3) $\times 10^{-9}$		161
$\mu^+\mu^-\pi^+\pi^-$	< 3.6 $\times 10^{-4}$	CL=90%	113
$\pi^+e^-\overline{\nu}_e$ + c.c.	< 1.7 $\times 10^{-4}$	CL=90%	256
$\pi^+\pi^-2\gamma$	< 2.1 $\times 10^{-3}$		236
$\pi^+\pi^-\pi^0\gamma$	< 6 $\times 10^{-4}$	CL=90%	174
$\pi^0\mu^+\mu^-\gamma$	< 3 $\times 10^{-6}$	CL=90%	210
Charge conjugation (C), Parity (P), Charge conjugation × Parity (CP), or Lepton Family number (LF) violating modes			
$\pi^0\gamma$	C [e] < 9 $\times 10^{-5}$	CL=90%	257
$\pi^+\pi^-$	P,CP < 4.4 $\times 10^{-6}$	CL=90%	236
$2\pi^0$	P,CP < 3.5 $\times 10^{-4}$	CL=90%	238
$2\pi^0\gamma$	C < 5 $\times 10^{-4}$	CL=90%	238
$3\pi^0\gamma$	C < 6 $\times 10^{-5}$	CL=90%	179
3γ	C < 1.6 $\times 10^{-5}$	CL=90%	274
$4\pi^0$	P,CP < 6.9 $\times 10^{-7}$	CL=90%	40
$\pi^0e^+e^-$	C [f] < 8 $\times 10^{-6}$	CL=90%	257

$\pi^0 \mu^+ \mu^-$	C	[f] <	5	$\times 10^{-6}$	CL=90%	210
$\mu^+ e^- + \mu^- e^+$	LF	<	6	$\times 10^{-6}$	CL=90%	264

$f_0(500)$

$I^G(J^{PC}) = 0^+(0^{++})$

also known as σ; was $f_0(600)$, $f_0(400–1200)$

See the review on "Scalar Mesons below 1 GeV."

Mass (T-Matrix Pole $\sqrt{s}$) = (400–550)$-i$(200–350) MeV
Mass (Breit-Wigner) = 400 to 800 MeV
Full width (Breit-Wigner) = 100 to 800 MeV

$f_0(500)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	seen	–
$\gamma\gamma$	seen	–

$\rho(770)$

$I^G(J^{PC}) = 1^+(1^{--})$

See the review on "Spectroscopy of Light Meson Resonances."

T-Matrix Pole $\sqrt{s}$ = (761–765) $-$ i (71–74) MeV
ρ^0 mass (Breit-Wigner) = 775.26 ± 0.23 MeV [g]
$\rho^\pm$ mass (Breit-Wigner) = 775.11 ± 0.34 MeV [h]
ρ^0 full width (Breit-Wigner) = 147.4 ± 0.8 MeV [g] (S = 2.0)
$\rho^\pm$ full width (Breit-Wigner) = 149.1 ± 0.8 MeV [h]

$\rho(770)$ DECAY MODES		Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi\pi$		$\sim$ 100 %		363
		$\rho(770)^\pm$ decays		
$\pi^\pm\gamma$		$(4.5 \pm 0.5) \times 10^{-4}$	S=2.2	375
$\pi^\pm\eta$		$< 6 \times 10^{-3}$	CL=84%	152
$\pi^\pm\pi^+\pi^-\pi^0$		$< 2.0 \times 10^{-3}$	CL=84%	254
		$\rho(770)^0$ decays		
$\pi^+\pi^-\gamma$		$(9.9 \pm 1.6) \times 10^{-3}$		362
$\pi^0\gamma$		$(4.7 \pm 0.8) \times 10^{-4}$	S=1.7	376
$\eta\gamma$		$(3.00 \pm 0.21) \times 10^{-4}$		194
$\pi^0\pi^0\gamma$		$(4.5 \pm 0.8) \times 10^{-5}$		363
$\mu^+\mu^-$	[i]	$(4.55 \pm 0.28) \times 10^{-5}$		373
e^+e^-	[i]	$(4.72 \pm 0.05) \times 10^{-5}$		388
$\pi^+\pi^-\pi^0$		$(9 \pm 4) \times 10^{-5}$		323
$\pi^+\pi^-\pi^+\pi^-$		$(1.8 \pm 0.9) \times 10^{-5}$		251

$\pi^+\pi^-\pi^0\pi^0$	$(1.6 \pm 0.8) \times 10^{-5}$		256
$\pi^0 e^+ e^-$	$< 1.2 \times 10^{-5}$	CL=90%	376

$\omega(782)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 782.66 \pm 0.13$ MeV (S = 2.0)
Full width $\Gamma = 8.68 \pm 0.13$ MeV

$\omega(782)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi^+\pi^-\pi^0$	(89.2 ± 0.7) %		327
$\pi^0\gamma$	(8.33 ± 0.25) %	S=2.1	380
$\pi^+\pi^-$	(1.53 ± 0.12) %	S=1.2	366
neutrals (excluding $\pi^0\gamma$)	$(7 \; {}^{+7}_{-5}) \times 10^{-3}$	S=1.1	–
$\eta\gamma$	$(4.5 \pm 0.4) \times 10^{-4}$	S=1.1	200
$\pi^0 e^+ e^-$	$(7.7 \pm 0.6) \times 10^{-4}$		380
$\pi^0\mu^+\mu^-$	$(1.34 \pm 0.18) \times 10^{-4}$	S=1.5	349
e^+e^-	$(7.41 \pm 0.19) \times 10^{-5}$	S=1.8	391
$\pi^+\pi^-\pi^0\pi^0$	$< 2 \times 10^{-4}$	CL=90%	262
$\pi^+\pi^-\gamma$	$< 3.6 \times 10^{-3}$	CL=95%	366
$\pi^+\pi^-\pi^+\pi^-$	$< 1 \times 10^{-3}$	CL=90%	256
$\pi^0\pi^0\gamma$	$(6.7 \pm 1.1) \times 10^{-5}$		367
$\eta\pi^0\gamma$	$< 3.3 \times 10^{-5}$	CL=90%	162
$\mu^+\mu^-$	$(7.4 \pm 1.8) \times 10^{-5}$		377
3γ	$< 1.9 \times 10^{-4}$	CL=95%	391
Charge conjugation (C) violating modes			
$\eta\pi^0$ C	$< 2.1 \times 10^{-4}$	CL=90%	162
$2\pi^0$ C	$< 2.2 \times 10^{-4}$	CL=90%	367
$3\pi^0$ C	$< 2.3 \times 10^{-4}$	CL=90%	330
invisible	$< 7 \times 10^{-5}$	CL=90%	–

