

N BARYONS

($S = 0$, $I = 1/2$)

$$p, N^+ = uud; \quad n, N^0 = udd$$

p

$$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$$

Mass $m = 1.007276466621 \pm 0.000000000053$ uMass $m = 938.27208816 \pm 0.00000029$ MeV [a]

$$|m_p - m_{\bar{p}}|/m_p < 7 \times 10^{-10}, \text{ CL} = 90\% [b]$$

$$|\frac{q_{\bar{p}}}{m_{\bar{p}}}|/(\frac{q_p}{m_p}) = 1.000000000003 \pm 0.000000000016$$

$$|q_p + q_{\bar{p}}|/e < 7 \times 10^{-10}, \text{ CL} = 90\% [b]$$

$$|q_p + q_e|/e < 1 \times 10^{-21} [c]$$

Magnetic moment $\mu = 2.7928473446 \pm 0.0000000008$ μ_N

$$(\mu_p + \mu_{\bar{p}}) / \mu_p = (0.002 \pm 0.004) \times 10^{-6}$$

Electric dipole moment $d < 0.021 \times 10^{-23}$ e cm

$$\text{Electric polarizability } \alpha = (11.5 \pm 0.4) \times 10^{-4} \text{ fm}^3 \quad (S = 1.1)$$

$$\text{Magnetic polarizability } \beta = (2.31 \pm 0.29) \times 10^{-4} \text{ fm}^3 \quad (S = 1.1)$$

$$p \text{ SPIN POLARIZABILITY } \gamma_{E1E1} = (-3.0 \pm 0.7) \times 10^{-4} \text{ fm}^4$$

$$p \text{ SPIN POLARIZABILITY } \gamma_{M1M1} = (3.7 \pm 0.5) \times 10^{-4} \text{ fm}^4$$

$$p \text{ SPIN POLARIZABILITY } \gamma_{E1M2} = (-1.2 \pm 1.0) \times 10^{-4} \text{ fm}^4$$

$$p \text{ SPIN POLARIZABILITY } \gamma_{M1E2} = (2.0 \pm 0.8) \times 10^{-4} \text{ fm}^4$$

Charge radius, μp Lamb shift = 0.84087 ± 0.00039 fm [d]Charge radius = 0.8409 ± 0.0004 fm [d]Magnetic radius = 0.851 ± 0.026 fm [e]Mean life $\tau > 9 \times 10^{29}$ years, CL = 90% ($p \rightarrow$ invisible mode)See the "Note on Nucleon Decay" in our 1994 edition (Phys. Rev. **D50**, 1173) for a short review.

The "partial mean life" limits tabulated here are the limits on τ/B_j , where τ is the total mean life and B_j is the branching fraction for the mode in question. For N decays, p and n indicate proton and neutron partial lifetimes.

p DECAY MODES	Partial mean life (10^{30} years)	Confidence level	p (MeV/c)
Antilepton + meson			
$N \rightarrow e^+ \pi$	$> 5300 (n), > 24000 (p)$	90%	459
$N \rightarrow \mu^+ \pi$	$> 3500 (n), > 16000 (p)$	90%	453
$N \rightarrow \nu \pi$	$> 1100 (n), > 390 (p)$	90%	459
$p \rightarrow e^+ \eta$	> 10000	90%	309
$p \rightarrow \mu^+ \eta$	> 4700	90%	297
$n \rightarrow \nu \eta$	> 158	90%	310
$N \rightarrow e^+ \rho$	$> 217 (n), > 720 (p)$	90%	149
$N \rightarrow \mu^+ \rho$	$> 228 (n), > 570 (p)$	90%	113
$N \rightarrow \nu \rho$	$> 19 (n), > 162 (p)$	90%	149
$p \rightarrow e^+ \omega$	> 1600	90%	143
$p \rightarrow \mu^+ \omega$	> 2800	90%	105
$n \rightarrow \nu \omega$	> 108	90%	144
$N \rightarrow e^+ K$	$> 17 (n), > 1000 (p)$	90%	339
$N \rightarrow \mu^+ K$	$> 26 (n), > 4500 (p)$	90%	329
$N \rightarrow \nu K$	$> 86 (n), > 5900 (p)$	90%	339
$n \rightarrow \nu K_S^0$	> 260	90%	338
$p \rightarrow e^+ K^*(892)^0$	> 84	90%	45
$N \rightarrow \nu K^*(892)$	$> 78 (n), > 51 (p)$	90%	45

NODE=BXXX005

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 NODE=S016M;DTYPE=M;OUR EVAL;
 $\rightarrow$ UNCHECKED $\leftarrow$
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NODE=S016CMR;DTYPE=A

NODE=S016DQ2;DTYPE=Y

NODE=S016DQ;DTYPE=Y

NODE=S016MM;DTYPE=m

NODE=S016MMD;DTYPE=x

NODE=S016EDM;DTYPE=e

NODE=S016EPL;DTYPE=A

NODE=S016MPL;DTYPE=k

NODE=S016A00;DTYPE=k

NODE=S016A01;DTYPE=k

NODE=S016A02;DTYPE=k

NODE=S016A03;DTYPE=k

NODE=S016CRE;DTYPE=r;OUR EVAL;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=S016CR;DTYPE=r

NODE=S016MCR;DTYPE=r

NODE=S016T;DTYPE=T

NODE=S016225;NODE=S016

NODE=S016;CLUMP=B

DESIG=6;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=7;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=10;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=22;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=23;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=24;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=14;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=15;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=25;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=12;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=13;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=26;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=8;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=9;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=11;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=99;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=34;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$
 DESIG=18;OUR LIM; $\rightarrow$ UNCHECKED $\leftarrow$

