TABLES OF PARTICLE PROPERTIES

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(Closing date for data: Jan. 1, 1982)

Stable Particle Table

For additional parameters, see Addendum to this table.

Quantities in italics have changed by more than one (old) standard deviation since April 1980.

Particle	$I^G(J^P)C_n$ [a]	Mass [b] (MeV) $Mass^2$ (GeV^2)	Mean life [b] (sec) $c\tau$ (cm)	Partial decay mode: Mode	Fraction [b]	p or p_{max} [c] (MeV/c)
			PHOTON			
γ	$0,1(1^-)-$	$(<6\times10^{-22})$	-------	stable		
			LEPTONS			
ν_e	$J=\frac{1}{2}$	(<0.000046) [d]	stable $(>3\times10^8 m_{\nu_e}$ (MeV))	stable		
e	$J=\frac{1}{2}$	0.5110034 ±0.0000014	stable $(>2\times10^{22}$y)	stable		
ν_μ	$J=\frac{1}{2}$	$0(<0.52)$	stable $(>1.1\times10^5 m_{\nu_\mu}$ (MeV))	stable		
			μ^- ↓ (or $\mu^+ \to$CC)			
μ	$J=\frac{1}{2}$	105.65943 ±0.00018 m^2=0.01116392	2.19714×10^{-6} ±0.00007 $c\tau=6.5868\times10^4$	$e^-\bar{\nu}\nu$ $e^-\bar{\nu}\nu\gamma$ †[$e^-\nu_e\bar{\nu}_\mu$ $e^-\gamma$ $e^-e^+e^-$ $e^-\gamma\gamma$	(98.6 ± 0.4)% [e](1.4)% (<9)%] (<1.9)$\times10^{-10}$ (<1.9)$\times10^{-9}$ (<5)$\times10^{-8}$	53 53 53 53 53 53
ν_τ	$J=\frac{1}{2}$	<250				
			τ^- ↓ (or $\tau^+ \to$CC)			
τ	$J=\frac{1}{2}$	1784.2 ±3.2 m^2=3.18	$(4.6\pm1.9)\times10^{-13}$ $c\tau$=0.014	$\mu^-\bar{\nu}\nu$ $e^-\bar{\nu}\nu$ hadron$^-$ neutrals 3(hadron$^\pm$) neutrals 5(hadron$^\pm$) neutrals †[3(hadron$^\pm$)ν 3(hadron$^\pm$)ν($\geq1\gamma$) †[$\pi^-\nu$ $\rho^-\nu$ K^- neutrals $\pi^-\pi^-\pi^+\nu$ $\pi^-\pi^-\pi^+(\geq0\pi^0)\nu$ †[$K^{*-}(892)\nu$ $K^{*-}(1430)\nu$ $\pi^-\rho^0\nu$	(18.5 ± 1.2)% (16.2 ± 1.0)% (37.0 ± 3.2)% (28.4 ± 3.0)% (<6)% (13 ± 8)% (15 ± 7)%] (10.7 ± 1.6)% (21.6 ± 3.6)% (small) (7 ± 5)% (18 ± 7)%] (1.7 ± 0.7)% (<0.9)% (5.4 ± 1.7)%]	889 892 887 726 864 864 669 316 718

(continued next page)

Stable Particle Table *(cont'd)*

Particle	$I^G(J^P)C_n$ [a]	Mass [b] (MeV) Mass^2 (GeV^2)	Mean life [b] (sec) $c\tau$ (cm)	Partial decay mode: Mode	Fraction [b]	p or p_{max} [c] (MeV/c)
				$\tau^- \rightarrow$ (or $\tau^+ \rightarrow$CC)		
τ (continued)				e^- chgd.parts.		
				$+ \mu^-$ chgd.parts.	(<4)%	
				$\mu^-\gamma$	(<5.5)$\times10^{-4}$	889
				$e^-\gamma$	(<6.4)$\times10^{-4}$	892
				$\mu^-\mu^+\mu^-$	(<4.9)$\times10^{-4}$	876
				$e^-\mu^+\mu^-$	(<3.3)$\times10^{-4}$	886
				$\mu^-e^+e^-$	(<4.4)$\times10^{-4}$	889
				$e^-e^+e^-$	(<4.0)$\times10^{-4}$	892
				$\mu^-\pi^0$	(<8.2)$\times10^{-4}$	884
				$e^-\pi^0$	(<2.1)$\times10^{-3}$	887
				μ^-K^0	(<1.0)$\times10^{-3}$	819
				e^-K^0	(<1.3)$\times10^{-3}$	823
				$\mu^-\rho^0$	(<4.4)$\times10^{-4}$	722
				$e^-\rho^0$	(<3.7)$\times10^{-4}$	726
NONSTRANGE MESONS [a]						
				$\pi^+ \rightarrow$ (or $\pi^- \rightarrow$CC)		
$\pi^\pm$	$1^-(0^-)$	139.5673 ±0.0007	2.6030×10^{-8} ±0.0023	$\mu^+\nu$	100%	30
		m^2=0.0194790	$c\tau$=780.4	$e^+\nu$	(1.267±0.023)$\times10^{-4}$	70
		$m_{\pi^\pm}-m_{\mu^\pm}$ =33.9079 ±0.0007	$(\tau^+ - \tau^-)/\bar{\tau}$= (0.05±0.07)% (test of CPT)	$\mu^+\nu\gamma$	[e] (1.24± 0.25)$\times10^{-4}$	30
				$e^+\nu\gamma$	[e] (5.6 ± 0.7)$\times10^{-8}$	70
				$e^+\nu\pi^0$	(1.02± 0.07)$\times10^{-8}$	5
				$e^+\nu e^+e^-$	(<5)$\times10^{-9}$	70
π^0	$1^-(0^-)+$	134.9630 ±0.0038	0.83×10^{-16} ±0.06 S=1.8*	$\gamma\gamma$	(*98.787* ± *0.030*)%	67
		m^2=0.018215	$c\tau$=2.5×10^{-6}	γe^+e^-	(*1.213*)%	67
		$m_{\pi^\pm}-m_{\pi^0}$ =4.6043 ±0.0037		$\gamma\gamma\gamma$	(<3.8)$\times10^{-7}$	67
				$e^+e^-e^+e^-$	[f] (3.32)$\times10^{-5}$	67
				$\gamma\gamma\gamma\gamma$	(<4)$\times10^{-6}$	67
				e^+e^-	($2.2\ ^{+\ 2.4}_{-\ 1.1}$)$\times10^{-7}$	67
				$\nu\nu$	(<2.4)$\times10^{-5}$	67
η	$0^+(0^-)+$	548.8 ±0.6 S=1.4* m^2=0.3012	Γ=(0.83±0.12)keV	$\gamma\gamma$	(*39.1* ± *0.8*)%	274
			Neutral decays (70.9±0.7)%	$3\pi^0$	(*31.8* ± *0.8*)% S=1.1*	180
				$\pi^0\gamma\gamma$	[g] (*<0.3*)%	258
			Charged decays (29.1±0.7)%	$\pi^+\pi^-\pi^0$	(23.7 ± 0.5)%	175
				$\pi^+\pi^-\gamma$	(4.91± 0.13)%	236
				$e^+e^-\gamma$	(0.50± 0.12)%	274
				$\mu^+\mu^-\gamma$	(*3.1* ± *0.4*)$\times10^{-4}$	253
				e^+e^-	(<3)$\times10^{-4}$	274
				$\mu^+\mu^-$	(*6.5* ± *2.1*)$\times10^{-6}$	253
				$\pi^+\pi^-e^+e^-$	(0.13± 0.13)%	236
				$\pi^+\pi^-\gamma\gamma$	(<0.21)%	236
				$\pi^+\pi^-\pi^0\gamma$	(<6)$\times10^{-4}$	175
				$\pi^+\pi^-$	(<0.15)%	236
				$\pi^0e^+e^-$	(<5)$\times10^{-5}$	258
				$\pi^0\mu^+\mu^-$	(<5)$\times10^{-6}$	211
				$\pi^0\mu^+\mu^-\gamma$	(<3)$\times10^{-6}$	211

Stable Particle Table *(cont'd)*

Particle	$I^G(J^P)C_n$ [a]	Mass [b] (MeV) Mass^2 (GeV^2)	Mean life [b] (sec) $c\tau$ (cm)	Partial decay mode: Mode	Fraction [b]	p or p_{max} [c] (MeV/c)
			STRANGE MESONS [a]			
			K^+ ↓ (or $K^- \to CC$)			
$K^\pm$	$\frac{1}{2}(0^-)$	493.667 ±0.015 m^2=0.2437	1.2371×10^{-8} ±0.0026 S=1.9* $c\tau$=370.9 $(\tau^+ - \tau^-)/\bar{\tau}$= (0.11±0.09)% (test of CPT) S=1.2*	$\mu^+\nu$	(63.50± 0.16)%	236
				$\pi^+\pi^0$	(21.16± 0.15)%	205
				$\pi^+\pi^+\pi^-$	(5.59± 0.03)% S=1.1*	125
				$\pi^+\pi^0\pi^0$	(1.73± 0.05)% S=1.4*	133
				$\pi^0\mu^+\nu$	(3.20± 0.09)% S=1.7*	215
				$\pi^0e^+\nu$	(4.82± 0.05)% S=1.1*	228
				$\mu^+\nu\gamma$	[e](5.8 ± 3.5)$\times10^{-3}$	236
				$\pi^0\pi^0e^+\nu$	($1.8 \pm^{2.4}_{0.6}$)$\times10^{-5}$	207
	$m_{K^\pm}-m_{K^0}$=−4.01 ±0.13 S=1.1*			$\pi^+\pi^-e^+\nu$	(3.90± 0.15)$\times10^{-5}$	203
				$\pi^+\pi^+e^-\bar{\nu}$	(<1.2)$\times10^{-8}$	203
				$\pi^+\pi^-\mu^+\nu$	(1.4 ± 0.9)$\times10^{-5}$	151
				$\pi^+\pi^+\mu^-\bar{\nu}$	(<3.0)$\times10^{-6}$	151
				$e^+\nu$	(1.54± 0.07)$\times10^{-5}$	247
				$e^+\nu\gamma$ (SD+) [h]	(1.52± 0.23)$\times10^{-5}$	247
				$e^+\nu\gamma$ (SD−) [h]	(<1.6)$\times10^{-4}$	247
				$\pi^+\pi^0\gamma$	[i,e](2.75± 0.16)$\times10^{-4}$	205
				$\pi^+\pi^+\pi^-\gamma$	[e](1.0 ± 0.4)$\times10^{-4}$	125
				$\pi^0\mu^+\nu\gamma$	[e](<6)$\times10^{-5}$	215
				$\pi^0e^+\nu\gamma$	[e](3.7 ± 1.4)$\times10^{-4}$	228
				$\pi^+e^+e^-$	(2.7 ± 0.5)$\times10^{-7}$	227
				$\pi^-e^+e^+$	(<1)$\times10^{-8}$	227
				$\pi^+\mu^+\mu^-$	(<2.4)$\times10^{-6}$	172
				$\pi^+\gamma\gamma$	[e](<3.5)$\times10^{-5}$	227
				$\pi^+\gamma\gamma\gamma$	[e](<3.0)$\times10^{-4}$	227
				$\pi^+\nu\bar{\nu}$	(<1.4)$\times10^{-7}$	227
				$\pi^+\gamma$	(<4)$\times10^{-6}$	227
				$\pi^\mp e^+\mu^\pm$	(<7)$\times10^{-9}$	214
				$\pi^+e^-\mu^+$	(<5)$\times10^{-9}$	214
				$e^+\nu\nu\bar{\nu}$	(<6)$\times10^{-5}$	247
				$\mu^+\nu\nu\bar{\nu}$	(<6)$\times10^{-6}$	236
				$\mu^+\nu e^+e^-$	(11 ± 3)$\times10^{-7}$	236
				$\mu^-\nu e^+e^+$	(<2.0)$\times10^{-8}$	236
				$e^+\nu e^+e^-$	($2 \pm^{2}_{1}$)$\times10^{-7}$	247
				$\mu^+\nu_e$	(<4)$\times10^{-3}$	236
K^0 $\bar{K}^0$	$\frac{1}{2}(0^-)$	497.67 ±0.13 S=1.1* m^2=0.24768		50 % K_{Short}, 50% K_{Long}		
K^0_S	$\frac{1}{2}(0^-)$		0.8923×10^{-10} ±0.0022 $c\tau$=2.675	$\pi^+\pi^-$	(68.61± 0.24)% S=1.1*	206
				$\pi^0\pi^0$	(31.39)%	209
				$\pi^+\pi^-\gamma$	[e](1.85± 0.10)$\times10^{-3}$	206
				$\mu^+\mu^-$	(<3.2)$\times10^{-7}$	225
				e^+e^-	(<3.4)$\times10^{-4}$	249
				$\gamma\gamma$	(<0.4)$\times10^{-3}$	249