$\eta'(958)$

$I^G(J^{PC}) = 0^+(0^{-+})$

Mass $m = 957.78 \pm 0.06$ MeV
Full width $\Gamma = 0.188 \pm 0.006$ MeV

$\eta'(958)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\pi^+\pi^-\eta$	(42.5 ± 0.5) %		232
$\rho^0\gamma$(including non-resonant $\pi^+\pi^-\gamma$)	(29.48 ± 0.35) %		165
$\pi^0\pi^0\eta$	(22.4 ± 0.5) %		239
$\omega\gamma$	(2.52 ± 0.07) %		159

$\omega e^+ e^-$	$(2.0 \pm 0.4) \times 10^{-4}$			159
$\gamma\gamma$	(2.307 ± 0.033) %			479
$3\pi^0$	$(2.50 \pm 0.17) \times 10^{-3}$			430
$\mu^+ \mu^- \gamma$	$(1.13 \pm 0.28) \times 10^{-4}$			467
$\pi^+ \pi^- \mu^+ \mu^-$	$(2.13 \pm 0.13) \times 10^{-5}$			401
$\pi^+ \pi^- \pi^0$	$(3.61 \pm 0.17) \times 10^{-3}$			428
$(\pi^+ \pi^- \pi^0)$ S-wave	$(3.8 \pm 0.5) \times 10^{-3}$			428
$\pi^\mp \rho^\pm$	$(7.4 \pm 2.3) \times 10^{-4}$			106
$2(\pi^+ \pi^-)$	$(8.51 \pm 0.33) \times 10^{-5}$			372
$\pi^+ \pi^- 2\pi^0$	$(2.11 \pm 0.15) \times 10^{-4}$			376
$2(\pi^+ \pi^-)$ neutrals	< 1	%	95%	–
$2(\pi^+ \pi^-)\pi^0$	$< 1.8 \times 10^{-3}$		90%	298
$2(\pi^+ \pi^-)2\pi^0$	< 1	%	95%	197
$3(\pi^+ \pi^-)$	$< 3.1 \times 10^{-5}$		90%	189
$K^\pm \pi^\mp$	$< 4 \times 10^{-5}$		90%	334
$\pi^+ \pi^- e^+ e^-$	$(2.43 \pm 0.06) \times 10^{-3}$			458
$\pi^+ e^- \nu_e +$ c.c.	$< 2.1 \times 10^{-4}$		90%	469
$\gamma e^+ e^-$	$(4.80 \pm 0.15) \times 10^{-4}$			479
$\pi^0 \gamma\gamma$	$(3.20 \pm 0.24) \times 10^{-3}$			469
$\pi^0 \gamma\gamma$(non resonant)	$(6.2 \pm 0.9) \times 10^{-4}$			–
$\eta\gamma\gamma$	$< 1.33 \times 10^{-4}$		90%	322
$4\pi^0$	$< 1.2 \times 10^{-5}$		90%	380
$e^+ e^-$	$< 5.6 \times 10^{-9}$		90%	479
$e^+ e^- e^+ e^-$	$(4.5 \pm 1.1) \times 10^{-6}$			479
invisible	$< 2.1 \times 10^{-4}$		90%	–
γDark Photon	5.0×10^{-07} to 3.50×10^{-06}		90%	–

Charge conjugation (C), Parity (P), Lepton family number (LF) violating modes

$\pi^+ \pi^-$	P,CP	$< 1.8 \times 10^{-5}$	90%	458
$\pi^0 \pi^0$	P,CP	$< 4 \times 10^{-4}$	90%	459
$\pi^0 e^+ e^-$	C	[f] $< 1.4 \times 10^{-3}$	90%	469
$\pi^0 \rho^0$	C	< 4 %	90%	111
$\eta e^+ e^-$	C	[f] $< 2.4 \times 10^{-3}$	90%	322
3γ	C	$< 1.0 \times 10^{-4}$	90%	479
$\mu^+ \mu^- \pi^0$	C	[f] $< 6.0 \times 10^{-5}$	90%	445
$\mu^+ \mu^- \eta$	C	[f] $< 1.5 \times 10^{-5}$	90%	273
$e\mu$	LF	$< 4.7 \times 10^{-4}$	90%	473
$\pi^+ \pi^-$ ALP $\rightarrow$ $\pi^+ \pi^- e^+ e^-$		$< 1.9 \times 10^{-5}$	90%	–

$f_0(980)$

$I^G(J^{PC}) = 0^+(0^{++})$

See the review on "Scalar Mesons below 1 GeV."

T-matrix pole $\sqrt{s}$ = (980–1010) − i (20–35) MeV [j]
Mass (Breit-Wigner) = 990 ± 20 MeV [j]
Full width (Breit-Wigner) = 10 to 100 MeV [j]

$f_0(980)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	seen	476
$K\overline{K}$	seen	36
$\gamma\gamma$	seen	495

$a_0(980)$

$I^G(J^{PC}) = 1^-(0^{++})$

See the review on "Scalar Mesons below 1 GeV."