Antilepton + mesons				NODE=S016;CLUMP=E
$p \rightarrow e^+ \pi^+ \pi^-$	> 82	90%	448	DESIG=56;OUR LIM;→ UNCHECKED ←
$p \rightarrow e^+ \pi^0 \pi^0$	> 147	90%	449	DESIG=57;OUR LIM;→ UNCHECKED ←
$n \rightarrow e^+ \pi^- \pi^0$	> 52	90%	449	DESIG=58;OUR LIM;→ UNCHECKED ←
$p \rightarrow \mu^+ \pi^+ \pi^-$	> 133	90%	425	DESIG=48;OUR LIM;→ UNCHECKED ←
$p \rightarrow \mu^+ \pi^0 \pi^0$	> 101	90%	427	DESIG=59;OUR LIM;→ UNCHECKED ←
$n \rightarrow \mu^+ \pi^- \pi^0$	> 74	90%	427	DESIG=60;OUR LIM;→ UNCHECKED ←
$n \rightarrow e^+ K^0 \pi^-$	> 18	90%	319	DESIG=61;OUR LIM;→ UNCHECKED ←
Lepton + meson				NODE=S016;CLUMP=F
$n \rightarrow e^- \pi^+$	> 65	90%	459	DESIG=29;OUR LIM;→ UNCHECKED ←
$n \rightarrow \mu^- \pi^+$	> 49	90%	453	DESIG=30;OUR LIM;→ UNCHECKED ←
$n \rightarrow e^- \rho^+$	> 62	90%	150	DESIG=31;OUR LIM;→ UNCHECKED ←
$n \rightarrow \mu^- \rho^+$	> 7	90%	115	DESIG=32;OUR LIM;→ UNCHECKED ←
$n \rightarrow e^- K^+$	> 32	90%	340	DESIG=33;OUR LIM;→ UNCHECKED ←
$n \rightarrow \mu^- K^+$	> 57	90%	330	DESIG=35;OUR LIM;→ UNCHECKED ←
Lepton + mesons				NODE=S016;CLUMP=G
$p \rightarrow e^- \pi^+ \pi^+$	> 30	90%	448	DESIG=47;OUR LIM;→ UNCHECKED ←
$n \rightarrow e^- \pi^+ \pi^0$	> 29	90%	449	DESIG=39;OUR LIM;→ UNCHECKED ←
$p \rightarrow \mu^- \pi^+ \pi^+$	> 17	90%	425	DESIG=49;OUR LIM;→ UNCHECKED ←
$n \rightarrow \mu^- \pi^+ \pi^0$	> 34	90%	427	DESIG=40;OUR LIM;→ UNCHECKED ←
$p \rightarrow e^- \pi^+ K^+$	> 75	90%	320	DESIG=41;OUR LIM;→ UNCHECKED ←
$p \rightarrow \mu^- \pi^+ K^+$	> 245	90%	279	DESIG=42;OUR LIM;→ UNCHECKED ←
Antilepton + photon(s)				NODE=S016;CLUMP=C
$p \rightarrow e^+ \gamma$	> 670	90%	469	DESIG=3;OUR LIM;→ UNCHECKED ←
$p \rightarrow \mu^+ \gamma$	> 478	90%	463	DESIG=4;OUR LIM;→ UNCHECKED ←
$n \rightarrow \nu \gamma$	> 550	90%	470	DESIG=5;OUR LIM;→ UNCHECKED ←
$p \rightarrow e^+ \gamma \gamma$	> 100	90%	469	DESIG=54;OUR LIM;→ UNCHECKED ←
$n \rightarrow \nu \gamma \gamma$	> 219	90%	470	DESIG=93;OUR LIM;→ UNCHECKED ←
Antilepton + single massless				NODE=S016;CLUMP=H
$p \rightarrow e^+ X$	> 790	90%	—	DESIG=194;OUR LIM;→ UNCHECKED ←
$p \rightarrow \mu^+ X$	> 410	90%	—	DESIG=195;OUR LIM;→ UNCHECKED ←
Three (or more) leptons				NODE=S016;CLUMP=D
$p \rightarrow e^+ e^+ e^-$	> 34000	90%	469	DESIG=16;OUR LIM;→ UNCHECKED ←
$p \rightarrow e^+ \mu^+ \mu^-$	> 9200	90%	457	DESIG=45;OUR LIM;→ UNCHECKED ←
$p \rightarrow e^+ \nu \nu$	> 170	90%	469	DESIG=36;OUR LIM;→ UNCHECKED ←
$n \rightarrow e^+ e^- \nu$	> 257	90%	470	DESIG=27;OUR LIM;→ UNCHECKED ←
$n \rightarrow \mu^+ e^- \nu$	> 83	90%	464	DESIG=37;OUR LIM;→ UNCHECKED ←
$n \rightarrow \mu^+ \mu^- \nu$	> 79	90%	458	DESIG=28;OUR LIM;→ UNCHECKED ←
$p \rightarrow \mu^+ e^+ e^-$	> 23000	90%	463	DESIG=55;OUR LIM;→ UNCHECKED ←
$p \rightarrow \mu^- e^+ e^+$	> 19000	90%	463	DESIG=196;OUR LIM;→ UNCHECKED ←
$p \rightarrow \mu^+ \mu^+ \mu^-$	> 10000	90%	439	DESIG=17;OUR LIM;→ UNCHECKED ←
$p \rightarrow \mu^+ \nu \nu$	> 220	90%	463	DESIG=38;OUR LIM;→ UNCHECKED ←
$p \rightarrow e^- \mu^+ \mu^+$	> 11000	90%	457	DESIG=46;OUR LIM;→ UNCHECKED ←
$n \rightarrow 3\nu$	> 5×10^{-4}	90%	470	DESIG=21;OUR LIM;→ UNCHECKED ←
Inclusive modes				NODE=S016;CLUMP=A
$N \rightarrow e^+ \text{anything}$	> 0.6 (n, p)	90%	—	DESIG=1;OUR LIM;→ UNCHECKED ←
$N \rightarrow \mu^+ \text{anything}$	> 12 (n, p)	90%	—	DESIG=2;OUR LIM;→ UNCHECKED ←
$N \rightarrow e^+ \pi^0 \text{anything}$	> 0.6 (n, p)	90%	—	DESIG=19;OUR LIM;→ UNCHECKED ←

$\Delta B = 2$ dinucleon modes

The following are lifetime limits per iron nucleus.