Stable Particle Table *(cont'd)*

Particle	$I^G(J^P)C_n$ [a]	Mass [b] (MeV) Mass^2 (GeV^2)	Mean life [b] (sec) $c\tau$ (cm)	Partial decay mode: Mode	Fraction [b]		p or p_{max} [c] (MeV/c)
K^0_L	$\frac{1}{2}(0^-)$		5.183×10^{-8} ±0.040 $c\tau=1554$	$\pi^0\pi^0\pi^0$	(21.5 ± 1.0)%	S=1.7*	139
				$\pi^+\pi^-\pi^0$	(12.39± 0.20)%	S=1.3*	133
				$\pi^\pm\mu^\mp\nu$	(27.1 ± 0.4)%	S=1.4*	216
				$\pi^\pm e^\mp\nu$	(38.7 ± 0.5)%	S=1.5*	229
				†[$\pi e\nu\gamma$	[e](1.3 ± 0.8)%]		229
	$m_{K_L}-m_{K_S}$ = 0.5349×10^{10} $\hbar$ sec^{-1} ±0.0022			$\pi^+\pi^-$	[j](0.203± 0.005)%	S=1.1*	206
				$\pi^0\pi^0$	[j](0.094± 0.018)%	S=1.5*	209
				$\pi^+\pi^-\gamma$	[e](4.41± 0.32)$\times10^{-5}$		206
				$\pi^0\gamma\gamma$	(<2.4)$\times10^{-4}$		231
				$\gamma\gamma$	(4.9 ± 0.4)$\times10^{-4}$		249
				$e\mu$	[k](<6)$\times10^{-6}$		238
				$\mu^+\mu^-$	(9.1 ± 1.9)$\times10^{-9}$		225
				$\mu^+\mu^-\gamma$	(2.8 ± 2.8)$\times10^{-7}$		225
				$\pi^0\mu^+\mu^-$	(<1.2)$\times10^{-6}$		177
				e^+e^-	[k](<2.0)$\times10^{-7}$		249
				$e^+e^-\gamma$	(1.7 ± 0.9)$\times10^{-5}$		249
				$\pi^0e^+e^-$	(<2.3)$\times10^{-6}$		231
				$\pi^+\pi^-e^+e^-$	(<8.8)$\times10^{-6}$		206
				$\pi^0\pi^\pm e^\mp\nu$	(6.2 ± 2.0)$\times10^{-5}$		207

CHARMED NONSTRANGE MESONS [a]

D^+ → (or D^- → CC)

$D^\pm$	$\frac{1}{2}(0^-)$	1869.4 ±0.6 m^2=3.495	$(9.1^{+2.2}_{-1.5})\times10^{-13}$ $c\tau=0.027$	$e^\pm$ anything	(19 $^{+4}_{-3}$)%		
				K^- anything	(16 ± 4)%		
				$\bar{K}^0$ any + K^0 any	(48 ± 15)%		
				K^+ anything	(6.0 ± 3.3)%		
		$m_{D^\pm}-m_{D^0}$= 4.7 ±0.3		η anything	[l](< 13)%		
				†[$K^-\pi^+\pi^+$	(4.6 ± 1.1)%		845
				$K^-\pi^+\pi^+\pi^+\pi^-$	(<4)%		772
				$\bar{K}^0\pi^+$	(1.8 ± 0.5)%		862
				$\bar{K}^0\pi^+\pi^0$	(13 ± 8)%		845
				$\bar{K}^0\pi^+\pi^+\pi^-$	(8.4 ± 3.5)%		814
				$\bar{K}^0K^+$	(0.45± 0.30)%		792
				$K^+K^-\pi^+$	(<0.6)%		744
				$K^+\pi^+\pi^-$	(<0.23)%		845
				$\pi^+\pi^0$	(<0.5)%		925
				$\pi^+\pi^+\pi^-$	(<0.37)%]		908
				†[$\bar{K}^{*0}\pi^+$	(<3.7)%]		714

D^0 → (or $\bar{D}^0$ → CC)

D^0 $\bar{D}^0$	$\frac{1}{2}(0^-)$	1864.7 ±0.6 m^2=3.477	$(4.8\ ^{+2.4}_{-1.5})\times10^{-13}$ $c\tau=0.014$	$e^\pm$ anything	(<6)%		
				K^- anything	(44 ± 10)%	S=1.3*	
				$\bar{K}^0$ any+ K^0 any	(33 ± 10)%		
				K^+ anything	(8 ± 3)%		
				η anything	[l](< 13)%		
				†[$K^-\pi^+$	(*2.4 ± 0.4*)%		861
				$K^-\pi^+\pi^0$	(9.3 ± 2.8)%		844
				$K^-\pi^+\pi^+\pi^-$	(*4.5 ± 1.3*)%	S=1.4*	812
				$K^-\pi^+\pi^0\pi^0$	(seen)		815
				$\bar{K}^0\pi^0$	(2.2 ± 1.1)%		860
				$\bar{K}^0\pi^+\pi^-$	(4.2 ± 0.8)%		842
				$\pi^+\pi^-$	(7.9 ± 3.8)$\times10^{-4}$		922
				$\pi^+\pi^+\pi^-\pi^-$	(<9)$\times10^{-4}$		768
				K^+K^-	(2.7 ± 0.8)$\times10^{-3}$]		791
				†[$K^{*-}\pi^+$	(3.4 ± 1.4)%		711
				$\bar{K}^{*0}\pi^0$	(1.4 $^{+2.3}_{-1.4}$)%		711
				$K^-\rho^+$	(7.2 $^{+3.0}_{-3.1}$)%		679
				$\bar{K}^0\rho^0$	(0.1 $^{+0.6}_{-0.1}$)%]		677
		$\frac{\Gamma(D^0\to\bar{D}^0\to K^+\pi^-)}{\Gamma(D^0\to K\pi)}$ < 0.16					

Stable Particle Table *(cont'd)*

Particle	$I^G(J^P)C_n$ [a]	Mass [b] (MeV) $Mass^2$ (GeV^2)	Mean life [b] (sec) $c\tau$ (cm)	Partial decay mode: Mode	Fraction [b]	p or p_{max} [c] (MeV/c)
CHARMED STRANGE MESON [a]						
$F^{\pm}$	$0(0^-)$ [m]	2021 ±15	$(2.2^{+2.8}_{-1.1})\times10^{-13}$	$F^+ \rightarrow$ ↓ (or $F^- \rightarrow$ CC)		
				$\eta\pi^+$	(seen)	930
				$\eta\pi^+\pi^+\pi^-$	(seen)	885
				$\eta'\pi^+\pi^+\pi^-$	(seen)	713
				$\rho^+\phi$	(seen)	467
→ B						
NONSTRANGE BARYONS [a]						
p	$\frac{1}{2}(\frac{1}{2}^+)$	938.2796 ±0.0027	stable ($\gtrsim8\times10^{30}$y)	stable		
		m^2=0.880369		$\lvert q_p\rvert-\lvert q_e\rvert < 10^{-21}\lvert q_e\rvert^n$		
n	$\frac{1}{2}(\frac{1}{2}^+)$	939.5731 ±0.0027	925±11	$pe^-\bar{\nu}$	100%	1
		m^2=0.882798	$c\tau=2.77\times10^{13}$	$p\nu\bar{\nu}$ (chg.noncons.)	(<9)$\times10^{-24}$	1
		$m_p-m_n=-1.29343$ ±0.00004		$\lvert q_n\rvert < 10^{-21}\lvert q_e\rvert^n$		
STRANGENESS -1 BARYONS [a]						
Λ	$0(\frac{1}{2}^+)$	1115.60 ±0.05	2.632×10^{-10} ±0.020 S=1.6*	$p\pi^-$	(64.2 ± 0.5)%	100
		S=1.2*		$n\pi^0$	(35.8 ± 0.5)%	104
		m^2=1.2446	$c\tau=7.89$	$pe^-\nu$	(8.35± 0.15)$\times10^{-4}$	163
		$m_\Lambda-m_{\Sigma^0}=-76.86$ ±0.08		$p\mu^-\nu$	(1.57± 0.35)$\times10^{-4}$	131
				$p\pi^-\gamma$	[e](8.5 ± 1.4)$\times10^{-4}$	100
Σ^+	$1(\frac{1}{2}^+)$	1189.36 ±0.06	0.800×10^{-10} ±0.004	$p\pi^0$	(51.64)%	189
		S=1.8*		$n\pi^+$	(48.36± 0.30)%	185
		m^2=1.4146	$c\tau=2.40$	$p\gamma$	(1.20± 0.13)$\times10^{-3}$ S=1.4*	225
				$n\pi^+\gamma$	[e](4.5 ± 0.5)$\times10^{-4}$	185
				$\Lambda e^+\nu$	(2.0 ± 0.5)$\times10^{-5}$	71
		$m_{\Sigma^+}-m_{\Sigma^-}=-7.97$ ±0.07		$n\mu^+\nu$	(<3.0)$\times10^{-5}$	202
		S=1.3*		$ne^+\nu$	(<5)$\times10^{-6}$	224
			$\frac{\Gamma(\Sigma^+\rightarrow \ell^+n\nu)}{\Gamma(\Sigma^-\rightarrow \ell^-n\nu)}$ <.04	pe^+e^-	(<7)$\times10^{-6}$	225
Σ^0	$1(\frac{1}{2}^+)$ [p]	1192.46 ±0.08	5.8×10^{-20} ±1.3	$\Lambda\gamma$	100%	74
		m^2=1.4220	$c\tau=1.7\times10^{-9}$	Λe^+e^-	[g](5.45)$\times10^{-3}$	74
				$\Lambda\gamma\gamma$	(<3)%	74
Σ^-	$1(\frac{1}{2}^+)$	1197.34 ±0.05	1.482×10^{-10} ±0.011 S=1.3*	$n\pi^-$	100%	193
		m^2=1.4336	$c\tau=4.44$	$ne^-\nu$	(1.08± 0.04)$\times10^{-3}$	230
				$n\mu^-\nu$	(0.45± 0.04)$\times10^{-3}$	210
				$\Lambda e^-\nu$	(0.61± 0.05)$\times10^{-4}$	79
		$m_{\Sigma^0}-m_{\Sigma^-}=-4.88$ ±0.06		$n\pi^-\gamma$	[e](4.6 ± 0.6)$\times10^{-4}$	193

Stable Particle Table *(cont'd)*

Particle	$I^G(J^P)C_n$ [a]	Mass [b] (MeV) Mass^2 (GeV^2)	Mean life [b] (sec) $c\tau$ (cm)	Partial decay mode: Mode	Fraction [b]	p or p_{max} [c] (MeV/c)
STRANGENESS −2 BARYONS [a]						
Ξ^0	$\frac{1}{2}(\frac{1}{2}^+)$ [q]	1314.9	2.90×10^{-10}	$\Lambda\pi^0$	100%	135
		±0.6	±0.10	$\Lambda\gamma$	(0.5 ± 0.5)%	184
		m^2=1.729	$c\tau$=8.69	$\Sigma^0\gamma$	(<7)%	117
				$p\pi^-$	(<3.6)$\times10^{-5}$	299
				$pe^-\nu$	(<1.3)$\times10^{-3}$	323
	$m_{\Xi^0}-m_{\Xi^-}$ =−6.4			$\Sigma^+e^-\nu$	(<1.1)$\times10^{-3}$	120
	±0.6			$\Sigma^-e^+\nu$	(<0.9)$\times10^{-3}$	112
				$\Sigma^+\mu^-\nu$	(<1.1)$\times10^{-3}$	65
				$\Sigma^-\mu^+\nu$	(<0.9)$\times10^{-3}$	49
				$p\mu^-\nu$	(<1.3)$\times10^{-3}$	309
Ξ^-	$\frac{1}{2}(\frac{1}{2}^+)$ [q]	1321.32	1.641×10^{-10}	$\Lambda\pi^-$	100%	139
		±0.13	±0.016	$\Lambda e^-\nu$	(2.9 ± 1.1)$\times10^{-4}$	190
		m^2=1.7459	$c\tau$=4.92	$\Sigma^0e^-\nu$	(<1.4)$\times10^{-4}$	123
				$\Lambda\mu^-\nu$	(3.5 ± 3.5)$\times10^{-4}$	163
				$\Sigma^0\mu^-\nu$	(<8)$\times10^{-4}$	70
				$n\pi^-$	(<1.1)$\times10^{-3}$	303
				$ne^-\nu$	(<3.2)$\times10^{-3}$	327
				$n\mu^-\nu$	(<1.5)%	313
				$\Sigma^-\gamma$	(<1.2)$\times10^{-3}$	118
				$p\pi^-\pi^-$	(<4)$\times10^{-4}$	223
				$p\pi^-e^-\nu$	(<4)$\times10^{-4}$	304
				$p\pi^-\mu^-\nu$	(<4)$\times10^{-4}$	250
				$\Xi^0e^-\nu$	(<2.3)$\times10^{-3}$	6
STRANGENESS −3 BARYON [a]						
Ω^-	$0(\frac{3}{2}^+)$ [q]	1672.45	0.819×10^{-10}	ΛK^-	(68.6 ± 1.3)%	211
		±0.32	±0.027	$\Xi^0\pi^-$	(23.4 ± 1.3)%	294
		m^2=2.7971	$c\tau$=2.46	$\Xi^-\pi^0$	(8.0 ± 0.8)%	290
				$\Xi^0e^-\nu$	(~1)%	319
				$\Xi^0(1530)\pi^-$	(~2)$\times10^{-3}$	
				$\Lambda\pi^-$	(<1.3)$\times10^{-3}$	449
				$\Xi^-\gamma$	(<3.1)$\times10^{-3}$	314
NONSTRANGE CHARMED BARYON [a]						
Λ_c^+	$0(\frac{1}{2}^+)$ [r]	2282.2	$(1.1^{+0.9}_{-0.4})\times10^{-13}$	$pK^-\pi^+$	(2.2 ± 1.0)%	820
		±3.1	$c\tau$=0.003	$p\bar{K}^0$	(1.1 ± 0.7)%	870
		S=1.8*		$p\bar{K}^0\pi^+\pi^-$	(<4)%	751
		m^2=5.21		$\Lambda\pi^+$	(0.6 ± 0.5)%	861
				$\Lambda\pi^+\pi^+\pi^-$	(< 3.1, seen)%	804
				$\Sigma^0\pi^+$	(seen)	822
				†[pK^{*0}	(0.48± 0.30)%	682
				$\Delta^{++}K^-$	(0.45± 0.27)%	707
				$pK^{*-}\pi^+$	(seen)]	576
				e^+ anything	(4.5 ± 1.7)%	
				†[pe^+ anything	(1.8 ± 0.9)%	
				Λe^+ anything	(1.1 ± 0.8)%]	