T-matrix pole $\sqrt{s}$ = (970–1020) − i (30–70) MeV [j]
Mass m = 980 ± 20 MeV [j]
Full width Γ = 50 to 100 MeV [j]

$a_0(980)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi$	seen	319
$K\overline{K}$	seen	†
$\eta'\pi$	seen	†
$\rho\pi$	not seen	138
$\gamma\gamma$	seen	490

$\phi(1020)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass m = 1019.460 ± 0.016 MeV
Full width Γ = 4.249 ± 0.013 MeV (S = 1.1)

$\phi(1020)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
K^+K^-	(49.9 ±0.5) %	S=1.5	127
$K^0_L K^0_S$	(33.6 ±0.4) %	S=1.3	110
$\rho\pi + \pi^+\pi^-\pi^0$	(14.9 ±0.4) %	S=1.3	–
$\eta\gamma$	(1.306±0.024) %	S=1.2	363
$\pi^0\gamma$	(1.33 ±0.05) × 10^{-3}		501
$\ell^+\ell^-$	—		510
e^+e^-	(2.964±0.033) × 10^{-4}	S=1.4	510
$\mu^+\mu^-$	(2.86 ±0.22) × 10^{-4}	S=1.2	499

$\eta e^+ e^-$	$(1.08 \pm 0.04) \times 10^{-4}$			363
$\pi^+ \pi^-$	$(9.5 \pm 1.9) \times 10^{-5}$	S=2.0		490
$\omega \pi^0$	$(4.7 \pm 0.5) \times 10^{-5}$			171
$\omega \gamma$	< 5 %	CL=84%		209
$\rho \gamma$	$< 1.2 \times 10^{-5}$	CL=90%		215
$\pi^+ \pi^- \gamma$	$(4.1 \pm 1.3) \times 10^{-5}$			490
$f_0(980) \gamma$	$(3.22 \pm 0.19) \times 10^{-4}$	S=1.1		29
$\pi^0 \pi^0 \gamma$	$(1.13 \pm 0.06) \times 10^{-4}$			492
$\pi^+ \pi^- \pi^+ \pi^-$	$(3.9 {}^{+2.8}_{-2.2}) \times 10^{-6}$			410
$\pi^+ \pi^+ \pi^- \pi^- \pi^0$	$< 4.6 \times 10^{-6}$	CL=90%		342
$\pi^0 e^+ e^-$	$(1.33 {}^{+0.07}_{-0.10}) \times 10^{-5}$			501
$\pi^0 \eta \gamma$	$(7.27 \pm 0.30) \times 10^{-5}$	S=1.5		346
$a_0(980) \gamma$	$(7.6 \pm 0.6) \times 10^{-5}$			39
$K^0 \overline{K}^0 \gamma$	$< 1.9 \times 10^{-8}$	CL=90%		110
$\eta'(958) \gamma$	$(6.23 \pm 0.21) \times 10^{-5}$			60
$\eta \pi^0 \pi^0 \gamma$	$< 2 \times 10^{-5}$	CL=90%		293
$\mu^+ \mu^- \gamma$	$(1.4 \pm 0.5) \times 10^{-5}$			499
$\rho \gamma \gamma$	$< 1.2 \times 10^{-4}$	CL=90%		215
$\eta \pi^+ \pi^-$	$< 1.8 \times 10^{-5}$	CL=90%		288
$\eta \mu^+ \mu^-$	$< 9.4 \times 10^{-6}$	CL=90%		321
$\eta U \rightarrow \eta e^+ e^-$	$< 1 \times 10^{-6}$	CL=90%		–
invisible	$< 1.7 \times 10^{-4}$	CL=90%		–
Lepton Family number (*LF*) violating modes				
$e^\pm \mu^\mp$ *LF*	$< 2 \times 10^{-6}$	CL=90%		504

$h_1(1170)$

$I^G(J^{PC}) = 0^-(1^{+-})$

Mass $m = 1166 \pm 6$ MeV
Full width $\Gamma = 375 \pm 35$ MeV

$h_1(1170)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho \pi$	seen	305

$b_1(1235)$

$I^G(J^{PC}) = 1^+(1^{+-})$

Mass $m = 1229.5 \pm 3.2$ MeV (S = 1.6)
Full width $\Gamma = 142 \pm 9$ MeV (S = 1.2)

$b_1(1235)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\omega \pi$	seen		348
[D/S amplitude ratio $= 0.277 \pm 0.027$]			

$\pi^{\pm}\gamma$	$(1.6\pm0.4)\times10^{-3}$			607
$\eta\rho$	seen			†
$\pi^+\pi^+\pi^-\pi^0$	$<$ 50	%	84%	535
$K^*(892)^{\pm}K^{\mp}$	seen			†
$(K\overline{K})^{\pm}\pi^0$	$<$ 8	%	90%	248
$K^0_S K^0_L \pi^{\pm}$	$<$ 6	%	90%	235
$K^0_S K^0_S \pi^{\pm}$	$<$ 2	%	90%	235
$\phi\pi$	$<$ 1.5	%	84%	147

$a_1(1260)$ [k]

$I^G(J^{PC}) = 1^-(1^{++})$

T-Matrix Pole $\sqrt{s} = (1209^{+13}_{-10}) - i(288^{+45}_{-12})$ MeV
Mass (Breit-Wigner) = 1230 ± 40 MeV [j]
Full width (Breit-Wigner) = 250 to 600 MeV [j]

$a_1(1260)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
3π	seen	577
$(\rho\pi)_{S-\text{wave}}$, $\rho\to\pi\pi$	seen	353
$(\rho\pi)_{D-\text{wave}}$, $\rho\to\pi\pi$	seen	353
$(\rho(1450)\pi)_{S-\text{wave}}$, $\rho\to\pi\pi$	seen	†
$(\rho(1450)\pi)_{D-\text{wave}}$, $\rho\to\pi\pi$	seen	†
$f_0(500)\pi$, $f_0\to\pi\pi$	seen	–
$f_0(980)\pi$, $f_0\to\pi\pi$	seen	179
$f_0(1370)\pi$, $f_0\to\pi\pi$	seen	†
$f_2(1270)\pi$, $f_2\to\pi\pi$	seen	†
$\pi^+\pi^-\pi^0$	seen	576
$\pi^0\pi^0\pi^0$	not seen	577
$KK\pi$	seen	250
$K^*(892)K$	seen	†
$\pi\gamma$	seen	608