$pp \rightarrow \pi^+ \pi^+$	> 72.2	90%	—
$pn \rightarrow \pi^+ \pi^0$	> 170	90%	—
$nn \rightarrow \pi^+ \pi^-$	> 0.7	90%	—
$nn \rightarrow \pi^0 \pi^0$	> 404	90%	—
$pp \rightarrow K^+ K^+$	> 170	90%	—
$pp \rightarrow e^+ e^+$	> 5.8	90%	—
$pp \rightarrow e^+ \mu^+$	> 3.6	90%	—
$pp \rightarrow \mu^+ \mu^+$	> 1.7	90%	—
$pn \rightarrow e^+ \bar{\nu}$	> 260	90%	—
$pn \rightarrow \mu^+ \bar{\nu}$	> 200	90%	—
$pn \rightarrow \tau^+ \bar{\nu}_\tau$	> 29	90%	—
$nn \rightarrow \text{invisible}$	> 1.4	90%	—
$nn \rightarrow \nu_e \bar{\nu}_e$	> 1.4	90%	—
$nn \rightarrow \nu_\mu \bar{\nu}_\mu$	> 1.4	90%	—
$pn \rightarrow \text{invisible}$	> 0.06	90%	—
$pp \rightarrow \text{invisible}$	> 0.11	90%	—

 $\bar{p}$ DECAY MODES

$\bar{p}$ DECAY MODES	Partial mean life (years)	Confidence level	p (MeV/c)
$\bar{p} \rightarrow e^- \gamma$	$> 7 \times 10^5$	90%	469
$\bar{p} \rightarrow \mu^- \gamma$	$> 5 \times 10^4$	90%	463
$\bar{p} \rightarrow e^- \pi^0$	$> 4 \times 10^5$	90%	459
$\bar{p} \rightarrow \mu^- \pi^0$	$> 5 \times 10^4$	90%	453
$\bar{p} \rightarrow e^- \eta$	$> 2 \times 10^4$	90%	309
$\bar{p} \rightarrow \mu^- \eta$	$> 8 \times 10^3$	90%	297
$\bar{p} \rightarrow e^- K_S^0$	> 900	90%	337
$\bar{p} \rightarrow \mu^- K_S^0$	$> 4 \times 10^3$	90%	326
$\bar{p} \rightarrow e^- K_L^0$	$> 9 \times 10^3$	90%	337
$\bar{p} \rightarrow \mu^- K_L^0$	$> 7 \times 10^3$	90%	326
$\bar{p} \rightarrow e^- \gamma \gamma$	$> 2 \times 10^4$	90%	469
$\bar{p} \rightarrow \mu^- \gamma \gamma$	$> 2 \times 10^4$	90%	463
$\bar{p} \rightarrow e^- \omega$	> 200	90%	143

 n

$$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$$

Mass $m = 1.0086649160 \pm 0.0000000005$ u
 Mass $m = 939.5654205 \pm 0.0000005$ MeV [a]
 $(m_n - m_{\bar{n}})/m_n = (9 \pm 5) \times 10^{-5}$
 $m_n - m_p = 1.2933324 \pm 0.0000005$ MeV
 $= 0.00138844919(45)$ u
 Mean life $\tau = 878.4 \pm 0.5$ s (S = 1.8)
 $c\tau = 2.6335 \times 10^8$ km
 Magnetic moment $\mu = -1.9130427 \pm 0.0000005 \mu_N$
 Electric dipole moment $d < 0.18 \times 10^{-25}$ ecm, CL = 90%
 Mean-square charge radius $\langle r_n^2 \rangle = -0.1155 \pm 0.0017$ fm²
 Magnetic radius $\sqrt{\langle r_M^2 \rangle} = 0.864^{+0.009}_{-0.008}$ fm
 Electric polarizability $\alpha = (11.8 \pm 1.1) \times 10^{-4}$ fm³
 Magnetic polarizability $\beta = (3.7 \pm 1.2) \times 10^{-4}$ fm³
 Charge $q = (-0.2 \pm 0.8) \times 10^{-21}$ e
 Mean $n\bar{n}$ -oscillation time $> 8.6 \times 10^7$ s, CL = 90% (free n)
 Mean $n\bar{n}$ -oscillation time $> 4.7 \times 10^8$ s, CL = 90% [f] (bound n)
 Mean nn' -oscillation time > 448 s, CL = 90% [g]

NODE=S016;CLUMP=I

NODE=S016

DESIG=62;OUR LIM;→ UNCHECKED ←
 DESIG=63;OUR LIM;→ UNCHECKED ←
 DESIG=64;OUR LIM;→ UNCHECKED ←
 DESIG=65;OUR LIM;→ UNCHECKED ←
 DESIG=193;OUR LIM;→ UNCHECKED ←
 DESIG=66;OUR LIM;→ UNCHECKED ←
 DESIG=67;OUR LIM;→ UNCHECKED ←
 DESIG=68;OUR LIM;→ UNCHECKED ←
 DESIG=69;OUR LIM;→ UNCHECKED ←
 DESIG=70;OUR LIM;→ UNCHECKED ←
 DESIG=192;OUR LIM;→ UNCHECKED ←
 DESIG=199;OUR LIM;→ UNCHECKED ←
 DESIG=71;OUR LIM;→ UNCHECKED ←
 DESIG=72;OUR LIM;→ UNCHECKED ←
 DESIG=101;OUR LIM;→ UNCHECKED ←
 DESIG=100;OUR LIM;→ UNCHECKED ←

NODE=S016;CLUMP=M
 NODE=S016

DESIG=81;OUR LIM;→ UNCHECKED ←
 DESIG=87;OUR LIM;→ UNCHECKED ←
 DESIG=82;OUR LIM;→ UNCHECKED ←
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 DESIG=83;OUR LIM;→ UNCHECKED ←
 DESIG=89;OUR LIM;→ UNCHECKED ←
 DESIG=84;OUR LIM;→ UNCHECKED ←
 DESIG=90;OUR LIM;→ UNCHECKED ←
 DESIG=85;OUR LIM;→ UNCHECKED ←
 DESIG=91;OUR LIM;→ UNCHECKED ←
 DESIG=94;OUR LIM;→ UNCHECKED ←
 DESIG=92;OUR LIM;→ UNCHECKED ←
 DESIG=96;OUR LIM;→ UNCHECKED ←