→ Λ_b^0
→ searches for massive neutrinos and lepton mixing
→ ν bounds from astrophysics and cosmology
→ heavy lepton searches
→ weak gauge boson searches
→ free quark searches
→ magnetic monopole searches
→ charm searches and evidence
→ bottom hadron searches
→ top hadron searches
→ other stable particle searches

ADDENDUM TO

Stable Particle Table

e

Magnetic Moment

e^{w} 1.001 159 652 209 ±.000 000 000 031 $\frac{e\hbar}{2m_e c}$

μ

μ^{w} 1.001 165 924 ±.000 000 009 $\frac{e\hbar}{2m_\mu c}$

μ Decay parameters[s]

$\rho = 0.752 \pm 0.003$ $\eta = -0.12 \pm 0.21$

$\xi \cdot P_\mu = 0.972 \pm 0.014$ $\delta = 0.755 \pm 0.009$ $h = 1.01 \pm 0.06$

$|g_A/g_V| = 0.86^{+0.33}_{-0.11}$ $\phi = 180° \pm 15°$

η

Mode	Left-right asymmetry	Sextant asymmetry	Quadrant asymmetry
$\pi^+\pi^-\pi^0$	(0.12±.17)%	(0.19±0.16)%	(−0.17±0.17)%
$\pi^+\pi^-\gamma$	(0.88±.40)%		

$\beta = 0.047 \pm 0.062$

$K^\pm$

Mode	Partial rate (sec^{-1})	
$\mu\nu$	$(51.33 \pm 0.17) \times 10^6$	S=1.2*
$\pi\pi^0$	$(17.10 \pm 0.13) \times 10^6$	S=1.1*
$\pi\pi^+\pi^-$	$(4.52 \pm 0.02) \times 10^6$	S=1.1*
$\pi\pi^0\pi^0$	$(1.40 \pm 0.04) \times 10^6$	S=1.4*
$\mu\pi^0\nu$	$(2.58 \pm 0.07) \times 10^6$	S=1.7*
$e\pi^0\nu$	$(3.90 \pm 0.04) \times 10^6$	S=1.1*

Slope parameters for $K \to 3\pi$[t]

$K^+ \to \pi^+\pi^+\pi^-$	g=−0.215±.004	S=1.4*
$K^- \to \pi^-\pi^-\pi^+$	g=−0.217±.007	S=2.5*
$K^\pm \to \pi^0\pi^0\pi^\pm$	g= 0.607±.030	S=1.3*
$K_L^0 \to \pi^+\pi^-\pi^0$	g= 0.670±.014	S=1.6*

See Data Card Listings for quadratic coefficients.

Form factors for $K_{\ell 3}$ decays

$K^+_{\ell 3}$: λ_+^e = 0.029±.004; λ_+^μ = 0.026±.008 S=1.5*; λ_0^μ = −0.003±.007 S=1.5*

$K^0_{\ell 3}$: λ_+^e = 0.0300±.0016 S=1.2*; λ_+^μ = 0.034 ±.006 S=2.5*; λ_0^μ = 0.020 ±.007 S=2.5*

See Data Card Listings for ξ, f_s, and f_t.

K^0_S

$\pi^+\pi^-$	[j] (0.7689±.0033)×10^{10}	
$\pi^0\pi^0$	[j] (0.3517±.0029)×10^{10}	S=1.1*

K^0_L

$\pi^0\pi^0\pi^0$	(4.14±0.20)×10^6	S=1.7*
$\pi^+\pi^-\pi^0$	(2.39±0.04)×10^6	S=1.2*
$\pi\mu\nu$	(5.23±0.09)×10^6	S=1.3*
$\pi e\nu$	(7.47±0.11)×10^6	S=1.3*
$\pi^+\pi^-$	[j] (3.91±0.10)×10^4	S=1.1*
$\pi^0\pi^0$	[j] (1.81±0.36)×10^4	S=1.5*

CP violation parameters[u,j]

$|\eta_{+-}| = (2.274 \pm .022) \times 10^{-3}$ $|\eta_{00}| = (2.33 \pm .08) \times 10^{-3}$ S=1.1*

$\phi_{+-} = (44.6 \pm 1.2)°$ $\phi_{00} = (54 \pm 5)°$

$|\eta_{+-0}|^2 < 0.12$ $|\eta_{000}|^2 < 0.28$ $\delta = (0.330 \pm .012)\%$

$\Delta S = -\Delta Q$

Re x = 0.009±.020 S=1.4* Im x = −0.004±.026 S=1.1*

p

Magnetic moment ($e\hbar/2m_p c$): 2.7928456 ±.0000011

n

n^{w} −1.91304184 ±.00000088

Decay parameters[v]

	Measured α	Measured φ(degree)	Derived γ	Derived Δ(degree)	Coupling Constant Ratios
$pe^-\nu$					$g_A/g_V = -1.255 \pm 0.006$; $\phi_{AV} = (180.11 \pm 0.17)°$

Λ

Λ^{w} −0.613 ±.004

$p\pi^-$	0.642±0.013	(−6.5±3.5)°	0.76	(7.7±4.1)°	
$n\pi^0$	0.646±0.044				
$pe\nu$					$g_A/g_V = -0.690 \pm 0.034$ S=1.4*

Σ^+

2.33 ±.13

$p\pi^0$	−0.979±0.016	(36±34)°	0.17	(187±6)°	
$n\pi^+$	+0.068±0.013	(167±20)°	−0.97	$(-73^{+134}_{-10})°$	
$p\gamma$	−0.72±0.29	S=1.1*			

Σ^-

−1.41 ±.25

$n\pi^-$	−0.068±0.008	(10±15)°	0.98	$(249^{+12}_{-116})°$	$g_A/g_V = \pm(0.385 \pm 0.070)$ S=2.3*
$ne^-\nu$					$g_V/g_A = 0.14 \pm 0.24$ S=1.6* $g_{WM}/g_A = 2.4 \pm 1.7$
$\Lambda e^-\nu$					

Ξ^0

−1.250 ±.014

$\Lambda\pi^0$	−0.413±0.022 S=2.0*	(21±12)°	0.85	$(218^{+12}_{-18})°$	

Ξ^-

−1.85 ±.75

$\Lambda\pi^-$	*−0.434±0.015* S=1.4*	(2±6)° S=1.1*	0.90	(184±12)°	

Ω⁻

ΛK^-	*−0.10±0.38* S=1.2*				

Stable Particle Table *(cont'd)*

→ Indicates an entry in the Stable Particle Data Card Listings not entered in the Stable Particle Table.

* S = Scale factor = $\sqrt{\chi^2/(N-1)}$, where N ≈ number of experiments. S should be ≈1. If S > 1, we have enlarged the error of the mean, $\delta\bar{x}$; i.e., $\delta\bar{x} \to S\delta\bar{x}$. This convention is still inadequate, since if S ≫ 1 the experiments are probably inconsistent, and therefore the real uncertainty is probably even greater than $S\delta\bar{x}$. See text, and ideograms in Stable Particle Data Card Listings.

† Square brackets indicate subreactions of some previous unbracketed decay mode(s). Reactions in one set of brackets may overlap with reactions in another set of brackets.

a. The baryon number B, strangeness S, and charm C of the hadrons which appear in the tables are as follows:

Mesons (B=0)	S	C	Baryons (B=1)	S	C
π,η	0	0	p,n	0	0
K^+,K^0	+1	0	Λ,Σ	−1	0
$K^-,\bar{K}^0$	−1	0	Ξ	−2	0
D^+,D^0	0	+1	Ω^-	−3	0
$D^-,\bar{D}^0$	0	−1	Λ_c^+	0	+1
F^+	+1	+1			
F^-	−1	−1			

b. Quoted upper limits correspond to a 90% confidence level.

c. In decays with more than two bodies, p_{max} is the maximum momentum that any particle can have.

d. 99% confidence level. Lower limit from same experiment, > 14 eV, not yet confirmed. See Stable Particle Data Card Listings.

e. See Stable Particle Data Card Listings for energy limits used in this measurement.

f. Theoretical value; see also Stable Particle Data Card Listings.

g. See note in Stable Particle Data Card Listings.

h. Structure-dependent part with positive (SD+) and negative (SD−) photon helicity.

i. The direct emission branching fraction is $(1.56\pm.35)\times10^{-5}$.

j. The $K_S^0 \to \pi\pi$ and $K_L^0 \to \pi\pi$ rates (and branching fractions) are from our branching fraction and rate fits and do not include results of K_L^0-K_S^0 interference experiments. The $|\eta_{+-}|$ and $|\eta_{00}|$ values given in the addendum are these rates combined with the $|\eta_{+-}|$ and $|\eta_{00}|$ results from interference experiments.

k. The stronger limit $<2\times10^{-9}$ of Clark et al., Phys. Rev. Lett. **26**, 1667 (1971) is not listed because of possible (but unknown) systematic errors. See Stable Particle Data Card Listings.

ℓ. This is a weighted average of $D^\pm$ (44%) and D^0 (56%) branching fractions.

m. Quantum numbers shown are favored but not yet established. See Stable Particle Data Card Listings.

n. Limit from neutrality-of-matter experiments. Assumes $|q_n| = |q_p| - |q_e|$.

p. J^P not measured for Σ^0. Assumed same as $\Sigma^\pm$ to allow isotriplet association.

q. P for Ξ and J^P for Ω^- not yet measured. Values shown are SU(3) predictions.

r. J^P for Λ_c^+ not yet measured. Values shown are SU(4) predictions.

s. $|g_A/g_V|$ defined by $g_A^2 = |C_A|^2+|C'_A|^2$, $g_V^2 = |C_V|^2+|C'_V|^2$, and $\Sigma\langle\bar{e}|\Gamma_i|\mu\rangle\langle\bar{\nu}|\Gamma_i(C_i+C'_i\gamma_5)|\nu\rangle$; ϕ defined by $\cos\phi = -\mathrm{Re}(C_A^* C'_V + C'_A C_V^*)/g_A g_V$, P_μ is muon longitudinal polarization [for more details, see text Section VI A].

t. The definition of the slope parameter of the Dalitz plot is as follows [see also text Section VI B.1]: $|M|^2 = 1 + g\left(\frac{s_3-s_0}{m_{\pi^+}^2}\right)$

u. The definition for the CP violation parameters is as follows [see also text Section VI B.3]:

$$\eta_{+-} = |\eta_{+-}|e^{i\phi_{+-}} = \frac{A(K_L^0\to\pi^+\pi^-)}{A(K_S^0\to\pi^+\pi^-)} \qquad \eta_{00} = |\eta_{00}|e^{i\phi_{00}} = \frac{A(K_L^0\to\pi^0\pi^0)}{A(K_S^0\to\pi^0\pi^0)}$$

$$\delta = \frac{\Gamma(K_L^0\to\ell^+)-\Gamma(K_L^0\to\ell^-)}{\Gamma(K_L^0\to\ell^+)+\Gamma(K_L^0\to\ell^-)}, \quad |\eta_{+-0}|^2 = \frac{\Gamma(K_S^0\to\pi^+\pi^-\pi^0)^{\text{CP viol.}}}{\Gamma(K_L^0\to\pi^+\pi^-\pi^0)}, \quad |\eta_{000}|^2 = \frac{\Gamma(K_S^0\to\pi^0\pi^0\pi^0)^{\text{CP viol.}}}{\Gamma(K_L^0\to\pi^0\pi^0\pi^0)}$$

v. The definition of these quantities is as follows [for more details on sign convention, see text Section VI B]:

$$\alpha = \frac{2|s||p|\cos\Delta}{|s|^2+|p|^2} \qquad \beta = \sqrt{1-\alpha^2}\sin\phi$$

$$\beta = \frac{-2|s||p|\sin\Delta}{|s|^2+|p|^2} \qquad \gamma = \sqrt{1-\alpha^2}\cos\phi$$

g_A, g_V, g_{WM} defined by $\langle B_f|\gamma_\lambda(g_V-g_A\gamma_5)+(g_{WM}/m_{B_i})\sigma^{\lambda\nu}q_\nu|B_i\rangle$

ϕ_{AV} defined by $g_A/g_V = |g_A/g_V|e^{i\phi_{AV}}$

w. For limits on electric dipole moment, see Data Card Listings. Forbidden by P and T invariance.

