

APPENDIX I

TABLES OF PARTICLE PROPERTIES

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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 1974.

Particle	$I^G(J^P)C_\pi$	Mass (MeV) Mass ² (GeV) ²	Mean Life (sec) cτ (cm)	Partial decay mode			S	B	
				Mode	Fraction ^a	p or p _{max} ^b (MeV/c)			
γ	0,1(1 ⁻) ⁻	0(<7×10 ⁻²²)		stable			-		
ν	$J=\frac{1}{2}$ ν_e : 0(<0.00006) ν_μ : 0(<0.65)		stable	stable			-	0	
e	$J=\frac{1}{2}$	0.5110034 ±0.0000014	stable (>5×10 ²¹ y)	stable			-	0	
μ	$J=\frac{1}{2}$	105.65948 ±0.00035 m ² =0.01116 m _μ -m _π ±= -33.909 ±0.006	2.197134×10 ⁻⁶ ±0.000077 cτ=6.5868×10 ⁴	e $\nu\bar{\nu}$ e $\gamma\gamma$ 3e e γ e ⁺ $\nu_e\nu_\mu$	100 (<4) (<6) (<2.2) (<25)	%)×10 ⁻⁶)×10 ⁻⁹)×10 ⁻⁸)%	53 53 53 53	-	0
π^\pm	1 ⁻ (0 ⁻)	139.5688 ±0.0064 m ² =0.0195	2.6030×10 ⁻⁸ ±0.0023 cτ=780.4 ($\tau^+-\tau^-$)/ $\bar{\tau}$ (0.05±0.07)% (test of CPT)	$\mu\nu$ e ν $\mu\nu\gamma$ $\pi^0e\nu$ e $\nu\gamma$ e νe^+e^-	100 (1.267±0.023)×10 ⁻⁴ c(1.24±0.25)×10 ⁻⁴ (1.02±0.07)×10 ⁻⁸ c(3.0 ±0.5)×10 ⁻⁸ (<3.4)×10 ⁻⁸	%	30 70 30 5 70	0	0
π^0	1 ⁻ (0 ⁻) ⁺	134.9645 ±0.0074 m ² =0.182 m _{π±} -m _{π0} =4.6043 ±0.0037	0.828×10 ⁻¹⁶ ±0.057 S=1.8 ⁺ cτ=2.5×10 ⁻⁶	$\gamma\gamma$ γe^+e^- $\gamma\gamma\gamma$ e ⁺ e ⁻ e ⁺ e ⁻ d $\gamma\gamma\gamma\gamma$ e ⁺ e ⁻	(98.85±0.05)% (1.15±0.05)% (<5) (3.32) (<6) (<2)	%)×10 ⁻⁶)×10 ⁻⁵)×10 ⁻⁵)×10 ⁻⁶	67 67 67 67 67	0	0

- a. Quoted upper limits correspond to a 90% confidence level.
- b. For two body decays; p is the momentum of each of the decay particles in the rest frame of the decaying particle. For decays to more than two particles, p_{max} is the maximum momentum that any of the decay particles can have, in the frame of the decaying particle.

Stable Particle Table (cont'd)