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NODE=S017AMU;DTYPE=M

NODE=S017M;DTYPE=M

NODE=S017DMM;DTYPE=D;OUR EVAL;
 → UNCHECKED ←
 NODE=S017D;DTYPE=D

NODE=S017DX;DTYPE=D;OUR EST;
 → UNCHECKED ←
 NODE=S017T;DTYPE=T

NODE=S017CTA;DTYPE=C;OUR EVAL

NODE=S017MM;DTYPE=m

NODE=S017EDM;DTYPE=e

NODE=S017MCR;DTYPE=r

NODE=S017MRD;DTYPE=r

NODE=S017EPL;DTYPE=A

NODE=S017MPL;DTYPE=k

NODE=S017Q;DTYPE=Y

NODE=S017NAN;DTYPE=N

NODE=S017NAX;DTYPE=N;OUR LIM;
 → UNCHECKED ←
 NODE=S017NOS;DTYPE=o

$pe^- \nu_e$ decay parameters ^[h]

$$\lambda \equiv g_A / g_V = -1.2753 \pm 0.0013 \quad (S = 2.7)$$

$$A = -0.11958 \pm 0.00021 \quad (S = 1.2)$$

$$B = 0.9807 \pm 0.0030$$

$$C = -0.2377 \pm 0.0026$$

$$a = -0.1044 \pm 0.0007$$

$$\phi_{AV} = (180.017 \pm 0.026)^\circ \quad [i]$$

$$D = (-1.2 \pm 2.0) \times 10^{-4} \quad [j]$$

$$R = 0.004 \pm 0.013 \quad [j]$$

$$\text{Fierz interference term } b = 0.017 \pm 0.020$$

See the proton listings for many other neutron decay modes.

n DECAY MODES	Fraction (Γ_i/Γ)	Confidence level	P (MeV/c)
$pe^- \bar{\nu}_e$	100 %		1
$pe^- \bar{\nu}_e \gamma$	[k] $(9.2 \pm 0.7) \times 10^{-3}$		1
hydrogen-atom $\bar{\nu}_e$	< 2.7×10^{-3}	95%	1.19
Charge conservation (Q) violating mode			
$p\nu_e \bar{\nu}_e$	Q < 8×10^{-27}	68%	1

$N(1440) 1/2^+$

$$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$$

$$\text{Re(pole position)} = 1360 \text{ to } 1380 (\approx 1370) \text{ MeV}$$

$$-2\text{Im(pole position)} = 180 \text{ to } 205 (\approx 190) \text{ MeV}$$

$$\text{Breit-Wigner mass} = 1410 \text{ to } 1470 (\approx 1440) \text{ MeV}$$

$$\text{Breit-Wigner full width} = 250 \text{ to } 450 (\approx 350) \text{ MeV}$$

$N(1440)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	55–75 %	398
$N\eta$	<1 %	†
$N\pi\pi$	17–50 %	347
$\Delta(1232)\pi$, P -wave	6–27 %	147
$N\sigma$	11–23 %	–
$p\gamma$, helicity=1/2	0.035–0.048 %	414
$n\gamma$, helicity=1/2	0.02–0.04 %	413

$N(1520) 3/2^-$

$$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$$

$$\text{Re(pole position)} = 1505 \text{ to } 1515 (\approx 1510) \text{ MeV}$$

$$-2\text{Im(pole position)} = 105 \text{ to } 120 (\approx 110) \text{ MeV}$$

$$\text{Breit-Wigner mass} = 1510 \text{ to } 1520 (\approx 1515) \text{ MeV}$$

$$\text{Breit-Wigner full width} = 100 \text{ to } 120 (\approx 110) \text{ MeV}$$

CLUMP=D

NODE=S017AV;DTYPE=d;CLUMP=D

NODE=S017BA;DTYPE=d;CLUMP=D

NODE=S017NA;DTYPE=d;CLUMP=D

NODE=S017APC;DTYPE=d;CLUMP=D

NODE=S017BNC;DTYPE=d;CLUMP=D

NODE=S017F;DTYPE=d;CLUMP=D

NODE=S017D1;DTYPE=d;CLUMP=D

NODE=S017TCC;DTYPE=d;CLUMP=D

NODE=S017A00;DTYPE=d;CLUMP=D

NODE=S017245;NODE=S017

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DESIG=3

NODE=S017;CLUMP=A

DESIG=2

NODE=B061

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→ UNCHECKED ←

NODE=B061IM;DTYPE=i;OUR EST;

→ UNCHECKED ←

NODE=B061M;DTYPE=M;OUR EST;

→ UNCHECKED ←

NODE=B061W;DTYPE=G;OUR EST;

→ UNCHECKED ←

NODE=B061230;NODE=B061

DESIG=1;OUR EST

DESIG=2;OUR EST

DESIG=4;OUR EST

DESIG=5;OUR EST

DESIG=8;OUR EST

DESIG=9;OUR EST

DESIG=10;OUR EST

NODE=B062

NODE=B062RE;DTYPE=i;OUR EST;

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NODE=B062IM;DTYPE=i;OUR EST;

→ UNCHECKED ←

NODE=B062M;DTYPE=M;OUR EST;

→ UNCHECKED ←

NODE=B062W;DTYPE=G;OUR EST;

→ UNCHECKED ←

$N(1520)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	55–65 %	453
$N\eta$	0.07–0.09 %	142
$N\pi\pi$	25–35 %	410
$\Delta(1232)\pi$	22–34 %	225
$\Delta(1232)\pi$, S -wave	15–23 %	225
$\Delta(1232)\pi$, D -wave	7–11 %	225
$N\rho$	10–16 %	†
$N\rho$, $S=3/2$, S -wave	10–16 %	†
$N\rho$, $S=1/2$, D -wave	0.2–0.4 %	†
$N\sigma$	<10 %	–
$p\gamma$	0.31–0.52 %	467
$p\gamma$, helicity=1/2	0.01–0.02 %	467
$p\gamma$, helicity=3/2	0.30–0.50 %	467
$n\gamma$	0.30–0.53 %	466
$n\gamma$, helicity=1/2	0.04–0.10 %	466
$n\gamma$, helicity=3/2	0.25–0.45 %	466