Meson Table

April 1982

In addition to the entries in the Meson Table, the Meson Data Card Listings contain all substantial claims for meson resonances. See contents of Meson Data Card Listings below.

Quantities in italics are new or have changed by more than one (old) standard deviation since April 1980.

J^P	G	0	1	½
N	+	ϵ	ρ	K^*
	−	ω/ϕ	δ	
A	+−	η	π	K

$I^G(J^P)C_n$	Mass M (MeV)	Full Width Γ (MeV)	M^2 $\pm\Gamma M$[a] (GeV^2)	Partial decay mode: Mode	Fraction(%) [Upper limits (%) are 90% CL]	p or p_{max}[b] (MeV/c)
NONSTRANGE MESONS						
$1^-(0^-)+$	139.57	0.0	0.019479	See Stable Particle Table		
	134.96	7.95 eV ±0.55 eV	0.018215			
$0^+(0^-)+$	548.8 ±0.6	0.83 keV ±0.12 keV	0.301 ±0.000	Neutral	70.9	See Stable
				Charged	29.1	Particle Table
$1^+(1^-)-$	*769*[‡] ±3[§]	*154*[‡] ±5[§]	0.591 ±0.118	$\pi\pi$	≈ 100	358
				$\pi\gamma$	*0.044 ±0.005*	372
				$\mu^+\mu^-$	0.0067 ±0.0012[d]	370
				e^+e^-	0.0043 ±0.0005[d]	384
				$\eta\gamma$	seen[‡]	189
M and Γ from neutral mode.				For upper limits, see footnote *e*		
$0^-(1^-)-$	782.6 ±0.2 S=1.1*	9.9 ±0.3	0.612 ±0.008	$\pi^+\pi^-\pi^0$	89.9 ±0.5	327
				$\pi^0\gamma$	8.7 ±0.5	380
				$\pi^+\pi^-$	1.4 ±0.2	366
				$\pi^0\mu^+\mu^-$	*0.010 ±0.002*	349
				e^+e^-	0.0072 ±0.0007 S=1.3*	391
				$\eta\gamma$	seen[‡]	199
				For upper limits, see footnote *f*		
$0^+(0^-)+^{‡}$	957.57 ±0.25	0.28 ±0.10	0.917 ±0.0003	$\eta\pi\pi$	65.3 ±1.6	231
				$\rho^0\gamma$	30.0 ±1.6	170
				$\omega\gamma$	2.8 ±0.5	159
				$\gamma\gamma$	1.9 ±0.2	479
				$\mu^+\mu^-\gamma$	*0.009 ±0.002*	467
				For upper limits, see footnote *g*		
$0^+(0^+)+$	*975*[c] ±4 S=1.4*	*33*[c] ±6	0.951 ±0.032	$\pi\pi$	*78 ±3*	467
				$K\bar{K}$	*22 ±3*	
See note on $\pi\pi$ and $K\bar{K}$ S wave.[‡]						
$1^-(0^+)+$	*983*[h] ±2	*54*[h] ±7	0.966 ±0.053	$\eta\pi$	seen	320
				$K\bar{K}$	seen	
$0^-(1^-)-$	1019.61 ±0.07	4.21 ±0.13	1.040 ±0.004	K^+K^-	49.1 ±1.0 S=1.3*	127
				$K_L K_S$	34.6 ±1.0 S=1.3*	111
				$\pi^+\pi^-\pi^0$ (incl. $\rho\pi$)	14.8 ±0.7 S=1.2*	462
				$\eta\gamma$	1.5 ±0.2	362
				$\pi^0\gamma$	0.14 ±0.05	501
				e^+e^-	0.031 ±0.001	510
				$\mu^+\mu^-$	0.025 ±0.003	499
				$\pi^+\pi^-$	*0.02 ±0.01*	490
				For upper limits, see footnote *i*		
$0^-(1^+)-$	*1190* ±60	*320* ±50	1.416 ±0.381	$\rho\pi$	*seen*	327
Seen in one experiment only.						
$1^+(1^+)-$	1233 ±10[§]	137 ±10[§]	1.52 ±0.17	$\omega\pi$	only mode seen	349
				[D/S amplitude ratio = 0.29 ±0.05]		
				For upper limits, see footnote *j*		

→

Meson Table *(cont'd)*

J^P	G	0	1	½	$I^G(J^P)C_n$	Mass M (MeV)	Full Width Γ (MeV)	M^2 $\pm\Gamma M^a$ (GeV^2)	Partial decay mode: Mode	Fraction(%) [Upper limits (%) are 90% CL]	p or p_{max} [b] (MeV/c)
N	+	ϵ	ρ	K^*							
	−	ω/ϕ	δ								
A	+−	η	π	K	⟼ *estab.*						
	f(1270)				$0^+(2^+)+$	1273 ±5§	179 ±20§	1.62 ±0.23	$\pi\pi$	83.1 ±1.9 S=1.4*	621
									$2\pi^+2\pi^-$	2.8 ±0.4 S=1.2*	558
									$K\bar{K}$	2.9 ±0.2 S=1.2*	397
									$\gamma\gamma$	*0.0016 ±0.0003*	637
									$\pi^+\pi^-2\pi^0$	seen	561
									For upper limits, see footnote *k*		
	$A_1(1270)$				$1^-(1^+)+$	*1275*‡ *±30*	*315*‡ *±45*	1.63 ±0.40	$\rho\pi$	*dominant*	389
									$\pi(\pi\pi)_{S\text{-wave}}$	*seen*	599
→	D(1285)				$0^+(1^+)+$	1283 ±5§	26 ±5§	1.65 ±0.03	$K\bar{K}\pi$	11 ±3	302
									$\eta\pi\pi$	49 ±6	482
									†[$\delta\pi$	36 ±7]	236
									4π (prob. $\rho\pi\pi$)‡	40 ±7	564
	$\epsilon(1300)$				$0^+(0^+)+$	~1300	200–600		$\pi\pi$	~90	635
									$K\bar{K}$	~10	418
									$\eta\eta$		348
	See note on $\pi\pi$ and $K\bar{K}$ S wave.‡										
	$\pi(1300)$				$1^-(0^-)+$	*1300*§ *±100*§	*200−600*		$\rho\pi$	*seen*	407
									$\pi(\pi\pi)_{S\text{-wave}}$	*seen*	612
	Not a well-established resonance.										
	$A_2(1320)$				$1^-(2^+)+$	1318 ±5§	*110* ±5§	1.74 ±0.14	$\rho\pi$	70.1 ±2.2	419
									$\eta\pi$	14.5 ±1.2	534
									$\omega\pi\pi$	10.6 ±2.5	361
									$K\bar{K}$	4.8 ±0.5	434
									$\eta'\pi$	< 2 (CL=97%)	286
									$\pi\gamma$	0.45 ±0.11	652
									$\gamma\gamma$	*0.0007 ±0.0004*	659
	E(1420)‡				$0^+(1^+)+$	1418 ±10§	52 ±10§	2.01 ±0.07	$K\bar{K}\pi$ (prob. $K^*\bar{K}+K\bar{K}^*$)	seen	423
									$\eta\pi\pi$	possibly seen	565
									†[$\delta\pi$	possibly seen]	348
	f'(1515)				$0^+(2^+)+$	1520 ±10§	75 ±10§	2.31 ±0.11	$K\bar{K}$	dominant	574
									$\pi\pi$	possibly seen	747
	$\rho'(1600)$				$1^+(1^-)-$	1600‡ ±20§	300‡ ±100§	2.56 ±0.48	4π (incl. $\rho\pi^+\pi^-$,$A_1\pi$)	large	738
									$\pi\pi$	< 30‡	788
									$K^*\bar{K}$ + $\bar{K}^*K$	~15	388
									$\eta\pi\pi$	~13	675
									$\bar{K}K$	~1	630
									e^+e^-	seen	800
→	$\omega(1670)$				$0^-(3^-)-$	1688 ±5	166 ±15§ S=1.1*	2.78 ±0.28	3π	seen	806
									†[$\rho\pi$	seen]	648
									5π	seen	740
									†[$\omega\pi\pi$ (prob. Bπ)	seen]	616
	$A_3(1680)$‡				$1^-(2^-)+$	*1680*§ *±30*§	250§ ±50§	2.82 ±0.42	$f\pi$	55 ±5	337
									$\rho\pi$	36 ±6	656
									$\pi(\pi\pi)_{S\text{-wave}}$	9 ±5	813
									For upper limits, see footnote *ℓ*		
	$\phi'(1680)$				$0^-(1^-)-$	*1684* *±15*§	*126* *±22*	2.84 ±0.21	$K^*\bar{K}$ + $\bar{K}^*K$	*dominant*	541
									$\omega\pi\pi$	*seen*	624
									$K\bar{K}$	*seen*	682
	g(1690)‡				$1^+(3^-)-$	1691 ±5§	200§ ±20§	2.86 ±0.34	2π	23.8 ±1.3	834
									4π (incl. $\pi\pi\rho$,$\rho\rho$,$A_2\pi$,$\omega\pi$)	70.9 ±1.9	787
									$K\bar{K}\pi$ (incl. $K^*\bar{K}$)	*3.8 ±1.2*	625
									$K\bar{K}$	1.5 ±0.3 S=1.3*	684
→→→	J^P, M, and Γ from the 2π and $K\bar{K}$ modes.										