$f_2(1270)$

$I^G(J^{PC}) = 0^+(2^{++})$

T-Matrix Pole $\sqrt{s} = (1260–1283) - i\ (90–110)$ MeV
Mass (Breit-Wigner) = 1275.4 ± 0.8 MeV (S = 1.1)
Full width (Breit-Wigner) = $186.6^{+2.8}_{-2.2}$ MeV (S = 1.5)

$f_2(1270)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
$\pi\pi$	$(84.3\ ^{+2.8}_{-1.0})$ %	S=1.2	623
$\pi^+\pi^-2\pi^0$	$(7.7\ ^{+1.2}_{-3.1})$ %	S=1.2	563

$K\overline{K}$	(4.6 ±0.4) %	S=2.7	404
$2\pi^+2\pi^-$	(2.8 ±0.4) %	S=1.2	559
$\eta\eta$	(4.0 ±0.8) $\times 10^{-3}$	S=2.1	326
$4\pi^0$	(3.0 ±1.0) $\times 10^{-3}$		565
$\gamma\gamma$	(1.42±0.24) $\times 10^{-5}$	S=1.4	638
$\eta\pi\pi$	< 8 $\times 10^{-3}$	CL=95%	478
$K^0K^-\pi^+$ + c.c.	< 3.4 $\times 10^{-3}$	CL=95%	293
e^+e^-	< 6 $\times 10^{-10}$	CL=90%	638

$f_1(1285)$

$I^G(J^{PC}) = 0^+(1^{++})$

Mass $m = 1281.8 \pm 0.5$ MeV (S = 1.7)
Full width $\Gamma = 23.0 \pm 1.1$ MeV (S = 1.6)

$f_1(1285)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
4π	(32.7± 1.8) %	S=1.2	568
$\pi^0\pi^0\pi^+\pi^-$	(21.8± 1.2) %	S=1.2	566
$2\pi^+2\pi^-$	(10.9± 0.6) %	S=1.2	563
$\rho^0\pi^+\pi^-$	(10.9± 0.6) %	S=1.2	336
$\rho^0\rho^0$	seen		†
$4\pi^0$	< 7 $\times 10^{-4}$	CL=90%	568
$\eta\pi^+\pi^-$	(35 ±15) %		479
$\eta\pi\pi$	(52.2± 1.9) %	S=1.2	482
$a_0(980)\pi$ [ignoring $a_0(980) \to K\overline{K}$]	(38 ± 4) %		238
$\eta\pi\pi$ [excluding $a_0(980)\pi$]	(14 ± 4) %		482
$K\overline{K}\pi$	(9.0± 0.4) %	S=1.1	308
$K\overline{K}^*(892)$	not seen		†
$\pi^+\pi^-\pi^0$	(3.0± 0.9) $\times 10^{-3}$		603
$\rho^\pm\pi^\mp$	< 3.1 $\times 10^{-3}$	CL=95%	390
$\gamma\rho^0$	(6.1± 1.0) %	S=1.7	407
$\phi\gamma$	(7.4± 2.6) $\times 10^{-4}$		235
e^+e^-	< 9.4 $\times 10^{-9}$	CL=90%	641

$\eta(1295)$

$I^G(J^{PC}) = 0^+(0^{-+})$

See the review on "Spectroscopy of Light Meson Resonances."
Mass $m = 1294 \pm 4$ MeV (S = 1.6)
Full width $\Gamma = 55 \pm 5$ MeV

$\eta(1295)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi^+\pi^-$	seen	487
$a_0(980)\pi$	seen	248
$\eta\pi^0\pi^0$	seen	490
$\eta(\pi\pi)_{S\text{-wave}}$	seen	–
$\sigma\eta$	seen	–
$K\overline{K}\pi$	seen	320

$\pi(1300)$

$I^G(J^{PC}) = 1^-(0^{-+})$

Mass $m = 1300 \pm 100$ MeV [j]
Full width $\Gamma = 200$ to 600 MeV [j]

$\pi(1300)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	404
$\pi(\pi\pi)_{S\text{-wave}}$	seen	–

$a_2(1320)$

$I^G(J^{PC}) = 1^-(2^{++})$

T-Matrix Pole $\sqrt{s} = (1305–1321) - i(52–58)$ MeV
Mass (Breit-Wigner) = 1318.2 ± 0.6 MeV (S = 1.2)
Full width $\Gamma = 107 \pm 5$ MeV

$a_2(1320)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor/ Confidence level	p (MeV/c)
3π	(70.1 ± 2.7) %	S=1.2	624
$\eta\pi$	(14.5 ± 1.2) %		535
$\omega\pi\pi$	(10.6 ± 3.2) %	S=1.3	366
$K\overline{K}$	(4.9 ± 0.8) %		437
$\eta'(958)\pi$	$(5.5 \pm 0.9) \times 10^{-3}$		288
$\pi^\pm\gamma$	$(2.91 \pm 0.27) \times 10^{-3}$		652
$\gamma\gamma$	$(9.4 \pm 0.7) \times 10^{-6}$		659
e^+e^-	$< 5 \times 10^{-9}$	CL=90%	659

$f_0(1370)$

$I^G(J^{PC}) = 0^+(0^{++})$

See the review on "Spectroscopy of Light Meson Resonances."
T-Matrix Pole $\sqrt{s} = (1250–1440) - i\ (60–300)$ MeV
Mass (Breit-Wigner) = 1200 to 1500 MeV
Full width (Breit-Wigner) = 200 to 500 MeV

$f_0(1370)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	seen	672
4π	seen	617
$4\pi^0$	seen	617
$2\pi^+2\pi^-$	seen	612
$\pi^+\pi^-2\pi^0$	seen	615
$\rho\rho$	seen	†
$2(\pi\pi)_S$-wave	seen	–
$\pi(1300)\pi$	seen	†
$a_1(1260)\pi$	seen	35
$\eta\eta$	seen	411
$K\overline{K}$	seen	475
$K\overline{K}n\pi$	not seen	†
6π	not seen	508
$\omega\omega$	not seen	†
$\gamma\gamma$	seen	685
e^+e^-	not seen	685

$\eta(1405)$

$I^G(J^{PC}) = 0^+(0^{-+})$

See the review on "Spectroscopy of Light Meson Resonances." See also $\eta(1475)$.