NODE=B062225;NODE=B062

DESIG=1;OUR EST
DESIG=2;OUR EST
DESIG=4;OUR EST
DESIG=181;OUR EST
DESIG=5;OUR EST
DESIG=6;OUR EST
DESIG=186;OUR EVAL
DESIG=187
DESIG=188
DESIG=10
DESIG=184;OUR EST
DESIG=11;OUR EST
DESIG=12;OUR EST
DESIG=185;OUR EST
DESIG=13;OUR EST
DESIG=14;OUR EST

 $N(1535) 1/2^-$

$$I(J^P) = \frac{1}{2}(\frac{1}{2}^-)$$

Re(pole position) = 1500 to 1520 (≈ 1510) MeV
 $-2\text{Im}(\text{pole position}) = 80$ to 130 (≈ 110) MeV
Breit-Wigner mass = 1515 to 1545 (≈ 1530) MeV
Breit-Wigner full width = 125 to 175 (≈ 150) MeV

NODE=B063

NODE=B063RE;DTYPE=i;OUR EST;
→ UNCHECKED ←
NODE=B063IM;DTYPE=i;OUR EST;
→ UNCHECKED ←
NODE=B063M;DTYPE=M;OUR EST;
→ UNCHECKED ←
NODE=B063W;DTYPE=G;OUR EST;
→ UNCHECKED ←
NODE=B063225;NODE=B063

$N(1535)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	32–52 %	464
$N\eta$	30–55 %	176
$N\pi\pi$	4–31 %	422
$\Delta(1232)\pi$, D -wave	1–4 %	240
$N\rho$	2–17 %	†
$N\rho$, $S=1/2$, S -wave	2–16 %	†
$N\rho$, $S=3/2$, D -wave	<1 %	†
$N\sigma$	2–10 %	–
$N(1440)\pi$	5–12 %	†
$p\gamma$, helicity=1/2	0.15–0.30 %	477
$n\gamma$, helicity=1/2	0.01–0.25 %	477

DESIG=1
DESIG=2
DESIG=4;OUR EST
DESIG=5
DESIG=188;OUR EST
DESIG=189
DESIG=190
DESIG=8
DESIG=11
DESIG=9;OUR EST
DESIG=10;OUR EST

 $N(1650) 1/2^-$

$$I(J^P) = \frac{1}{2}(\frac{1}{2}^-)$$

Re(pole position) = 1650 to 1680 (≈ 1665) MeV
 $-2\text{Im}(\text{pole position}) = 100$ to 170 (≈ 135) MeV
Breit-Wigner mass = 1635 to 1665 (≈ 1650) MeV
Breit-Wigner full width = 100 to 150 (≈ 125) MeV

NODE=B066

NODE=B066RE;DTYPE=i;OUR EST;
→ UNCHECKED ←
NODE=B066IM;DTYPE=i;OUR EST;
→ UNCHECKED ←
NODE=B066M;DTYPE=M;OUR EST;
→ UNCHECKED ←
NODE=B066W;DTYPE=G;OUR EST;
→ UNCHECKED ←

$N(1650)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	50–70 %	547
$N\eta$	15–35 %	348
ΛK	5–15 %	169
$N\pi\pi$	20–58 %	514
$\Delta(1232)\pi$, D -wave	6–18 %	345
$N\rho$	12–22 %	†
$N\rho$, $S=1/2$, S -wave	<4 %	†
$N\rho$, $S=3/2$, D -wave	12–18 %	†
$N\sigma$	2–18 %	–
$N(1440)\pi$	6–26 %	150
$p\gamma$, helicity=1/2	0.04–0.20 %	558
$n\gamma$, helicity=1/2	0.003–0.17 %	557

NODE=B066225;NODE=B066

DESIG=1;OUR EST
DESIG=2;OUR EST
DESIG=3;OUR EST
DESIG=5;OUR EST
DESIG=6;OUR EST
DESIG=188;OUR EST
DESIG=189;OUR EST
DESIG=190;OUR EST
DESIG=9;OUR EST
DESIG=10;OUR EST
DESIG=11;OUR EST
DESIG=12;OUR EST

 $N(1675) 5/2^-$

$$I(J^P) = \frac{1}{2}(\frac{5}{2}^-)$$

Re(pole position) = 1650 to 1660 (≈ 1655) MeV
 $-2\text{Im}(\text{pole position}) = 120$ to 150 (≈ 135) MeV
Breit-Wigner mass = 1665 to 1680 (≈ 1675) MeV
Breit-Wigner full width = 130 to 160 (≈ 145) MeV

NODE=B064

NODE=B064RE;DTYPE=i;OUR EST;
→ UNCHECKED ←
NODE=B064IM;DTYPE=i;OUR EST;
→ UNCHECKED ←
NODE=B064M;DTYPE=M;OUR EST;
→ UNCHECKED ←
NODE=B064W;DTYPE=G;OUR EST;
→ UNCHECKED ←
NODE=B064225;NODE=B064

$N(1675)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	38–42 %	564
$N\eta$	< 1 %	376
ΛK	<0.04 %	216
$N\pi\pi$	25–45 %	532
$\Delta(1232)\pi$, D -wave	23–37 %	366
$N\rho$	0.1–0.9 %	†
$N\rho$, $S=1/2$	<0.2 %	†
$N\rho$, $S=3/2$, D -wave	0.1–0.7 %	†
$N\sigma$	3–7 %	–
$p\gamma$	0–0.02 %	575
$p\gamma$, helicity=1/2	0–0.01 %	575
$p\gamma$, helicity=3/2	0–0.01 %	575
$n\gamma$	0–0.15 %	574
$n\gamma$, helicity=1/2	0–0.05 %	574
$n\gamma$, helicity=3/2	0–0.10 %	574