Particle	$I(GJ^P)C_n$	Mass (MeV) Mass ² (GeV) ²	Mean life (sec) cτ (cm)	Partial decay mode			p or Pmax ^b (MeV/c)	S	B					
				Mode	Fraction ^a									
K^\pm	$\frac{1}{2}(0^-)$	493.707 ±0.037 m ² =0.244 m _{K[±]} -m _{K⁰} =-3.99 ±0.13 S=1.1 [*]	1.2371×10 ⁻⁸ ±0.0026 S=1.9 [*] cτ=370.9 (r ⁺ -r ⁻)/τ̄= (.11±.09)% (test of CPT) S=1.2 [*]	μν	(63.61±0.16)%	236	+1 for K ⁺ -1 for K ⁻	0						
				ππ ⁰	(21.05±0.14)%	205								
				ππ ⁺ π ⁺	(5.59±0.03)% S=1.1 [*]	125								
				ππ ⁰ π ⁰	(1.73±0.05)% S=1.4 [*]	133								
				μπ ⁰ ν	(3.20±0.09)% S=1.7 [*]	215								
				eπ ⁰ ν	(4.82±0.05)% S=1.1 [*]	228								
				μνγ	(5.8 ±3.5)×10 ⁻³	236								
				eπ ⁰ π ⁰ ν	(1.8 ±2.4)×10 ⁻⁵	207								
				ππ ⁺ e ⁺ ν	(3.7 ±0.2)×10 ⁻⁵	203								
				ππ ⁺ e ⁺ ν	(<5)×10 ⁻⁷	203								
				ππ ⁺ μ ⁺ ν	(0.9 ±0.4)×10 ⁻⁵	151								
				ππ ⁺ μ ⁺ ν	(<3.0)×10 ⁻⁶	151								
				νν	(1.54±0.09)×10 ⁻⁵	247								
				eνγ	(1.62±0.47)×10 ⁻⁵	247								
				ππ ⁰ γ	(2.71±0.19)×10 ⁻⁴	205								
				ππ ⁺ π ⁻ γ	(1.0 ±0.4)×10 ⁻⁴	125								
				μπ ⁰ νγ	(<6)×10 ⁻⁵	215								
				eπ ⁰ νγ	(3.7 ±1.4)×10 ⁻⁴	228								
				πe ⁺ e ⁻	(2.6 ±0.5)×10 ⁻⁷	227								
				π ⁺ e ⁺ e ⁺	(<1.5)×10 ⁻⁵	227								
				πμ ⁺ μ ⁻	(<2.4)×10 ⁻⁶	172								
				γγ	(<3.5)×10 ⁻⁵	227								
				γγγ	(<3.0)×10 ⁻⁴	227								
				πνν	(<0.6)×10 ⁻⁶	227								
				πγ	(<4)×10 ⁻⁶	227								
				eπ ⁺ μ ⁺	(<2.8)×10 ⁻⁸	214								
				eπ ⁺ μ ⁺	(<1.4)×10 ⁻⁸	214								
				μννν	(<6)×10 ⁻⁶	236								