Mass $m = 1408.7^{+2.0}_{-1.2}$ MeV (S = 2.2)
Full width $\Gamma = 50.3 \pm 2.5$ MeV (S = 1.6)

$\eta(1405)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$K\overline{K}\pi$	seen		424
$\eta\pi\pi$	seen		562
$a_0(980)\pi$	seen		344
$\eta(\pi\pi)_S$-wave	seen		–
$f_0(980)\eta$	seen		†
4π	seen		638
$\rho\rho$	<58 %	99.85%	†
$\rho^0\gamma$	seen		491
$K^*(892)K$	seen		122

$h_1(1415)$

$I^G(J^{PC}) = 0^-(1^{+-})$

Mass $m = 1409^{+9}_{-8}$ MeV (S = 1.9)
Full width $\Gamma = 78 \pm 11$ MeV

$f_1(1420)$

$I^G(J^{PC}) = 0^+(1^{++})$

See the review on "Spectroscopy of Light Meson Resonances."

Mass $m = 1428.4^{+1.5}_{-1.3}$ MeV (S = 1.8)

Full width $\Gamma = 56.7 \pm 3.3$ MeV (S = 1.3)

$f_1(1420)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}\pi$	seen	440
$K\overline{K}^*(892)+$ c.c.	seen	167
$\eta\pi\pi$	possibly seen	574
$\phi\gamma$	seen	350

$\omega(1420)$ [l]

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 1410 \pm 60$ MeV [j]

Full width $\Gamma = 290 \pm 190$ MeV [j]

$\omega(1420)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	480
$\omega\pi\pi$	seen	437
$b_1(1235)\pi$	seen	112
e^+e^-	seen	705

$a_0(1450)$

$I^G(J^{PC}) = 1^-(0^{++})$

See the review on "Spectroscopy of Light Meson Resonances."

T-Matrix Pole $\sqrt{s} = (1290–1500) - i\ (30–140)$ MeV

Mass (Breit-Wigner) = 1439 ± 34 MeV (S = 1.8)

Full width (Breit-Wigner) = 258 ± 14 MeV

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

$a_0(1450)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\eta$	0.093±0.020	607
$\pi\eta'(958)$	0.033±0.017	384
$K\overline{K}$	0.082±0.028	523
$\omega\pi\pi$	**DEFINED AS 1**	458
$a_0(980)\pi\pi$	seen	310
$\gamma\gamma$	seen	719

$\rho(1450)$

$I^G(J^{PC}) = 1^+(1^{--})$

See the review on "Spectroscopy of Light Meson Resonances."

Mass $m = 1465 \pm 25$ MeV [j]

Full width $\Gamma = 400 \pm 60$ MeV [j]

$\rho(1450)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	seen	720
$\pi^+\pi^-$	seen	719
4π	seen	669
e^+e^-	seen	732
$\eta\rho$	seen	311
$a_2(1320)\pi$	not seen	55
$K\overline{K}$	seen	541
K^+K^-	seen	541
$K\overline{K}^*(892)+$ c.c.	possibly seen	229
$\pi^0\gamma$	seen	726
$\eta\gamma$	seen	630
$f_0(500)\gamma$	not seen	–
$f_0(980)\gamma$	not seen	398
$f_0(1370)\gamma$	not seen	92
$f_2(1270)\gamma$	not seen	177

$\eta(1475)$

$I^G(J^{PC}) = 0^+(0^{-+})$

See the review on "Spectroscopy of Light Meson Resonances." See also $\eta(1405)$.

Mass $m = 1476 \pm 4$ MeV (S = 1.4)

Full width $\Gamma = 96 \pm 9$ MeV (S = 1.7)

$\eta(1475)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}\pi$	seen	477
$K\overline{K}^*(892)+$ c.c.	seen	245
$a_0(980)\pi$	seen	396
$\gamma\gamma$	seen	738
$K^0_S K^0_S \eta$	possibly seen	†
$\gamma\phi(1020)$	possibly seen	386

$f_0(1500)$

$I^G(J^{PC}) = 0^+(0^{++})$

See the review on "Spectroscopy of Light Meson Resonances."

T-Matrix Pole $\sqrt{s}$ = (1430–1530) − i (40–90) MeV
Mass (Breit-Wigner) = 1522 ± 25 MeV
Full width (Breit-Wigner) = 108 ± 33 MeV

$f_0(1500)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
$\pi\pi$	(34.5±2.2) %	1.2	749
$\pi^+\pi^-$	seen		748
$2\pi^0$	seen		749
4π	(48.9±3.3) %	1.2	700
$4\pi^0$	seen		700
$2\pi^+2\pi^-$	seen		696
$2(\pi\pi)_{S\text{-wave}}$	seen		–
$\rho\rho$	seen		†
$\pi(1300)\pi$	seen		163
$a_1(1260)\pi$	seen		234
$\eta\eta$	(6.0±0.9) %	1.1	528
$\eta\eta'(958)$	(2.2±0.8) %	1.4	107
$K\overline{K}$	(8.5±1.0) %	1.1	579
$\gamma\gamma$	not seen		761

$f_2'(1525)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass m = 1517.3 ± 2.4 MeV (S = 2.8)
Full width $\Gamma = 72^{+7}_{-6}$ MeV

$f_2'(1525)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	(88.8 ±2.2) %	576
$\eta\eta$	(10.3 ±2.2) %	525
$\pi\pi$	(8.2 ±1.5) $\times 10^{-3}$	747
$\gamma\gamma$	(1.12±0.15) $\times 10^{-6}$	759

$f_2(1565)$

$I^G(J^{PC}) = 0^+(2^{++})$

See the review on "Spectroscopy of Light Meson Resonances."