DESIG=1;OUR EST
DESIG=2;OUR EST
DESIG=186
DESIG=5;OUR EST
DESIG=6;OUR EST
DESIG=187;OUR EST
DESIG=188
DESIG=189
DESIG=11;OUR EST
DESIG=184;OUR EST
DESIG=13;OUR EST
DESIG=14;OUR EST
DESIG=185;OUR EST
DESIG=15;OUR EST
DESIG=16;OUR EST

 $N(1680) 5/2^+$

$$I(J^P) = \frac{1}{2}(\frac{5}{2}^+)$$

Re(pole position) = 1660 to 1680 (≈ 1670) MeV
 $-2\text{Im}(\text{pole position}) = 110$ to 135 (≈ 120) MeV
Breit-Wigner mass = 1680 to 1690 (≈ 1685) MeV
Breit-Wigner full width = 115 to 130 (≈ 120) MeV

NODE=B065

NODE=B065RE;DTYPE=i;OUR EST;
→ UNCHECKED ←
NODE=B065IM;DTYPE=i;OUR EST;
→ UNCHECKED ←
NODE=B065M;DTYPE=M;OUR EST;
→ UNCHECKED ←
NODE=B065W;DTYPE=G;OUR EST;
→ UNCHECKED ←

$N(1680)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	NODE=B065225;NODE=B065
$N\pi$	60–70 %	571	DESIG=1;OUR EST
$N\eta$	<1 %	386	DESIG=2;OUR EST
$N\pi\pi$	28–53 %	539	DESIG=5
$\Delta(1232)\pi$	11–23 %	374	DESIG=181;OUR EST
$\Delta(1232)\pi$, P -wave	4–10 %	374	DESIG=6;OUR EST
$\Delta(1232)\pi$, F -wave	1–13 %	374	DESIG=7;OUR EST
$N\rho$	8–11 %	†	DESIG=187;OUR EST
$N\rho$, $S=3/2$, P -wave	6–8 %	†	DESIG=188
$N\rho$, $S=3/2$, F -wave	2–3 %	†	DESIG=189
$N\sigma$	9–19 %	–	DESIG=11;OUR EST
$p\gamma$	0.21–0.32 %	581	DESIG=184;OUR EST
$p\gamma$, helicity=1/2	0.001–0.011 %	581	DESIG=12;OUR EST
$p\gamma$, helicity=3/2	0.20–0.32 %	581	DESIG=13;OUR EST
$n\gamma$	0.021–0.046 %	581	DESIG=185;OUR EST
$n\gamma$, helicity=1/2	0.004–0.029 %	581	DESIG=14;OUR EST
$n\gamma$, helicity=3/2	0.01–0.024 %	581	DESIG=15;OUR EST

 $N(1700) 3/2^-$

$$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$$

Re(pole position) = 1650 to 1750 (≈ 1700) MeV
 $-2\text{Im}(\text{pole position}) = 100$ to 300 (≈ 200) MeV
 Breit-Wigner mass = 1650 to 1800 (≈ 1720) MeV
 Breit-Wigner full width = 100 to 300 (≈ 200) MeV

NODE=B018

NODE=B018RE;DTYPE=i;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B018IM;DTYPE=i;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B018M;DTYPE=M;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B018W;DTYPE=G;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B018225;NODE=B018

$N(1700)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\pi$	7–17 %	594	DESIG=1;OUR EST
$N\eta$	1–2 %	422	DESIG=2
$N\omega$	10–34 %	†	DESIG=186;OUR EST
ΛK	1–2 %	283	DESIG=187
$N\pi\pi$	>89 %	564	DESIG=171;OUR EST
$\Delta(1232)\pi$	55–85 %	402	DESIG=181;OUR EST
$\Delta(1232)\pi$, S -wave	50–80 %	402	DESIG=5;OUR EST
$\Delta(1232)\pi$, D -wave	4–14 %	402	DESIG=6;OUR EST
$N\rho$, $S=3/2$, S -wave	32–44 %	75	DESIG=8;OUR EST
$N\sigma$	2–14 %	–	DESIG=10;OUR EST
$N(1440)\pi$	3–11 %	225	DESIG=15;OUR EST
$N(1520)\pi$	<4 %	145	DESIG=16;OUR EST
$p\gamma$	0.01–0.05 %	604	DESIG=184;OUR EST
$p\gamma$, helicity=1/2	0.0–0.024 %	604	DESIG=11;OUR EST
$p\gamma$, helicity=3/2	0.002–0.026 %	604	DESIG=12;OUR EST
$n\gamma$	0.01–0.13 %	603	DESIG=185;OUR EST
$n\gamma$, helicity=1/2	0.0–0.09 %	603	DESIG=13;OUR EST
$n\gamma$, helicity=3/2	0.01–0.05 %	603	DESIG=14;OUR EST

 $N(1710) 1/2^+$

$$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$$

Re(pole position) = 1650 to 1750 (≈ 1700) MeV
 $-2\text{Im}(\text{pole position}) = 80$ to 160 (≈ 120) MeV
 Breit-Wigner mass = 1680 to 1740 (≈ 1710) MeV
 Breit-Wigner full width = 80 to 200 (≈ 140) MeV

NODE=B014

NODE=B014RE;DTYPE=i;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B014IM;DTYPE=i;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B014M;DTYPE=M;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B014W;DTYPE=G;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$

$N(1710)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	5–20 %	588
$N\eta$	10–50 %	412
$N\omega$	1–5 %	†
ΛK	5–25 %	269
ΣK	seen	138
$N\pi\pi$	14–48 %	557
$\Delta(1232)\pi$, P -wave	3–9 %	394
$N\rho$, $S=1/2$, P -wave	11–23 %	†
$N\sigma$	<16 %	–
$N(1535)\pi$	9–21 %	113
$p\gamma$, helicity=1/2	0.002–0.08 %	598
$n\gamma$, helicity=1/2	0.0–0.02%	597