Meson Table *(cont'd)*

J^P	I / G	0	1	½					
N	+	ϵ	ρ	K^*	$I^G(J^P)C_n$	Mass M (MeV)	Full Width Γ (MeV)	M^2 $\pm\Gamma M$[a] (GeV^2)	Partial decay mode: Mode / Fraction(%) [Upper limits (%) are 90% CL] / p or p_{max}[b] (MeV/c)
	−	ω/ϕ	δ						
A	+−	η	π	K	⟼ *estab.*				

h(2040)	$0^+(4^+)+$	2040§ ±20§	150§ ±50§	4.16 ±0.31	$\pi\pi$	seen	1010
					$K\bar{K}$	seen	890
$\eta_c(2980)$	$0^+(\ )+$	*2981 ±6*	*< 20*	8.89	$\eta\pi^+\pi^-$	*seen*	1426
					$2(\pi^+\pi^-)$	*seen*	1458
					$K^+K^-\pi^+\pi^-$	*seen*	1343
					$p\bar{p}$	*seen*	1158
$J/\psi(3100)$	$0^-(1^-)-$	3096.9 ±0.1	0.063 ±0.009	9.591 ±0.000	e^+e^-	7.4 ±1.2	1548
					$\mu^+\mu^-$	7.4 ±1.2	1545
					hadrons + radiative	85 ±2	
					Decay modes into stable hadrons		
					†$[2(\pi^+\pi^-)\pi^0$	3.7 ±0.5	1496
					$3(\pi^+\pi^-)\pi^0$	2.9 ±0.7	1433
					$\pi^+\pi^-\pi^0K^+K^-$	1.2 ±0.3	1368
					$4(\pi^+\pi^-)\pi^0$	0.9 ±0.3	1345
					$\pi^+\pi^-K^+K^-$	0.72 ±0.23	1407
					$p\bar{p}\pi^+\pi^-$	0.53 ±0.06	1107
					$2(\pi^+\pi^-)$	0.4 ±0.1	1517
					$3(\pi^+\pi^-)$	0.4 ±0.2	1466
					$n\bar{n}\pi^+\pi^-$	*0.38 ±0.36*	1106
					$\Xi^-\bar{\Xi}^+$	0.32 ±0.08	818
					$2(\pi^+\pi^-)K^+K^-$	0.31 ±0.13	1320
					$K^0_SK^\pm\pi^\mp$	0.26 ±0.07	1440
					$\Sigma^+\bar{\Sigma}^-$	*0.24 ±0.26*	988
					$p\bar{p}\eta$	0.23 ±0.04	948
					$p\bar{p}$	0.22 ±0.02	1232
					$p\bar{n}\pi^-$ or $\bar{p}n\pi^+$	0.21 ±0.02	1174
					$n\bar{n}$	0.18 ±0.09	1231
					$p\bar{p}\pi^+\pi^-\pi^0$	0.16 ±0.06[m]	1033
					$\Sigma^0\bar{\Sigma}^0$	0.13 ±0.04	988
					$\Lambda\bar{\Lambda}$	0.11 ±0.02	1074
					$p\bar{p}\pi^0$	0.11 ±0.01	1176
					$2(K^+K^-)$	*0.07 ±0.03*	1131
					K^+K^-	*0.022 ±0.008*	1468
					$\pi^+\pi^-$	*0.011 ±0.005*	1542
					$\Lambda\bar{\Sigma}$	< 0.015	1032
					$K^0_SK^0_L$	*< 0.009*]	1466
					Decay modes into hadronic resonances		
					†$[\rho\pi$	1.22 ±0.12	1449
					$\omega2\pi^+2\pi^-$	0.85 ±0.34	1392
					ρA_2	0.84 ±0.45	1126
					$\omega\pi\pi$	0.68 ±0.19	1435
					$K^{*0}(892)\bar{K}^{*0}(1430)+$c.c.	0.67 ±0.26	1007
					$K^\pm K^{*\mp}(892)$	0.34 ±0.05	1373
					$B^\pm(1235)\pi^\mp$	0.29 ±0.07	1299
					$K^0\bar{K}^{*0}(892)+$c.c.	0.27 ±0.06	1373
					ωf	0.23 ±0.08 S=1.2*	1144
					$\phi\pi^+\pi^-$	0.21 ±0.09	1365
					$\eta' p\bar{p}$	0.18 ±0.06	596
					$\phi K\bar{K}$	0.18 ±0.08	1176
					$\omega p\bar{p}$	0.16 ±0.03	768
					$\omega K\bar{K}$	0.16 ±0.10	1265
					$\phi\eta$	0.10 ±0.06	1320
					$\phi f'(1515)$	*0.08 ±0.05*	874
					$\pi^\pm A_2^\mp$	*< 0.43*	1263
					$K^{*0}(1430)\bar{K}^{*0}(1430)$	*< 0.29*	584
					$K^0\bar{K}^{*0}(1430)+$c.c.	*< 0.2*	1154
					$K^\pm K^{*\mp}(1430)$	*< 0.2*	1154
					$\phi2\pi^+2\pi^-$	*< 0.15*	1318
					$\phi\eta'$	*< 0.13*	1192
					$K^{*0}(892)\bar{K}^{*0}(892)$	*< 0.05*	1266
					ϕf	*< 0.037*	1037
					$\omega f'$	*< 0.016*]	1006
					Radiative decay modes		
					†$[\gamma\iota(1440)$	*0.55 ±0.22*[n]	1224
					$\gamma\eta'$	*0.36 ±0.05*	1400
					γf	0.15 ±0.04	1287
					$\gamma\eta$	*0.086 ±0.009*	1500
					$\gamma\pi^0$	*0.007 ±0.005*	1546
					$\gamma D(1285)$	*< 0.6*	1283
					2γ	*< 0.05*	1548
					$\gamma f'(1515)$	*< 0.03*	1175
					$\gamma p\bar{p}$	*< 0.01*	1232
					3γ	*< 0.006*]	1548
$\chi(3415)$	$0^+(0^+)+$	3415.0 ±1.0		11.662	$2(\pi^+\pi^-)$ (incl. $\pi\pi\rho$)	4.3 ±0.9	1679
					$\pi^+\pi^-K^+K^-$ (incl. $\pi K\bar{K}^*$)	3.4 ±0.9	1580
					$3(\pi^+\pi^-)$	1.7 ±0.6	1633
					$\pi^+\pi^-$	0.9 ±0.2	1702
					$\gamma J/\psi(3100)$	*0.8 ±0.2*	303
					K^+K^-	0.8 ±0.2	1635
					$p\bar{p}\pi^+\pi^-$	0.6 ±0.2	1320
					For upper limits, see footnote *o*		

Meson Table *(cont'd)*

J^P	G \ I	0	1	½	$I^G(J^P)C_n$	Mass M (MeV)	Full Width Γ (MeV)	M^2 $\pm\Gamma M$[a] (GeV^2)	Partial decay mode: Mode	Fraction(%) [Upper limits (%) are 90% CL]	p or p_{max}[b] (MeV/c)
N	+	ϵ	ρ	K^*							
	−	ω/ϕ	δ								
A	+−	η	π	K	⊢ *estab.*						
	p_c or χ(3510)	$0^+(1^+)+$	3510.0 ±0.6		12.320	$\gamma J/\psi(3100)$	28 ±3	389
						$3(\pi^+\pi^-)$	2.4 ±0.9	1683
						$2(\pi^+\pi^-)$ (incl. $\pi\pi\rho$)	1.8 ±0.5	1727
						$\pi^+\pi^-K^+K^-$ (incl. $\pi K\bar{K}^*$)	1.0 ±0.4	1632
						$\pi^+\pi^-p\bar{p}$	0.15 ±0.10	1381
						For upper limits, see footnote *p*		
	χ(3555)	$0^+(2^+)+$	3555.8 ±0.6		12.644	$\gamma J/\psi(3100)$	15.7 ±1.7	429
						$2(\pi^+\pi^-)$ (incl. $\pi\pi\rho$)	2.3 ±0.5	1750
						$\pi^+\pi^-K^+K^-$ (incl. $\pi K\bar{K}^*$)	2.0 ±0.5	1656
						$3(\pi^+\pi^-)$	1.2 ±0.8	1706
						$\pi^+\pi^-p\bar{p}$	0.35 ±0.14	1410
						$\pi^+\pi^-$	*0.20 ±0.11*	1772
						K^+K^-	*0.16 ±0.12*	1708
						For upper limits, see footnote *q*		
→	ψ(3685)	$0^-(1^-)-$	3686.0 ±0.1	0.215 ±0.040	13.587 ±0.001	e^+e^-	0.9 ±0.1	1843
						$\mu^+\mu^-$	0.8 ±0.2	1840
						hadrons + radiative	98.1 ±0.3	
		$m_{\psi(3685)} - m_{\psi(3100)}$ = 589.06 ±0.13						
	Radiative decay modes					Decay modes into hadrons		
	†[γχ(3415)		8.2 ±1.4		261	†[$J/\psi\pi^+\pi^-$	33 ±2	477
	γχ(3510)		8.0 ±1.3		172	$J/\psi\pi^0\pi^0$	17 ±2	481
	γχ(3555)		7.4 ±1.3		128	$J/\psi\eta$	*2.8 ±0.6*[§]	196
	$\gamma\eta_c(2980)$		*0.43 ±0.26*		638	$2(\pi^+\pi^-)\pi^0$	0.35 ±0.15	1799
	$\gamma\eta_c'(3590)$		*0.2* to *1.3*		91	$\pi^+\pi^-K^+K^-$	0.16 ±0.04	1726
	$\gamma\pi^0$		*<0.5* (CL=95%)		1841	$J/\psi\pi^0$	*0.10 ±0.03*	528
	γη		*<0.02*		1802	$p\bar{p}\pi^+\pi^-$	0.08 ±0.02	1491
	γη′		*<0.02*		1719	$K^{*0}(892)K^\pm\pi^\mp$	*0.067 ±0.025*	1674
	γι(1440)		*<0.018*[n]]		1570	$2(\pi^+\pi^-)$	0.05 ±0.01	1817
						$\rho^0\pi^+\pi^-$	*0.042 ±0.015*	1751
						$p\bar{p}$	*0.019 ±0.005*	1586
						$3(\pi^+\pi^-)$	*0.015 ±0.010*	1774
						K^+K^-	*0.010 ±0.007*	1776
						$\pi^+\pi^-$	*0.008 ±0.005*	1838
						$\rho\pi$	*<0.1*	1760
						$\Lambda\bar{\Lambda}$	*<0.04*]	1467
	ψ(3770)	$(1^-)-$	3770 ±3	25 ±3	14.213 ±0.094	e^+e^-	0.0011 ±0.0002	1885
						$D\bar{D}$	dominant	242
		$m_{\psi(3770)} - m_{\psi(3685)}$ = 83.9 ±2.4 S=1.8*						
	ψ(4030)	$(1^-)-$	4030[§] ±5[§]	52 ±10	16.241 ±0.210	e^+e^- hadrons	0.0014 ±0.0004 dominant	2015
	ψ(4160)	$(1^-)-$	4159 ±20	78 ±20	17.297 ±0.324	e^+e^- hadrons	0.0010 ±0.0004 dominant	2079
	ψ(4415)	$(1^-)-$	4415 ±6	43 ±20[§]	19.492 ±0.190	e^+e^- hadrons	0.0010 ±0.0003 S=1.4* dominant	2208
	Υ(9460)	$(1^-)-$	9456 ±10	0.042 ±0.015	89.416 ±0.0004	$\mu^+\mu^-$	3.2 ±0.7	4727
						e^+e^-	2.8 ±1.1	4728
	Υ(10020)	$(1^-)-$	10016 ±10	0.030 ±0.010	100.320 ±0.0003	$\mu^+\mu^-$	*seen*	5007
						e^+e^-	*1.7 ±0.6*	5008
		$m_{\Upsilon(10020)} - m_{\Upsilon(9460)}$ = 559 ±3				Υ(9460)ππ	*30 ±6*	472
	Υ(10350)	$(1^-)-$	*10347 ±10*		107.060	e^+e^-	*seen*	5174
		$m_{\Upsilon(10350)} - m_{\Upsilon(9460)}$ = *891 ±4*						

Meson Table *(cont'd)*

J^P	G \ I	0	1	½						
N	+	ϵ	ρ	K^*	$I^G(J^P)C_n$	Mass M (MeV)	Full Width Γ (MeV)	M^2 $\pm\Gamma M$[a] (GeV^2)	Partial decay mode: Mode	Partial decay mode: Fraction(%) [Upper limits (%) are 90% CL]	Partial decay mode: p or p_{max}[b] (MeV/c)
	−	ω/ϕ	δ								
A	+−	η	π	K	⟝ *estab.*						
	$\Upsilon(10570)$	$(1^-)-$	*10569 ±10*	*14 ±5*	111.704 ±0.15	e^+e^-	*0.0019 ±0.0008*	5285
		$m_{\Upsilon(10570)} - m_{\Upsilon(9460)} = 1113 \pm 4$						
	STRANGE MESONS							
	K^+	$1/2(0^-)$	493.67		0.244	See Stable Particle Table		
	K^0		497.67		0.248			
	$K^*(892)$	$1/2(1^-)$	891.8 ±0.4 S=1.2*	50.8 ±0.9	0.795 ±0.045	$K\pi$	≈ 100	288
						$K\gamma$	0.15 ±0.07	309
						$K\pi\pi$	< 0.07 (CL=95%)	216
	M and Γ from charged mode; $m^0 - m^\pm = 6.7 \pm 1.2$ MeV.							
	$Q_1(1280)$	$1/2(1^+)$	1270§ ±10§	90§ ±20§	1.61 ±0.11	$K\rho$	*42 ±6*	45
						$\kappa\pi$	*28 ±4*	
						$K^*\pi$	*16 ±5*	299
						$K\omega$	*11 ±2*	
						$K\epsilon$	*3 ±2*	
	$\kappa(1350)$	$1/2(0^+)$	~1350	~250	1.82 ±0.34	$K\pi$	seen	574
	See note on $K\pi$ S wave.‡							
	$Q_2(1400)$	$1/2(1^+)$	1414 ±13	180 ±10	2.00 ±0.25	$K^*\pi$	*94 ±6*	410
						$K\rho$	*3 ±3*	308
						$K\epsilon$	*2 ±2*	
						$K\omega$	*1 ±1*	294
→	$K^*(1430)$	$1/2(2^+)$	1434§ ±5§	100§ ±10§	2.06 ±0.14	$K\pi$	*44.8 ±2.3*	S=2.7* 623
						$K^*\pi$	*24.6 ±2.0*	S=1.1* 424
						$K^*\pi\pi$	13.0 ±2.6	S=1.1* 374
						$K\rho$	*8.8 ±1.1*	S=1.3* 334
						$K\omega$	4.2 ±1.5	320
→						$K\eta$	5 ±5§	492
→	$L(1770)$‡	$1/2(2^-)$	*~1770*§	*~200*§	3.13 ±0.35	$K^*(1430)\pi$	dominant	278
						$K^*(892)\pi$	*seen*	652
						Kf	*seen*	
	See note on L(1770).‡							
	$K^*(1780)$‡	$1/2(3^-)$	*1775*§ *±10*§	140§ ±20§	3.15 ±0.25	$K\pi\pi$	large	793
						†[$K\rho$	large]	616
						†[$K^*\pi$	large]	654
→						$K\pi$	17 ±5§	812
	See note on $K^*(1780)$.‡							
→	**CHARMED, NONSTRANGE MESONS**							
	D^+	$1/2(0^-)$	1869.4		3.495	See Stable Particle Table		
	D^0		1864.7		3.477			
	$D^{*+}(2010)$	$1/2(1^-)$	2010.1 ±0.7	< 2.0	4.041	$D^0\pi^+$	64 ±11	39
						$D^+\pi^0$	28 ±9	38
						$D^+\gamma$	8 ±7	136
		$m_{D^{*+}} - m_{D^0} = 145.4 \pm 0.2$ MeV						
	$D^{*0}(2010)$	$1/2(1^-)$	2007.2 ±2.1	< 5	4.029	$D^0\pi^0$	55 ±15	44
						$D^0\gamma$	45 ±15	137
	CHARMED, STRANGE MESON							
	F^+	$0(0^-)$	2021		4.084	See Stable Particle Table		
→								