T-Matrix Pole $\sqrt{s}$ = (1495–1560) − i (40–110) MeV
Mass (Breit-Wigner) = 1571 ± 13 MeV
Full width (Breit-Wigner) = 132 ± 23 MeV (S = 1.1)

$f_2(1565)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi$	seen	774
$\pi^+\pi^-$	seen	773
$\pi^0\pi^0$	seen	774
$\rho^0\rho^0$	seen	126
$2\pi^+2\pi^-$	seen	722
$\eta\eta$	seen	563
$\omega\omega$	seen	64
$K\overline{K}$	seen	611
$\gamma\gamma$	seen	785

$\pi_1(1600)$

$I^G(J^{PC}) = 1^-(1^{-+})$

See the review on "Spectroscopy of Light Meson Resonances."

Mass (T-Matrix Pole $\sqrt{s}$) = (1480–1680) − i (150–300) MeV
Mass (Breit-Wigner, $\eta\pi$ mode) = 1354 ± 25 MeV (S = 1.8)
Mass (Breit-Wigner, non-$\eta\pi$ mode) = 1645^{+40}_{-17} MeV (S = 1.3)
Full width (Breit-Wigner, $\eta\pi$ mode) = 330 ± 35 MeV
Full width (Breit-Wigner, non-$\eta\pi$ mode) = 370^{+50}_{-60} MeV

$\pi_1(1600)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi\pi$	seen	795
$\rho^0\pi^-$	seen	631
$f_2(1270)\pi^-$	not seen	304
$b_1(1235)\pi$	seen	343
$\eta'(958)\pi^-$	seen	532
$\eta\pi$	seen	725
$f_1(1285)\pi$	seen	300

$a_1(1640)$

$I^G(J^{PC}) = 1^-(1^{++})$

Mass m = 1655 ± 16 MeV (S = 1.2)
Full width Γ = 250 ± 40 MeV (S = 1.8)

$a_1(1640)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi\pi\pi$	seen	800
$f_2(1270)\pi$	seen	314
$\sigma\pi$	seen	–
$\rho\pi_{S-wave}$	seen	638

$\rho\pi$ $D-wave$	seen	638
$\omega\pi\pi$	seen	607
$f_1(1285)\pi$	seen	309
$a_1(1260)\eta$	not seen	†

$\eta_2(1645)$

$I^G(J^{PC}) = 0^+(2^{-+})$

Mass $m = 1617 \pm 5$ MeV
Full width $\Gamma = 181 \pm 11$ MeV

$\eta_2(1645)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$a_2(1320)\pi$	seen	242
$K\overline{K}\pi$	seen	580
$K^*\overline{K}$	seen	404
$\eta\pi^+\pi^-$	seen	685
$a_0(980)\pi$	seen	499
$f_2(1270)\eta$	not seen	†

$\omega(1650)$ [n]

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 1670 \pm 30$ MeV [j]
Full width $\Gamma = 315 \pm 35$ MeV [j]

$\omega(1650)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	647
$\rho(1450)\pi$	seen	145
$\omega\pi\pi$	seen	617
$\omega\eta$	seen	500
e^+e^-	seen	835
$\pi^0\gamma$	not seen	830

$\omega_3(1670)$

$I^G(J^{PC}) = 0^-(3^{--})$

Mass $m = 1667 \pm 4$ MeV
Full width $\Gamma = 168 \pm 10$ MeV

$\omega_3(1670)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi$	seen	645
$\omega\pi\pi$	seen	615
$b_1(1235)\pi$	possibly seen	361

$\pi_2(1670)$

$I^G(J^{PC}) = 1^-(2^{-+})$

Mass $m = 1670.6^{+2.9}_{-1.2}$ MeV (S = 1.3)
Full width $\Gamma = 258^{+8}_{-9}$ MeV (S = 1.2)

$\pi_2(1670)$ DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
3π	(95.8±1.4) %		808
$f_2(1270)\pi$	(56.3±3.2) %		327
$\rho\pi$	(31 ±4) %		647
$\sigma\pi$	(10 ±4) %		–
$\pi(\pi\pi)_S$-wave	(8.7±3.4) %		–
$\pi^\pm\pi^+\pi^-$	(53 ±4) %		806
$K\overline{K}^*(892)+$ c.c.	(4.2±1.4) %		453
$\omega\rho$	(2.7±1.1) %		302
$\pi^\pm\gamma$	(7.0±1.2) $\times 10^{-4}$		829
$\gamma\gamma$	$<$ 2.8 $\times 10^{-7}$	90%	835
$\eta\pi$	$<$ 5 %		739
$\pi^\pm 2\pi^+ 2\pi^-$	$<$ 5 %		735
$\rho(1450)\pi$	$<$ 3.6 $\times 10^{-3}$	97.7%	145
$b_1(1235)\pi$	$<$ 1.9 $\times 10^{-3}$	97.7%	364
$f_1(1285)\pi$	possibly seen		322
$a_2(1320)\pi$	not seen		291

$\phi(1680)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 1680 \pm 20$ MeV [j]
Full width $\Gamma = 150 \pm 50$ MeV [j]

$\phi(1680)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}^*(892)+$ c.c.	seen	462
$K^0_S K\pi$	seen	621
$K\overline{K}$	seen	680
e^+e^-	seen	840
$\omega\pi\pi$	not seen	623
$K^+K^-\pi^+\pi^-$	seen	544
$\eta\phi$	seen	290
$\eta\gamma$	seen	751
$f'_2(1525)\gamma$	not seen	155

$\rho_3(1690)$

$I^G(J^{PC}) = 1^+(3^{--})$

Mass $m = 1688.8 \pm 2.1$ MeV
Full width $\Gamma = 161 \pm 10$ MeV (S = 1.5)