				K^0	$\frac{1}{2}(0^-)$	497.70 ±0.13 S=1.1 [*] m ² =0.248			50% K _{Short} , 50% K _{Long}				+1	0
				K_S^0	$\frac{1}{2}(0^-)$				0.8930×10 ⁻¹⁰ (f) ±.0023 cτ=2.68	π ⁺ π ⁻ (68.67±0.25)% S=1.1 [*] π ⁰ π ⁰ (31.33±0.25)% S=1.1 [*] μ ⁺ μ ⁻ (<3.2)×10 ⁻⁷ e ⁺ e ⁻ (<3.4)×10 ⁻⁴ π ⁺ π ⁻ γ (2.0 ±0.4)×10 ⁻³ γγ (<0.4)×10 ⁻³	206 209 225 249 206 249			
K_L^0	$\frac{1}{2}(0^-)$		5.181×10 ⁻⁸ ±.040 cτ=1553 m _{K_L} -m _{K_S} = 0.5349×10 ¹⁰ h sec ⁻¹ ±0.0022	π ⁰ π ⁰ π ⁰ (21.4 ±0.7)% S=1.2 [*] π ⁺ π ⁻ π ⁰ (12.25±0.18)% S=1.1 [*] πμν (27.1 ±0.5)% πeν (39.0 ±0.5)% S=1.1 [*] πeνγ (1.3 ±0.8)% π ⁺ π ⁻ (0.201±0.006)% π ⁰ π ⁰ (0.094±0.019)% S=1.5 [*] π ⁺ π ⁻ γ (6.0 ±2.0)×10 ⁻⁵ π ⁰ γγ (<2.4)×10 ⁻⁴ γγ (4.9 ±0.5)×10 ⁻⁴ eμ (<2.0)×10 ⁻⁹ μ ⁺ μ ⁻ (1.0 ±0.3)×10 ⁻⁸ μ ⁺ μ ⁻ γ (<7.8)×10 ⁻⁶ μ ⁺ μ ⁻ π ⁰ (<5.7)×10 ⁻⁵ e ⁺ e ⁻ (<2.0)×10 ⁻⁹ e ⁺ e ⁻ γ (<2.8)×10 ⁻⁵ π ⁺ π ⁻ e ⁺ e ⁻ (<7.2)×10 ⁻⁶ π ⁰ π ⁺ e ⁺ ν (<2.2)×10 ⁻³	139 133 216 229 229 206 209 206 231 249 238 225 225 177 249 249 206 207									
η	$0^+(0^-)$	548.8 ±0.6 S=1.4 [*] m ² =0.301	Γ=(0.85±0.12)keV(l) Neutral decays (71.0±0.7)% S=1.1 [*] τ < 10 ⁻²⁰ Charged decays (29.0±0.7)% S=1.1 [*]	γγ (38.0 ±1.0)% S=1.2 [*] π ⁰ γγ (3.1 ±1.1)% S=1.2 [*] 3π ⁰ (29.9 ±1.1)% S=1.1 [*] π ⁺ π ⁻ π ⁰ (23.6 ±0.6)% S=1.1 [*] π ⁺ π ⁻ γ (4.89±0.13)% S=1.1 [*] e ⁺ e ⁻ γ (0.50±0.12)% π ⁰ e ⁺ e ⁻ (<0.04)% π ⁺ π ⁻ (<0.15)% π ⁺ π ⁻ e ⁺ e ⁻ (0.1 ±0.1)% π ⁺ π ⁻ π ⁰ γ (<6)×10 ⁻⁴ π ⁺ π ⁻ γγ (<0.2)% μ ⁺ μ ⁻ (2.2 ±0.8)×10 ⁻⁵ μ ⁺ μ ⁻ π ⁰ (<5)×10 ⁻⁴	274 258 180 175 236 274 258 236 236 175 236 253 211	0	0							