Meson Table *(cont'd)*

Contents of Meson Data Card Listings

→ Indicates an entry in the Meson Data Card Listings not entered in the Meson Table. We do not regard these as established resonances. All the entries in the Listings can be found in the Table of Contents of the Meson Data Card Listings immediately preceding these footnotes.

‡ See Meson Data Card Listings.

* Quoted error includes scale factor $S = \sqrt{\chi^2/(N-1)}$. See footnote to Stable Particle Table.

† Square brackets indicate a subreaction of the previous (unbracketed) decay mode(s).

§ This is only an educated guess; the error given is larger than the error on the average of the published values. (See the Meson Data Card Listings for the latter.)

a. ΓM is approximately the half-width of the resonance when plotted against M^2.

b. For decay modes into ≥ 3 particles, p_{max} is the maximum momentum that any of the particles in the final state can have. The momenta have been calculated by using the averaged central mass values, without taking into account the widths of the resonances.

c. From pole position ($M - i\Gamma/2$).

d. The e^+e^- branching fraction is from $e^+e^- \to \pi^+\pi^-$ experiments only. The $\omega\rho$ interference is then due to $\omega\rho$ mixing only, and is expected to be small. See note in the Meson Data Card Listings. The $\mu^+\mu^-$ branching fraction is compiled from 3 experiments, each possibly with substantial $\omega\rho$ interference. The error reflects this uncertainty; see notes in the Meson Data Card Listings. If $e\mu$ universality holds, $\Gamma(\rho^0 \to \mu^+\mu^-) = \Gamma(\rho^0 \to e^+e^-) \times 0.99785$.

Meson Table *(cont'd)*

e. Empirical limits on fractions for other decay modes of $\rho(770)$ are $\pi^{\pm}\eta < 0.8\%$ (CL=84%), $\pi^+\pi^+\pi^-\pi^- < 0.15\%$, $\pi^{\pm}\pi^+\pi^-\pi^0 < 0.2\%$ (CL=84%).

f. Empirical limits on fractions for other decay modes of $\omega(783)$ are $\pi^+\pi^-\gamma < 5\%$, $\pi^0\pi^0\gamma < 1\%$, η + neutral(s) $< 1.5\%$, $\mu^+\mu^- < 0.02\%$.

g. Empirical limits on fractions for other decay modes of $\eta'(958)$ are $\pi^+\pi^- < 2\%$ (CL=84%), $\pi^+\pi^-\pi^0 < 5\%$ (CL=84%), $\pi^+\pi^+\pi^-\pi^- < 1\%$ (CL=95%), $\pi^+\pi^+\pi^-\pi^-\pi^0 < 1\%$ (CL=84%), $6\pi < 1\%$, $\pi^+\pi^-e^+e^- < 0.6\%$, $\pi^0e^+e^- < 1.3\%$ (CL=84%), $\eta e^+e^- < 1.1\%$, $\pi^0\rho^0 < 4\%$, $\eta\mu^+\mu^- < 1.5 \times 10^{-5}$, $\pi^0\mu^+\mu^- < 6 \times 10^{-5}$.

h. The mass and width are from the $\eta\pi$ mode only. If the $K\bar{K}$ channel is strongly coupled, the width may be larger.

i. Empirical limits on fractions for other decay modes of $\phi(1020)$ are $\pi^+\pi^-\gamma < 0.7\%$, $\omega\gamma < 5\%$ (CL=84%), $\rho\gamma < 2\%$ (CL=84%), $2\pi^+2\pi^-\pi^0 < 1\%$ (CL=95%), $2\pi^+2\pi^- < 0.1\%$.

j. Empirical limits on fractions for other decay modes of B(1235) are $\pi\pi < 15\%$, $K\bar{K} < 2\%$ (CL=84%), $4\pi < 50\%$ (CL=84%), $\phi\pi < 1.5\%$ (CL=84%), $\eta\pi < 25\%$, $(\bar{K}K)^{\pm}\pi^0 < 8\%$, $K_SK_S\pi^{\pm} < 2\%$, $K_SK_L\pi^{\pm} < 6\%$.

k. Empirical limits (CL=95%) on fractions for other decay modes of f(1270) are $\eta\pi\pi < 1\%$, $K^0K^-\pi^+$ + c.c. $< 0.5\%$, $\eta\eta < 2\%$.

ℓ. Empirical limits on fractions for other decay modes of $A_3(1680)$ are $\eta\pi < 10\%$, $5\pi < 10\%$.

m. Includes $p\bar{p}\pi^+\pi^-\gamma$ and excludes $p\bar{p}\eta$, $p\bar{p}\omega$, $p\bar{p}\eta'$.

n. The $\iota(1440)$ evidence is listed under E(1420); see E(1420) mini-review.

o. Empirical limits on fractions for other decay modes of $\chi(3415)$ are $2\gamma < 0.17\%$, $p\bar{p} < 0.011\%$.

p. Empirical limits on fractions for other decay modes of $\chi(3510)$ are ($\pi^+\pi^-$ and K^+K^-) $< 0.2\%$, $\gamma\gamma < 0.16\%$, $p\bar{p} < 0.13\%$.

q. Empirical limits on fractions for other decay modes of $\chi(3555)$ are $2\gamma < 0.06\%$, $p\bar{p} < 0.10\%$, $J/\psi\pi^+\pi^-\pi^0 < 1.5\%$.

Established Nonets, and octet-singlet mixing angles θ obtained from the Gell-Mann-Okubo mass formula [Appendix II, Eq. (3)]. Of the two isosinglets, the "mainly octet" one is written first, followed by a semicolon. The angle $\delta = \theta - 35.3°$ measures the deviation from ideal mixing.

$(J^P)C_n$	Nonet members	$\theta_{lin.}$	$\theta_{quadr.}$	$\delta_{lin.}$	$\delta_{quadr.}$
$(0^-)+$	π, K, η; η'	$-24.4 \pm 0.1°$	$-11.1 \pm 0.2°$	$-59.7 \pm 0.1°$	$-46.4 \pm 0.2°$
$(1^-)-$	ρ, K^*, ϕ; ω	$35.9 \pm 0.5°$	$38.6 \pm 0.4°$	$0.6 \pm 0.5°$	$3.3 \pm 0.4°$
$(2^+)+$	A_2, $K^*(1430)$, f'; f	$26 \pm 3°$	$28 \pm 3°$	$-9 \pm 3°$	$-7 \pm 3°$
$(1^+)+^{\dagger}$	A_1, Q_A, E; D	$52 \pm 13°$	$51 \pm 12°$	$16 \pm 13°$	$15 \pm 12°$

† $m(Q_A)$ is assumed to be the average of $m(Q_1)$ and $m(Q_2)$.

More generally, because of unitarity, the mixing angles are energy dependent and complex above the first threshold (see Appendix II C), which is important especially for the scalar and the axial mesons. Note also that the two axial strange mesons (Q_1 and Q_2) are mixtures of the exact SU(3) states: $Q_1 = \cos\phi\, Q_A + \sin\phi\, Q_B$, $Q_2 = -\sin\phi\, Q_A + \cos\phi\, Q_B$. Below we give the mixing angles δ and ϕ obtained in a unitary mixing scheme using both masses and widths as input data:

$(J^P)C_n$	Nonet members	Mixing angles	
$(1^+)+$	A_1, Q_A, E; D	$\delta_{DE}(1283)$	$= 14° + i1°$
		$\delta_{DE}(1418)$	$= 25° + i8°$
$(1^+)-$	B, Q_B, $H'^{\dagger}$; H	$\delta_{HH'}(1190)$	$= -6° + i4°$
		$\delta_{HH'}(1400)$	$= -15° + i10°$
		$\phi_{Q_1Q_2}(1270)$	$= 50° + i3°$
		$\phi_{Q_1Q_2}(1414)$	$= 61° - i3°$
$(0^+)+$	δ, κ, S^*; ϵ	$\delta_{S^*\epsilon}(975)$	$= +4° + i29°$
		$\delta_{S^*\epsilon}(1300)$	$= -33° + i7°$

† as yet, not seen experimentally

Baryon Table

April 1982

The following short list gives the name, the nominal mass, the quantum numbers (where known), and the status of each of the Baryon States in the Data Card Listings. States with 3- or 4-star status are included in the Baryon Table below; the others are omitted because the evidence for the existence of the effect and/or for its interpretation as a resonance is open to question.

N(939)	P11	****	Δ(1232)	P33	****	Λ(1115)	P01	****	Σ(1193)	P11	****	Ξ(1317)	P11	****
N(1440)	P11	****	Δ(1550)	P31	**	Λ(1405)	S01	****	Σ(1385)	P13	****	Ξ(1530)	P13	****
N(1520)	D13	****	Δ(1600)	P33	***	Λ(1520)	D03	****	Σ(1480)		*	Ξ(1630)		**
N(1535)	S11	****	Δ(1620)	S31	****	Λ(1600)	P01	***	Σ(1560)		**	Ξ(1680)	S11	**
N(1540)	P13	*	Δ(1700)	D33	****	Λ(1670)	S01	****	Σ(1580)	D13	**	Ξ(1820)	13	***
N(1650)	S11	****	Δ(1900)	S31	***	Λ(1690)	D03	****	Σ(1620)	S11	**	Ξ(1940)		**
N(1675)	D15	****	Δ(1905)	F35	****	Λ(1800)	S01	***	Σ(1660)	P11	***	Ξ(2030)	1	***
N(1680)	F15	****	Δ(1910)	P31	****	Λ(1800)	P01	***	Σ(1670)	D13	****	Ξ(2120)		*
N(1700)	D13	****	Δ(1920)	P33	***	Λ(1800)	G09	Dead	Σ(1670)		**	Ξ(2250)		*
N(1710)	P11	****	Δ(1930)	D35	****	Λ(1800)		*	Σ(1690)		**	Ξ(2370)	1	**
N(1720)	P13	****	Δ(1940)	D33	*	Λ(1820)	F05	****	Σ(1750)	S11	***	Ξ(2500)		**
N(1990)	F17	***	Δ(1950)	F37	****	Λ(1830)	D05	****	Σ(1770)	P11	Dead			
N(2000)	F15	**	Δ(2150)	S31	*	Λ(1890)	P03	****	Σ(1775)	D15	****	Ω(1672)	P03	****
N(2080)	D13	***	Δ(2160)		*	Λ(2000)		*	Σ(1840)	P13	*			
N(2100)	S11	*	Δ(2200)	G37	**	Λ(2020)	F07	*	Σ(1880)	P11	**	Λ_c(2282)		****
N(2100)	P11	*	Δ(2300)	H39	**	Λ(2100)	G07	****	Σ(1915)	F15	****			
N(2190)	G17	****	Δ(2350)	D35	*	Λ(2110)	F05	***	Σ(1940)	D13	***	Σ_c(2450)		**
N(2200)	D15	***	Δ(2400)	F37	*	Λ(2325)	D03	*	Σ(2000)	S11	*			
N(2220)	H19	****	Δ(2400)	G39	*	Λ(2350)		****	Σ(2030)	F17	****	Λ_b(5500)		*
N(2250)	G19	****	Δ(2420)	H311	***	Λ(2585)		***	Σ(2070)	F15	*			
N(2600)	I111	***	Δ(2500)		*				Σ(2080)	P13	**	Dibaryons		
N(2700)	K113	*	Δ(2750)	I313	*				Σ(2100)	G17	*	NN(2170)	1D2	***
N(2800)	G19	*	Δ(2850)		***				Σ(2250)		****	NN(2250)	3F3	***
N(3000)		*	Δ(2950)	K315	*				Σ(2455)		***	NN(?)		*
N(3030)		***	Δ(3230)		***				Σ(2620)		***	ΛN(2130)	3S1	***
N(3245)		*							Σ(3000)		**	ΞN(?)		*
N(3690)		*	Z0(1780)	P01	*				Σ(3170)		*			
N(3755)		*	Z0(1865)	D03	*									
			Z1(1900)	P13	*									
			Z1(2150)		*									
			Z1(2500)		*									

**** Good, clear, and unmistakable.
*** Good, but in need of clarification or not absolutely certain.
** Needs confirmation.
* Weak.