$\rho_3(1690)$ DECAY MODES	Fraction (Γ_i/Γ)	Scale factor	p (MeV/c)
4π	(71.1 ± 1.9) %		790
$\pi^\pm\pi^+\pi^-\pi^0$	(67 ±22) %		787
$\omega\pi$	(16 ± 6) %		655
$\pi\pi$	(23.6 ± 1.3) %		834
$K\overline{K}\pi$	(3.8 ± 1.2) %		629
$K\overline{K}$	(1.58± 0.26) %	1.2	685
$\eta\pi^+\pi^-$	seen		727
$\rho(770)\eta$	seen		520
$\pi\pi\rho$	seen		633
$a_2(1320)\pi$	seen		307
$\rho\rho$	seen		335

$\rho(1700)$

$I^G(J^{PC}) = 1^+(1^{--})$

See the review on "Spectroscopy of Light Meson Resonances."
Mass $m = 1720 \pm 20$ MeV [j] ($\eta\rho^0$ and $\pi^+\pi^-$ modes)
Full width $\Gamma = 250 \pm 100$ MeV [j] ($\eta\rho^0$ and $\pi^+\pi^-$ modes)

$\rho(1700)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$2(\pi^+\pi^-)$	seen	803
$\rho\pi\pi$	seen	653
$\rho^0\pi^+\pi^-$	seen	651
$\rho^\pm\pi^\mp\pi^0$	seen	652
$a_1(1260)\pi$	seen	404
$h_1(1170)\pi$	seen	450
$\pi(1300)\pi$	seen	349
$\rho\rho$	seen	373
$\pi^+\pi^-$	seen	849
$\pi\pi$	seen	849
$K\overline{K}^*(892)+$ c.c.	seen	496
$\eta\rho$	seen	545
$a_2(1320)\pi$	not seen	334
$K\overline{K}$	seen	704
e^+e^-	seen	860

$\pi^0\omega$	seen	674
$\pi^0\gamma$	not seen	855
$f_0(1500)\gamma$	not seen	187

$a_2(1700)$

$I^G(J^{PC}) = 1^-(2^{++})$

T-Matrix Pole $\sqrt{s}$ = (1630–1780) − i (60–250) MeV
Mass m = 1706 ± 14 MeV (S = 1.2)
Full width $\Gamma = 380^{+60}_{-50}$ MeV (S = 3.9)

$a_2(1700)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi$	(2.5±0.6) %	758
$\eta'\pi$	seen	574
$\gamma\gamma$	$(7.9\pm1.7)\times10^{-7}$	853
$\rho\pi$	seen	669
$f_2(1270)\pi$	seen	357
$K\overline{K}$	(1.3±0.8) %	695
$\omega\pi^-\pi^0$	seen	639
$\omega\rho$	seen	347

$f_0(1710)$

$I^G(J^{PC}) = 0^+(0^{++})$

See the review on "Spectroscopy of Light Meson Resonances."
T-matrix pole $\sqrt{s}$ = (1680–1820) − i (50–180) MeV
Mass (Breit-Wigner) = 1733^{+8}_{-7} MeV (S = 1.5)
Full width (Breit-Wigner) = 150^{+12}_{-10} MeV (S = 1.3)

$f_0(1710)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	seen	712
$\eta\eta$	seen	671
$\eta\eta'$	not seen	417
$\pi\pi$	seen	856
$\gamma\gamma$	seen	866
$\omega\omega$	seen	372

$\pi(1800)$

$I^G(J^{PC}) = 1^-(0^{-+})$

See the review on "Spectroscopy of Light Meson Resonances."
Mass $m = 1810^{+9}_{-11}$ MeV (S = 2.2)
Full width $\Gamma = 215^{+7}_{-8}$ MeV

$\pi(1800)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\pi^+\pi^-\pi^-$	seen	878
$f_0(500)\pi^-$	seen	–
$f_0(980)\pi^-$	seen	624
$f_0(1370)\pi^-$	seen	366
$f_0(1500)\pi^-$	not seen	232
$\rho\pi^-$	not seen	731
$\eta\eta\pi^-$	seen	660
$a_0(980)\eta$	seen	471
$a_2(1320)\eta$	not seen	†
$f_2(1270)\pi$	not seen	441
$f_0(1370)\pi^-$	not seen	366
$f_0(1500)\pi^-$	seen	232
$\eta\eta'(958)\pi^-$	seen	373
$K_0^*(1430)K^-$	seen	†
$K^*(892)K^-$	not seen	568

$\phi_3(1850)$

$I^G(J^{PC}) = 0^-(3^{--})$

Mass $m = 1854 \pm 7$ MeV
Full width $\Gamma = 87^{+28}_{-23}$ MeV (S = 1.2)

$\phi_3(1850)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	seen	785
$K\overline{K}^*(892)+$ c.c.	seen	602

$\eta_2(1870)$

$I^G(J^{PC}) = 0^+(2^{-+})$

Mass $m = 1842 \pm 8$ MeV
Full width $\Gamma = 225 \pm 14$ MeV

$\eta_2(1870)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\pi\pi$	seen	816
$a_2(1320)\pi$	seen	434
$f_2(1270)\eta$	seen	119
$a_0(980)\pi$	seen	651
$\gamma\gamma$	seen	921

$\pi_2(1880)$

$I^G(J^{PC}) = 1^-(2^{-+})$

Mass $m = 1874^{+26}_{-5}$ MeV (S = 1.6)
Full width $\Gamma = 237^{+33}_{-30}$ MeV (S = 1.2)

$\pi_2(1880)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\eta\pi^-$	seen	702
$a_0(980)\eta$	seen	528
$a_2(1320)\eta$	seen	76
$f_0(1500)\pi$	seen	294
$f_1(1285)\pi$	seen	485
$\omega\pi^-\pi^0$	seen	744

$f_2(1950)$

$I^G(J^{PC}) = 0^+(2^{++})$

T-Matrix Pole $\sqrt{s}$ = (1830–2020) $- i$ (110–220) MeV
Mass (Breit-Wigner) = 1936 ± 12 MeV (S = 1.3)
Full width (Breit-Wigner) = 464 ± 24 MeV