NODE=B014225;NODE=B014

DESIG=1;OUR EST
DESIG=2;OUR EST
DESIG=12;OUR EST
DESIG=3;OUR EST
DESIG=4;OUR EST
DESIG=5;OUR EST
DESIG=6
DESIG=7
DESIG=188
DESIG=187;OUR EST
DESIG=10;OUR EST
DESIG=11;OUR EST

 $N(1720) 3/2^+$

$$I(J^P) = \frac{1}{2}(\frac{3}{2}^+)$$

Re(pole position) = 1660 to 1710 (≈ 1680) MeV
 $-2\text{Im}(\text{pole position}) = 150$ to 300 (≈ 200) MeV
Breit-Wigner mass = 1680 to 1750 (≈ 1720) MeV
Breit-Wigner full width = 150 to 400 (≈ 250) MeV

NODE=B015

NODE=B015RE;DTYPE=i;OUR EST;
→ UNCHECKED ←
NODE=B015IM;DTYPE=i;OUR EST;
→ UNCHECKED ←
NODE=B015M;DTYPE=M;OUR EST;
→ UNCHECKED ←
NODE=B015W;DTYPE=G;OUR EST;
→ UNCHECKED ←
NODE=B015225;NODE=B015

$N(1720)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	8–14 %	594
$N\eta$	1–5 %	422
$N\omega$	12–40 %	†
ΛK	4–19 %	283
$N\pi\pi$	>50 %	564
$\Delta(1232)\pi$	47–89 %	402
$\Delta(1232)\pi$, P -wave	47–77 %	402
$\Delta(1232)\pi$, F -wave	<12 %	402
$N\rho$, $S=1/2$, P -wave	1–2 %	75
$N\sigma$	2–14 %	–
$N(1440)\pi$	<2 %	225
$N(1520)\pi$, S -wave	1–5 %	145
$p\gamma$	0.05–0.25 %	604
$p\gamma$, helicity=1/2	0.05–0.15 %	604
$p\gamma$, helicity=3/2	0.002–0.16 %	604
$n\gamma$	0.0–0.016 %	603
$n\gamma$, helicity=1/2	0.0–0.01 %	603
$n\gamma$, helicity=3/2	0.0–0.015 %	603

DESIG=1;OUR EST
DESIG=2;OUR EST
DESIG=187;OUR EST
DESIG=3
DESIG=5
DESIG=181;OUR EST
DESIG=6;OUR EST
DESIG=14;OUR EST
DESIG=7;OUR EST
DESIG=9;OUR EST
DESIG=15;OUR EST
DESIG=16;OUR EST
DESIG=184;OUR EST
DESIG=10;OUR EST
DESIG=11;OUR EST
DESIG=185;OUR EST
DESIG=12;OUR EST
DESIG=13;OUR EST

 $N(1875) 3/2^-$

$$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$$

was $N(2080)$

Re(pole position) = 1850 to 1950 (≈ 1900) MeV
 $-2\text{Im}(\text{pole position}) = 100$ to 220 (≈ 160) MeV
Breit-Wigner mass = 1850 to 1920 (≈ 1875) MeV
Breit-Wigner full width = 120 to 250 (≈ 200) MeV

NODE=B016

NODE=B016RE;DTYPE=p;OUR EST;
→ UNCHECKED ←
NODE=B016IM;DTYPE=p;OUR EST;
→ UNCHECKED ←
NODE=B016M;DTYPE=M;OUR EST;
→ UNCHECKED ←
NODE=B016W;DTYPE=G;OUR EST;
→ UNCHECKED ←

$N(1875)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\pi$	3–11 %	695	NODE=B016225;DESIG=1;OUR EST
$N\eta$	3–16 %	559	DESIG=2
$N\omega$	15–25 %	371	DESIG=12;OUR EST
ΛK	1–2 %	454	DESIG=3
ΣK	0.3–1.1 %	384	DESIG=4
$N\pi\pi$	>56 %	670	DESIG=5;OUR EST
$\Delta(1232)\pi$	4–44 %	520	DESIG=14;OUR EST
$\Delta(1232)\pi$, S -wave	2–21 %	520	DESIG=21
$\Delta(1232)\pi$, D -wave	2–23 %	520	DESIG=22
$N\rho$, $S=3/2$, S -wave	36–56 %	379	DESIG=23
$N\sigma$	16–60 %	–	DESIG=24
$N(1440)\pi$	2–8 %	365	DESIG=11;OUR EST
$N(1520)\pi$	<2 %	301	DESIG=13;OUR EST
$\Lambda K^*(892)$	<0.2 %	†	DESIG=178
$p\gamma$	0.001–0.025 %	703	DESIG=10;OUR EST
$p\gamma$, helicity=1/2	0.001–0.021 %	703	DESIG=6;OUR EST
$p\gamma$, helicity=3/2	<0.003 %	703	DESIG=7;OUR EST
$n\gamma$	<0.040 %	702	DESIG=15;OUR EST
$n\gamma$, helicity=1/2	<0.007 %	702	DESIG=8;OUR EST
$n\gamma$, helicity=3/2	<0.033 %	702	DESIG=9;OUR EST

 $N(1880) 1/2^+$

$$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$$

Re(pole position) = 1820 to 1900 ($\approx$ 1860) MeV
 $-2\text{Im}(\text{pole position}) = 180$ to 280 ($\approx$ 230) MeV
 Breit-Wigner mass = 1830 to 1930 ($\approx$ 1880) MeV
 Breit-Wigner full width = 200 to 400 ($\approx$ 300) MeV

NODE=B087

NODE=B087RE;DTYPE=r;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B087IM;DTYPE=r;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B087M;DTYPE=M;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B087W;DTYPE=G;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$