Particle[a]	$I(J^P)L_{2I\cdot 2J}$[b]	P_{beam}[c] (GeV/c) $\sigma = 4\pi\lambda^2$ (mb)	Mass[d] M (MeV)	Full[e] width Γ (MeV)	M^2[f] $\pm\Gamma M$ (GeV^2)	Partial decay mode: Mode[g]	Fraction[h] (%)	p[i] (MeV/c)
S=0 I=1/2 NUCLEON RESONANCES (N)								
p	$1/2(1/2^+)$		938.3		0.880	See Stable Particle Table		
n			939.6		0.883			
N(1440)	$1/2(1/2^+)P'_{11}$	p = 0.61	1400 to	120 to	2.07	Nπ	50–70	397
		σ = 31.0	1480	350	±0.29	Nη	8–18	†
				(200)		Nππ	~30	342
						Δπ	12–28 *	143
						Nρ	~ 7	†
						Nϵ	~ 5	†
N(1520)	$1/2(3/2^-)D'_{13}$	p = 0.74	1510 to	100 to	2.31	Nπ	50–60	456
		σ = 23.5	1530	140	±0.19	Nη	< 1	149
				(125)		Nππ	35–50	410
						Δπ	15–25 *	228
						Nρ	15–25	†
						Nϵ	< 5	†
N(1535)	$1/2(1/2^-)S'_{11}$	p = 0.76	1520 to	100 to	2.36	Nπ	35–50	467
		σ = 22.4	1560	250	±0.23	Nη	40–65	182
				(150)		Nππ	~ 5	422
						Δπ	~ 1 *	242
						Nρ	~ 3	†
						Nϵ	~ 2	†

Baryon Table *(cont'd)*

Particle[a]	$I(J^P)L_{2I,2J}$[b]	P_{beam}[c] (GeV/c) $\sigma = 4\pi\lambda^2$ (mb)	Mass[d] M (MeV)	Full[e] width Γ (MeV)	M^2[f] $\pm\Gamma M$ (GeV^2)	Partial decay mode Mode[g]	Fraction[h] (%)	p[i] (MeV/c)
N(1650)	$1/2(1/2^-)S_{11}''$	p = 0.96	1620 to	100 to	2.72	Nπ	55–65	547
		σ = 16.4	1680	200	±0.25	Nη	~ 1	346
				(150)		ΛK	5–10	161
						ΣK	3–10	†
						Nππ	~30	511
						[Δπ	4–15]*	344
						Nρ	~20	†
						[Nε	< 5]	†
N(1675)	$1/2(5/2^-)D_{15}'$	p = 1.01	1660 to	120 to	2.81	Nπ	30–40	563
		σ = 15.4	1690	180	±0.26	Nη	< 2	374
				(155)		ΛK	< 1	209
						Nππ	55–70	529
						[Δπ	50–65]*	364
						[Nρ	~ 5]	†
N(1680)	$1/2(5/2^+)F_{15}'$	p = 1.01	1670 to	110 to	2.82	Nπ	55–65	567
		σ = 15.2	1690	140	±0.21	Nη	< 1	379
				(125)		Nππ	~40	532
						[Δπ	~12]*	369
						Nρ	~10	†
						[Nε	~20]	†
N(1700)	$1/2(3/2^-)D_{13}''$	p = 1.05	1670 to	70 to	2.89	Nπ	8–12	580
		σ = 14.5	1730	120	±0.17	Nη	~ 4	400
				(100)		ΛK	~ 1	250
						Nππ	~85	547
						[Δπ	15–40]*	385
						Nρ	~ 5	†
						[Nε	<40]	†
N(1710)	$1/2(1/2^+)P_{11}''$	p = 1.07	1680 to	90 to	2.92	Nπ	10–20	587
		σ = 14.2	1740	130	±0.19	Nη	5–35	410
				(110)		ΛK	5–15	264
						ΣK	2–10	138
						Nππ	>50	554
						[Δπ	10–25]*	393
						Nρ	25–65	48
						[Nε	15–40]	†
N(1720)	$1/2(3/2^+)P_{13}''$	p = 1.09	1690 to	125 to	2.96	Nπ	10–20	594
		σ = 13.9	1800	250	±0.34	Nη	3–6	420
				(200)		ΛK	2–12	278
						ΣK	2–5	162
						Nππ	~70	561
						[Δπ	~20]*	401
						Nρ	45–70	104
						[Nε	~20]	†
N(1990)	$1/2(7/2^+)F_{17}$	p = 1.62	1950 to	120 to	3.96	Nπ	~ 5	766
		σ = 8.34	2050	400	±0.70	Nη	~ 3	648
				(350)		ΛK	seen	554
						ΣK	seen	497
→ N(2080)	$1/2(3/2^-)D_{13}'''$	p = 1.82	2030 to	115 to	4.33	Nπ	~10	821
		σ = 7.26	2100	300	±0.57	ΛK	seen	627
→				(275)		ΣK	seen	576
→ N(2190)	$1/2(7/2^-)G_{17}$	p = 2.07	2120 to	200 to	4.80	Nπ	~14	888
		σ = 6.21	2230	500	±0.77	Nη	~ 2	790
				(350)		ΛK	< 1	712
N(2200)	$1/2(5/2^-)D_{15}''$	p = 2.10	1900 to	150 to	4.84	Nπ	~ 8	894
		σ = 6.12	2230	400	±0.66	Nη	seen	797
				(300)		ΛK	seen	718
N(2220)	$1/2(9/2^+)H_{19}$	p = 2.14	2150 to	300 to	4.93	Nπ	~18	905
		σ = 5.97	2300	500	±0.89	Nη	~ 1	811
				(400)				

Baryon Table *(cont'd)*

Particle[a]	$I(J^P)L_{2I,2J}$[b]	P_{beam}[c] (GeV/c) $\sigma = 4\pi\lambda^2$ (mb)	Mass[d] M (MeV)	Full[e] width Γ (MeV)	M^2[f] $\pm\Gamma M$ (GeV^2)	Partial decay mode Mode[g]	Fraction[h] (%)	p[i] (MeV/c)
N(2250)	$1/2(9/2^-)G'_{19}$	p = 2.21 σ = 5.74	2130 to 2270	200 to 500 (300)	5.06 ±0.68	Nπ Nη	~10 ~ 2	923 831
N(2600)	$1/2(11/2^-)I_{111}$	p = 3.12 σ = 3.86	2580 to 2700	>300 (400)	6.76 ±1.04	Nπ	~ 5	1126
N(3030)	1/2(?)	p = 4.41 σ = 2.62	~3030	~400 (400)	9.18 ±1.21	Nπ	(J+1/2)x <0.1 [j]	1366
		S=0 I=3/2 DELTA RESONANCES (Δ)						
Δ(1232)	$3/2(3/2^+)P'_{33}$	p = 0.30 σ = 95.0	1230 to 1234	110 to 120 (115)	1.52 ±0.14	Nπ Nγ	99.4 0.6	227 259
	Δ(++) pole position:[k] $M-i\Gamma/2 = (1210.6\pm0.5) - i(49.7\pm0.3)$ [ℓ]							
	Δ(0) pole position:[k] $M-i\Gamma/2 = (1210.3\pm1.0) - i(53.0\pm1.0)$ [ℓ]							
Δ(1600)	$3/2(3/2^+)P''_{33}$	p = 0.87 σ = 18.7	1500 to 1900	150 to 350 (250)	2.56 ±0.40	Nπ Nππ [Δπ Nρ]	15–25 ~80 20–65 * <10	512 473 301 †
Δ(1620)	$3/2(1/2^-)S'_{31}$	p = 0.91 σ = 17.7	1600 to 1650	120 to 160 (140)	2.62 ±0.23	Nπ Nππ [Δπ Nρ]	25–35 ~70 35–50 * <40	526 488 318 †
Δ(1700)	$3/2(3/2^-)D'_{33}$	p = 1.05 σ = 14.5	1630 to 1740	190 to 300 (250)	2.89 ±0.43	Nπ Nππ [Δπ Nρ]	10–20 ~85 <50 * ~40	580 547 385 †
Δ(1900)	$3/2(1/2^-)S''_{31}$	p = 1.44 σ = 9.71	1850 to 2000	130 to 300 (150)	3.61 ±0.29	Nπ ΣK	6–12 ~10	710 410
Δ(1905)	$3/2(5/2^+)F_{35}$	p = 1.45 σ = 9.63	1890 to 1920	250 to 400 (300)	3.63 ±0.57	Nπ ΣK Nππ [Δπ Nρ]	8–15 < 3 ~80 10–30 * ~60	713 415 687 542 421
Δ(1910)	$3/2(1/2^+)P''_{31}$	p = 1.46 σ = 9.54	1850 to 1950	200 to 330 (220)	3.65 ±0.42	Nπ ΣK Nππ [Δπ Nρ]	20–25 2–20 >40 small * <40	716 421 691 545 426
Δ(1920)	$3/2(3/2^+)P'''_{33}$	p = 1.48 σ = 9.39	1860 to 2160	190 to 300 (250)	3.69 ±0.48	Nπ ΣK	14–20 ~ 5	722 431
Δ(1930)	$3/2(5/2^-)D'_{35}$	p = 1.50 σ = 9.21	1890 to 1960	150 to 350 (250)	3.72 ±0.48	Nπ ΣK	4–14 <10	729 441
Δ(1950)	$3/2(7/2^+)F'_{37}$	p = 1.54 σ = 8.91	1910 to 1960	200 to 340 (240)	3.80 ±0.47	Nπ ΣK Nππ [Δπ Nρ]	35–45 < 1 ~60 ~40 * ~20	741 460 716 574 469
Δ(2420)	$3/2(11/2^+)H_{311}$	p = 2.64 σ = 4.68	2380 to 2450	300 to 500 (300)	5.86 ±0.73	Nπ	5–15	1023
Δ(2850)	$3/2(?^+)$	p = 3.85 σ = 3.05	2800 to 2900	~400 (400)	8.12 ±1.14	Nπ	(J+1/2)x ~0.25 [j]	1266
Δ(3230)	3/2(?)	p = 5.08 σ = 2.25	3200 to 3350	~440 (440)	10.43 ±1.42	Nπ	(J+1/2)x ~0.05 [j]	1475