$f_2(1950)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K^*(892)\overline{K}^*(892)$	seen	377
$\pi^+\pi^-$	seen	958
$\pi^0\pi^0$	seen	959
4π	seen	921
$\eta\eta$	seen	798
$K\overline{K}$	seen	833
$\gamma\gamma$	seen	968
$p\overline{p}$	seen	238

$a_4(1970)$

$I^G(J^{PC}) = 1^-(4^{++})$

Mass $m = 1967 \pm 16$ MeV (S = 2.1)
Full width $\Gamma = 324^{+15}_{-18}$ MeV

$a_4(1970)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$K\overline{K}$	seen	851
$\pi^+\pi^-\pi^0$	seen	959
$\rho\pi$	seen	825
$f_2(1270)\pi$	seen	559

$\omega\pi^-\pi^0$	seen	801
$\omega\rho$	seen	601
$\eta\pi$	seen	902
$\eta'(958)\pi$	seen	743

$f_2(2010)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 2010^{+60}_{-80}$ MeV
Full width $\Gamma = 200 \pm 60$ MeV

$f_2(2010)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\phi\phi$	seen	†
$K\overline{K}$	seen	876

$f_0(2020)$

$I^G(J^{PC}) = 0^+(0^{++})$

T-Matrix Pole $\sqrt{s} = (1870–2080) - i\ (120–240)$ MeV
Mass (Breit-Wigner) $= 1982^{+54.1}_{-3.0}$ MeV
Full width (Breit-Wigner) $= 440 \pm 50$ MeV

$f_0(2020)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\rho\pi\pi$	seen	814
$\pi^0\pi^0$	seen	982
$\rho\rho$	seen	617
$\omega\omega$	seen	608
$\eta\eta$	seen	826
$\eta'\eta'$	seen	254

$f_4(2050)$

$I^G(J^{PC}) = 0^+(4^{++})$

Mass $m = 2018 \pm 11$ MeV (S = 2.1)
Full width $\Gamma = 237 \pm 18$ MeV (S = 1.9)

$f_4(2050)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\omega\omega$	seen	637
$\pi\pi$	(17.0 ± 1.5) %	1000
$K\overline{K}$	$(6.8^{+3.4}_{-1.8}) \times 10^{-3}$	880
$\eta\eta$	$(2.1\pm0.8) \times 10^{-3}$	848
$4\pi^0$	< 1.2 %	964
$\gamma\gamma$	seen	1009

$a_2(1320)\pi$	seen	567

$f_2(2150)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 2157 \pm 12$ MeV
Full width $\Gamma = 152 \pm 30$ MeV (S = 1.4)

$f_2(2150)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\eta\eta$	seen	929
$K\overline{K}$	seen	959
$f_2(1270)\eta$	seen	542
$a_2(1320)\pi$	seen	666
$p\overline{p}$	seen	532

$\phi(2170)$

$I^G(J^{PC}) = 0^-(1^{--})$

Mass $m = 2164 \pm 5$ MeV
Full width $\Gamma = 88^{+26}_{-21}$ MeV (S = 2.5)

$\phi(2170)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
e^+e^-	seen	1082
$\phi\eta$	seen	728
$\phi\eta'$	seen	439
$\phi\pi\pi$	seen	815
$\phi f_0(980)$	seen	401
$K^+K^- f_0(980) \rightarrow K^+K^-\pi^+\pi^-$	seen	–
$K^+K^- f_0(980) \rightarrow K^+K^-\pi^0\pi^0$	seen	–
$K^{*0}K^\pm\pi^\mp$	not seen	762
$K^*(892)^0\overline{K}^*(892)^0$	not seen	613

$f_2(2300)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 2297 \pm 28$ MeV
Full width $\Gamma = 150 \pm 40$ MeV

$f_2(2300)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\phi\phi$	seen	529
$K\overline{K}$	seen	1037
$\gamma\gamma$	seen	1149

$f_2(2340)$

$I^G(J^{PC}) = 0^+(2^{++})$

Mass $m = 2346^{+21}_{-10}$ MeV
Full width $\Gamma = 331^{+27}_{-18}$ MeV

$f_2(2340)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$\phi\phi$	seen	580
$\eta\eta$	seen	1037
$\eta'\eta'$	seen	677

NOTES

[a] See the review on "Form Factors for Radiative Pion and Kaon Decays" for definitions and details.

[b] Measurements of $\Gamma(e^+\nu_e)/\Gamma(\mu^+\nu_\mu)$ always include decays with γ's, and measurements of $\Gamma(e^+\nu_e\gamma)$ and $\Gamma(\mu^+\nu_\mu\gamma)$ never include low-energy γ's. Therefore, since no clean separation is possible, we consider the modes with γ's to be subreactions of the modes without them, and let $[\Gamma(e^+\nu_e) + \Gamma(\mu^+\nu_\mu)]/\Gamma_{\text{total}} = 100\%$.

[c] See the $\pi^\pm$ Particle Listings for the energy limits used in this measurement; low-energy γ's are not included.

[d] Derived from an analysis of neutrino-oscillation experiments.

[e] Forbidden by angular momentum conservation.

[f] C parity forbids this to occur as a single-photon process.

[g] As measured in $e^+e^- \to \rho^0$.

[h] As measured in $e^+e^- \to \pi^+\pi^-\pi^0$ and τ decays.

[i] The $\omega\rho$ interference is then due to $\omega\rho$ mixing only, and is expected to be small. If $e\mu$ universality holds, $\Gamma(\rho^0 \to \mu^+\mu^-) = \Gamma(\rho^0 \to e^+e^-) \times 0.99785$.

[j] Our estimate. See the Particle Listings for details.

[k] See the "Note on $a_1(1260)$" in the $a_1(1260)$ Particle Listings in PDG 06, Journal of Physics **G33** 1 (2006).

[l] See also the $\omega(1650)$.

[n] See also the $\omega(1420)$.