Stable Particle Table (cont'd)

Particle	$I^G(J^P)C_n$	Mass (MeV) Mass ² (GeV) ²	Mean Life (sec) cτ (cm)	Partial decay mode			S	B
				Mode	Fraction ^a	p or p _{max} ^b (MeV/c)		
p	$\frac{1}{2}(\frac{1}{2}^+)$	938.2796 ±0.0027 m ² =0.8804	stable (>2×10 ³⁰ y)				0	+1
n	$\frac{1}{2}(\frac{1}{2}^+)$	939.5731 ±0.0027 m ² =0.8828 m _p -m _n =-1.29343 ±0.00004	918±14 cτ=2.75×10 ¹³	pe ⁻ ν	100 %		0	+1
Λ	0($\frac{1}{2}^+$)	1115.60 ±0.05 S=1.2 ⁺ m ² =1.245	2.578×10 ⁻¹⁰ ±.021 S=1.6 ⁺ cτ=7.73	pπ ⁻ nπ ⁰ pe ⁻ ν pμ ⁻ ν pπ ⁻ γ	(64.2 ± 0.5)% (35.8 ± 0.5)% (8.13±0.29)×10 ⁻⁴ (1.57±0.35)×10 ⁻⁴ c(0.85±0.14)×10 ⁻³	100 104 163 131 100	-1	+1
Σ ⁺	1($\frac{1}{2}^+$)	1189.37 ±0.06 S=1.8 ⁺ m ² =1.415 m _{Σ⁺} -m _{Σ⁻} =-7.98 ±.08 S=1.2 ⁺	0.800×10 ⁻¹⁰ ±.006 cτ=2.40 [[Σ ⁺ →(π ⁺ n)ν] Γ(Σ ⁺ →l ⁺ nν)<.043	pπ ⁰ nπ ⁺ pγ nπ ⁺ γ Λe ⁺ ν Σ ⁺ μ ⁺ ν Σ ⁺ e ⁺ ν pe ⁺ e ⁻	(51.6 ± 0.7)% (48.4 ± 0.7)% (1.24±0.18)×10 ⁻³ c(0.93±0.10)×10 ⁻³ (2.02±0.47)×10 ⁻⁵ (<3.0)×10 ⁻⁵ (<0.5)×10 ⁻⁵ (<7)×10 ⁻⁶	189 185 225 185 71 202 224 225	-1	+1
Σ ⁰	1($\frac{1}{2}^+$)	1192.47 ±0.08 m ² =1.422	<1.0×10 ⁻¹⁴ cτ<3×10 ⁻⁴	Λγ Λe ⁺ e ⁻ Λγγ	100 % d(5.45)×10 ⁻³ (<3) %	74 74 74	-1	+1
Σ ⁻	1($\frac{1}{2}^+$)	1197.35 ±0.06 m ² =1.434 m _{Σ⁰} -m _{Σ⁻} =-4.88 ±.06	1.482×10 ⁻¹⁰ ±.017 S=1.5 ⁺ cτ=4.44	nπ ⁻ ne ⁻ ν nμ ⁻ ν Λe ⁻ ν nπ ⁻ γ	100 % (1.08±0.04)×10 ⁻³ (0.45±0.04)×10 ⁻³ (0.60±0.06)×10 ⁻⁴ c(4.6 ± 0.6)×10 ⁻⁴	193 230 210 79 193	-1	+1
Ξ ⁰	$\frac{1}{2}(\frac{1}{2}^+)(1)$	1314.9 ±0.6 m ² =1.729 m _{Ξ⁰} -m _{Ξ⁻} =-6.4 ±.6	2.96×10 ⁻¹⁰ ±.12 cτ=8.87	Λπ ⁰ Λγ Σ ⁰ γ pπ ⁻ pe ⁻ ν Σ ⁰ e ⁻ ν Σ ⁰ e ⁺ ν Σ ⁰ μ ⁺ ν Σ ⁰ μ ⁻ ν pμ ⁻ ν	100 % (0.5 ± 0.5)% (<7) % (<3.6)×10 ⁻⁵ (<1.3)×10 ⁻³ (<1.1)×10 ⁻³ (<0.9)×10 ⁻³ (<1.1)×10 ⁻³ (<0.9)×10 ⁻³ (<1.3)×10 ⁻³ (<1.3)×10 ⁻³	135 184 117 299 323 120 112 64 49 309	-2	+1
Ξ ⁻	$\frac{1}{2}(\frac{1}{2}^+)(1)$	1321.29 ±0.14 m ² =1.746	1.652×10 ⁻¹⁰ ±.023 S=1.1 ⁺ cτ=4.95	Λπ ⁻ Λe ⁻ ν Σ ⁰ e ⁻ ν Λμ ⁻ ν Σ ⁰ μ ⁻ ν nπ ⁻ ne ⁻ ν nμ ⁻ ν Σ ⁻ γ pπ ⁻ π ⁻ pπ ⁻ e ⁻ ν pπ ⁻ μ ⁻ ν Σ ⁰ e ⁻ ν	100 % k(0.69±0.18)×10 ⁻³ (<0.5)×10 ⁻³ (3.5 ± 3.5)×10 ⁻⁴ (<0.8)×10 ⁻³ (<1.1)×10 ⁻³ (<3.2)×10 ⁻³ (<1.5) % (<1.2)×10 ⁻³ (<4)×10 ⁻⁴ (<4)×10 ⁻⁴ (<4)×10 ⁻⁴ (<2.3)×10 ⁻⁴	139 190 123 163 70 303 327 313 118 223 304 250 6	-2	+1
Ω ⁻	0($\frac{1}{2}^+)(1)$	1672.2 ±.4 m ² =2.796	1.3 ^{+0.3} _{-0.2} ×10 ⁻¹⁰ cτ=4.0	Ξ ⁰ π ⁻ Ξ ⁻ π ⁰ ΛK ⁻	Total of 43 events seen	293 290 211	-3	+1