Baryon Table *(cont'd)*

Particle[a]	$I(J^P)L_{I\cdot 2J}$[b]	P_{beam}[c] (GeV/c) $\sigma = 4\pi\lambda^2$ (mb)	Mass[d] M (MeV)	Full[e] width Γ (MeV)	M^2[f] $\pm\Gamma M$ (GeV^2)	Partial decay mode: Mode	Fraction[h] (%)	p[i] (MeV/c)
			S=-1 I=0 LAMBDA RESONANCES (Λ)					
Λ	$0(1/2^+)$		1115.6		1.245	See Stable Particle Table		
Λ(1405)	$0(1/2^-)S'_{01}$	Below K^-p threshold	1405 ±5[ℓ]	40±10[ℓ]	1.97 ±0.06	Σπ	100	152
Λ(1520)	$0(3/2^-)D'_{03}$	p = 0.395 σ = 82.2	1519.4 ±1.0[ℓ]	15.6±1.0[ℓ]	2.31 ±0.02	$N\bar{K}$	45±1	244
						Σπ	42±1	267
						Λππ	10±1	252
						Σππ	0.9±0.1	152
Λ(1600)	$0(1/2^+)P'_{01}$	p = 0.58 σ = 41.6	1560 to 1700	50 to 250 (150)	2.56 ±0.24	$N\bar{K}$	15–30	343
						Σπ	10–60	336
Λ(1670)	$0(1/2^-)S''_{01}$	p = 0.74 σ = 28.5	1660 to 1680	25 to 50 (35)	2.79 ±0.06	$N\bar{K}$	15–25	414
						Σπ	20–60	393
						Λη	15–35	64
Λ(1690)	$0(3/2^-)D''_{03}$	p = 0.78 σ = 26.1	1685 to 1695	50 to 70 (60)	2.86 ±0.10	$N\bar{K}$	20–30	433
						Σπ	20–40	409
						Λππ	~25	415
						Σππ	~20	350
Λ(1800)	$0(1/2^-)S'''_{01}$	p = 1.01 σ = 17.6	1720 to 1850	200 to 400 (300)	3.24 ±0.54	$N\bar{K}$	25–40	528
						Σπ	seen	493
						Σ(1385)π	seen	345
						$N\bar{K}^*(892)$	seen	†
Λ(1800)	$0(1/2^+)P''_{01}$	p = 1.01 σ = 17.6	1750 to 1850	50 to 250 (150)	3.24 ±0.27	$N\bar{K}$	20–50	528
						Σπ	10–40	493
						Σ(1385)π	seen	345
						$N\bar{K}^*(892)$	30–60	†
Λ(1820)	$0(5/2^+)F'_{05}$	p = 1.06 σ = 16.5	1815 to 1825	70 to 90 (80)	3.29 ±0.15	$N\bar{K}$	55–65	545
						Σπ	8–14	508
						Σ(1385)π	5–10	362
Λ(1830)	$0(5/2^-)D_{05}$	p = 1.08 σ = 16.0	1810 to 1830	60 to 110 (95)	3.35 ±0.17	$N\bar{K}$	3–10	553
						Σπ	35–75	515
						Σ(1385)π	>15	371
Λ(1890)	$0(3/2^+)P'_{03}$	p = 1.21 σ = 13.6	1850 to 1910	60 to 200 (100)	3.57 ±0.19	$N\bar{K}$	20–35	599
						Σπ	3–10	559
						Σ(1385)π	seen	420
						$N\bar{K}^*(892)$	seen	233
Λ(2100)	$0(7/2^-)G_{07}$	p = 1.68 σ = 8.68	2090 to 2110	100 to 250 (200)	4.41 ±0.42	$N\bar{K}$	25–35	751
						Σπ	~ 5	704
						Λη	< 3	617
						ΞK	< 3	483
						Λω	< 8	443
						$N\bar{K}^*(892)$	10–20	514
Λ(2110)	$0(5/2^+)F''_{05}$	p = 1.70 σ = 8.54	2090 to 2140	150 to 250 (200)	4.45 ±0.42	$N\bar{K}$	5–25	757
						Σπ	10–40	711
						Λω	seen	455
						Σ(1385)π	seen	589
						$N\bar{K}^*(892)$	10–60	524
Λ(2350)	$0(9/2^+)$	p = 2.29 σ = 5.84	2340 to 2370	100 to 250 (150)	5.52 ±0.35	$N\bar{K}$	~12	915
						Σπ	~10	867
Λ(2585)	0(?)	p = 2.92 σ = 4.35	~2585	~300 (300)	6.68 ±0.78	$N\bar{K}$	(J+1/2)x ~1.0[j]	1060

Baryon Table *(cont'd)*

Particle[a]	$I(J^P)L_{I,2J}$[b]	P_{beam}[c] (GeV/c) $\sigma = 4\pi\lambda^2$ (mb)	Mass[d] M (MeV)	Full[e] width Γ (MeV)	M^2[f] $\pm\Gamma M$ (GeV^2)	Partial decay mode: Mode	Fraction[h] (%)	p[i] (MeV/c)
S=-1 I=1 SIGMA RESONANCES (Σ)								
Σ	$1(1/2^+)$		(+)1189.4		1.415	See Stable Particle Table		
			(0)1192.5		1.422			
			(-)1197.3		1.434			
Σ(1385)	$1(3/2^+)P'_{13}$	Below	(+)1382.3±0.4	35±1	1.92	Λπ	88±2	208
		K^-p	S=1.6[m]	S=1.0[m]	±0.05	Σπ	12±2	127
		threshold	(0)1382.0±2.5	~35				
			S=1.6[m]					
			(-)1387.4±0.6	40±2				
			S=2.2[m]	S=1.9[m]				
Σ(1660)	$1(1/2^+)P'_{11}$	p = 0.72	1630 to	40 to	2.76	$N\bar{K}$	10–30	405
		σ = 29.8	1690	200	±0.17	Λπ	seen	439
				(100)		Σπ	seen	385
Σ(1670)	$1(3/2^-)D''_{13}$	p = 0.74	1665 to	40 to	2.79	$N\bar{K}$	7–13	414
		σ = 28.5	1685	80	±0.10	Λπ	5–15	447
				(60)		Σπ	30–60	393
Σ(1750)	$1(1/2^-)S''_{11}$	p = 0.91	1730 to	60 to	3.06	$N\bar{K}$	10–40	486
		σ = 20.7	1800	160	±0.16	Λπ	seen	507
				(90)		Σπ	< 8	455
						Ση	15–55	81
Σ(1775)	$1(5/2^-)D_{15}$	p = 0.96	1770 to	105 to	3.15	$N\bar{K}$	37–43	508
		σ = 19.0	1780	135	±0.21	Λπ	14–20	525
				(120)		Σπ	2–5	474
						Σ(1385)π	8–12	324
						Λ(1520)π	17–23	198
Σ(1915)	$1(5/2^+)F'_{15}$	p = 1.26	1900 to	80 to	3.67	$N\bar{K}$	5–15	618
		σ = 12.8	1935	160	±0.23	Λπ	seen	622
				(120)		Σπ	seen	577
						Σ(1385)π	< 5	440
Σ(1940)	$1(3/2^-)D'''_{13}$	p = 1.32	1900 to	150 to	3.76	$N\bar{K}$	<20	637
		σ = 12.1	1950	300	±0.43	Λπ	seen	639
				(220)		Σπ	seen	594
						Σ(1385)π	seen	460
						Λ(1520)π	seen	354
						Δ(1232)$\bar{K}$	seen	410
						$N\bar{K}$*(892)	seen	320
Σ(2030)	$1(7/2^+)F_{17}$	p = 1.52	2025 to	150 to	4.12	$N\bar{K}$	17–23	702
		σ = 9.93	2040	200	±0.37	Λπ	17–23	700
				(180)		Σπ	5–10	657
						ΞK	< 2	412
						Σ(1385)π	5–15	529
						Λ(1520)π	10–20	430
						Δ(1232)$\bar{K}$	10–20	498
						$N\bar{K}$*(892)	< 5	438
Σ(2250)	1(?)	p = 2.04	2210 to	60 to	5.06	$N\bar{K}$	<10	851
		σ = 6.76	2280	150	±0.23	Λπ	seen	842
				(100)		Σπ	seen	803
Σ(2455)	1(?)	p = 2.57	~2455	~120	6.03	$N\bar{K}$	(J+1/2)x	981
		σ = 5.08		(120)	±0.29		~0.2[j]	
Σ(2620)	1(?)	p = 3.02	~2600	~200	6.86	$N\bar{K}$	(J+1/2)x	1081
		σ = 4.19		(200)	±0.52		~0.3[j]	

Baryon Table *(cont'd)*

Particle[a]	$I(J^P)L_{2I\cdot 2J}$[b]	P_{beam}[c] (GeV/c) $\sigma = 4\pi\lambda^2$ (mb)	Mass[d] M (MeV)	Full[e] width Γ (MeV)	M^2[f] $\pm\Gamma M$ (GeV^2)	Partial decay mode: Mode	Fraction (%)	p[i] (MeV/c)
S=-2 I=1/2 CASCADE RESONANCES (Ξ)								
Ξ	$1/2(1/2^+)$		(0)1314.9 (-)1321.3		1.729 1.746	See Stable Particle Table		
Ξ(1530)	$1/2(3/2^+)P_{13}$		(0)1531.8±0.3 S = 1.3[m] (-)1535.0±0.6	9.1±0.5 10.1±1.9	2.34 ±0.02	Ξπ	100	148
Ξ(1820)	$1/2(3/2^-)$		1823 ±6[ℓ]	20^{+15}_{-10}[ℓ]	3.31 ±0.04	ΛK̄ ΣK̄ Ξπ Ξ(1530)π	~45 ~10 small ~45	396 306 413 231
Ξ(2030)	$1/2(?^?)$		2024 ±6[ℓ]	16^{+15}_{-5}[ℓ]	4.12 ±0.03	ΛK̄ ΣK̄ Ξπ Ξ(1530)π	~20 ~80 small small	587 524 573 418
Ω^-	$0(3/2^+)$		1672.4±0.3		2.797	See Stable Particle Table		
Λ_c^+	$0(1/2^+)$		2282±3		5.21	See Stable Particle Table		

Particle[a]	$I(J^P)^{2S+1}L_J$[b]	P_{beam}[c] (GeV/c) $\sigma = 4\pi\lambda^2$ (mb)	Mass[d] M (MeV)	Full[e] width Γ (MeV)	M^2[f] $\pm\Gamma M$ (GeV^2)	Partial decay mode: Mode	Fraction[h] (%)	p[i] (MeV/c)
S=0 DIBARYONS								
d	$0(1^+)$		1875.6		3.518			
NN(2170)	$1(2^+)^1D_2$	p = 1.26 σ = 16.5	2140 to 2190	50 to 125 (90)	4.71 ±0.20	NN πd	10–20 seen	545 241
NN(2250)	$1(3^-)^3F_3$	p = 1.49 σ = 12.7	2200 to 2400	75 to 225 (150)	5.06 ±0.34	NN πd	20–30 seen	621 318
S=-1 DIBARYONS								
ΛN(2130)	$1/2(1^+)^3S_1$	p = 0.64 σ = 61.5	2100 to 2200	5 to 25 (15)	4.54 ±0.03	ΛN	seen	282

Baryon Table *(cont'd)*

→ Each arrow in the left-hand margin indicates there is an entry in the Data Card Listings for a baryon that is not well enough established (status less than 3 stars) to be included here. There is a short list of *all* the baryons in the Listings, whatever their status, at the front of this Table.

f. This mode is energetically forbidden when the nominal mass of the decaying resonance (and of any resonance in the final state) is used, but is in fact allowed due to the finite width of the resonance(s).

*. The modes in brackets are sub-reactions of the first preceding unbracketed mode.

a. The nominal mass here (in MeV) is used for identification. See column 4 for the actual mass.

b. When there is more than one baryon with the same quantum numbers, one prime is attached to the spectroscopic symbol for the first of them (e.g., S_{11}'), two primes to the second, etc.

c. The quantities here are calculated using the nominal mass of column 1.

d. Usually a conservatively large range of masses rather than a statistical average of various determinations of the mass is given. In these cases, the mass determinations are nearly entirely from various phase-shift analyses of more or less the same data. It is thus not appropriate to treat the determinations as independent measurements or to average them together. The masses, widths, and branching fractions in this Table are Breit-Wigner parameters. The Data Card Listings also include pole parameters where they are available.

e. Usually a conservatively large range of widths rather than a statistical average of various determinations of the width is given (see note *d* for the reason). The nominal value in parentheses is then simply a best guess.

f. The quantities here are calculated using the nominal mass of column 1 and the nominal width of column 5.

g. For information on the Nγ decay modes of the N and Δ baryons, see the mini-review on these states in the Listings.

h. Most of the inelastic branching fractions come from partial-wave analyses, and these determine $\sqrt{xx'}$, where x and x′ are the elastic and inelastic branching fractions, not x′ directly. Thus any uncertainty (and it is often considerable) in x carries over into x′. When x′ so determined is really poorly known, we here simply note that the mode is seen. The values of $\sqrt{xx'}$ are given in the Data Card Listings.

i. For a 2-body decay mode, this is the momentum of the decay products in the rest frame of the decaying particle. For a mode with more than two decay products, this is the maximum momentum any of the products can have in this frame. The nominal mass of column 1 is used, as is the nominal mass of any resonance in the final state.

j. The size of the bump in the total cross section gives (J+1/2)x, where x is the elastic branching fraction, but the value of J is not known.

k. These pole positions are from fits to phase shifts (without Coulomb corrections). The Data Card Listings now include pole positions and residues for most of the N and Δ resonances. See Sect. I of the N and Δ mini-review in the Listings for a brief discussion of the advantages of pole parameters over the usual Breit-Wigner parameters.

ℓ. The error given here is only an educated guess. It is larger than the error on the weighted average of the published values (the error on this average is given in the Listings).

m. The error given here has been scaled up by the "S factor" (see the * footnote to the Stable Particle Table for how S is defined) because the various measurements disagree more seriously than one would expect from statistics.