$N(1880)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\pi$	3–31 %	698	NODE=B087225;DESIG=1
$N\eta$	1–55 %	563	DESIG=2
$N\omega$	12–28 %	377	DESIG=13
ΛK	1–3 %	459	DESIG=3
ΣK	10–24 %	389	DESIG=4
$N\pi\pi$	>32 %	673	DESIG=12;OUR EST
$\Delta(1232)\pi$	5–42 %	524	DESIG=5
$N\rho$, $S=1/2$, P -wave	19–45 %	385	DESIG=15
$N\sigma$	8–40 %	539	DESIG=7
$N(1535)\pi$	4–12 %	293	DESIG=10
$Na_0(980)$	1–5 %	†	DESIG=11
$\Lambda K^*(892)$	0.5–1.1 %	†	DESIG=14
$p\gamma$, helicity=1/2	seen	706	DESIG=8;OUR EST
$n\gamma$, helicity=1/2	0.002–0.63 %	705	DESIG=9;OUR EST

 $N(1895) 1/2^-$

$$I(J^P) = \frac{1}{2}(\frac{1}{2}^-)$$

was $N(2090)$

Re(pole position) = 1890 to 1930 ($\approx$ 1910) MeV
 $-2\text{Im}(\text{pole position}) = 80$ to 140 ($\approx$ 110) MeV
 Breit-Wigner mass = 1870 to 1920 ($\approx$ 1895) MeV
 Breit-Wigner full width = 80 to 200 ($\approx$ 120) MeV

NODE=B004

NODE=B004RE;DTYPE=r;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B004IM;DTYPE=r;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B004M;DTYPE=M;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B004W;DTYPE=G;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$

$N(1895)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\pi$	2–18 %	707	NODE=B004225;DESIG=1
$N\eta$	15–45 %	575	DESIG=11
$N\eta'$	10–40 %	†	DESIG=17
$N\omega$	16–40 %	395	DESIG=15
ΛK	3–23 %	473	DESIG=2
ΣK	6–20 %	405	DESIG=12
$N\pi\pi$	17–74 %	683	DESIG=3;OUR EST
$\Delta(1232)\pi$, D -wave	3–11 %	535	DESIG=5
$N\rho$	14–50 %	403	DESIG=6;OUR EST
$N\rho$, $S=1/2$, S -wave	<18 %	403	DESIG=7
$N\rho$, $S=3/2$, D -wave	14–32 %	403	DESIG=8
$N\sigma$	<13 %	–	DESIG=9
$N(1440)\pi$	2–12 %	382	DESIG=10
$\Lambda K^*(892)$	4–9 %	†	DESIG=16
$p\gamma$, helicity=1/2	0.01–0.06 %	715	DESIG=13;OUR EST
$n\gamma$, helicity=1/2	0.003–0.05 %	715	DESIG=14;OUR EST

$N(1900) 3/2^+$

$$I(J^P) = \frac{1}{2}(\frac{3}{2}^+)$$

Re(pole position) = 1900 to 1940 (≈ 1920) MeV
 $-2\text{Im}(\text{pole position}) = 90$ to 160 (≈ 130) MeV
 Breit-Wigner mass = 1890 to 1950 (≈ 1920) MeV
 Breit-Wigner full width = 100 to 320 (≈ 200) MeV

NODE=B144

NODE=B144RE;DTYPE=p;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B144IM;DTYPE=p;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B144M;DTYPE=M;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B144W;DTYPE=G;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$

$N(1900)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)	
$N\pi$	1–20 %	723	NODE=B144215;DESIG=1
$N\eta$	2–14 %	595	DESIG=4;OUR EST
$N\eta'$	4–8 %	151	DESIG=20
$N\omega$	7–13 %	424	DESIG=5;OUR EST
ΛK	2–20 %	495	DESIG=6;OUR EST
ΣK	3–7 %	431	DESIG=7;OUR EST
$N\pi\pi$	>56 %	699	DESIG=2;OUR EST
$\Delta(1232)\pi$	30–70 %	553	DESIG=3;OUR EST
$\Delta(1232)\pi$, P -wave	9–25 %	553	DESIG=18;OUR EST
$\Delta(1232)\pi$, F -wave	21–45 %	553	DESIG=17;OUR EST
$N\rho$, $S=1/2$	25–40 %	432	DESIG=22
$N\sigma$	1–7 %	–	DESIG=16;OUR EST
$N(1520)\pi$	7–23 %	341	DESIG=15;OUR EST
$N(1535)\pi$	4–10 %	328	DESIG=14;OUR EST
$\Lambda K^*(892)$	< 0.2 %	†	DESIG=19
$p\gamma$	0.001–0.025 %	731	DESIG=8;OUR EST
$p\gamma$, helicity=1/2	0.001–0.021 %	731	DESIG=9;OUR EST
$p\gamma$, helicity=3/2	<0.003 %	731	DESIG=10;OUR EST
$n\gamma$	<0.040 %	730	DESIG=11;OUR EST
$n\gamma$, helicity=1/2	<0.007 %	730	DESIG=12;OUR EST
$n\gamma$, helicity=3/2	<0.033 %	730	DESIG=13;OUR EST

$N(2060) 5/2^-$

$$I(J^P) = \frac{1}{2}(\frac{5}{2}^-)$$

was $N(2200)$

Re(pole position) = 2020 to 2130 (≈ 2070) MeV
 $-2\text{Im}(\text{pole position}) = 350$ to 430 (≈ 400) MeV
 Breit-Wigner mass = 2030 to 2200 (≈ 2100) MeV
 Breit-Wigner full width = 300 to 450 (≈ 400) MeV

NODE=B005

NODE=B005RE;DTYPE=r;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B005IM;DTYPE=r;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B005M;DTYPE=M;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B005W;DTYPE=G;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$

<i>N</i>(2060) DECAY MODES	Fraction (Γ_i/Γ)	<i>p</i> (MeV/c)	
$N\pi$	7–12 %	834	NODE=B005225;DESIG=1;OUR EST
$N\eta$	2–38 %	729	DESIG=2
$N\omega$	1–7 %	600	DESIG=21;OUR EST
ΛK	10–20 %	644	DESIG=3
ΣK	1–5 %	593	DESIG=4;OUR EST
$N\pi\pi$	12–52 %	814	DESIG=5;OUR EST
$\Delta(1232)\pi$, <i>D</i> -wave	4–10 %	680	DESIG=7
$N\rho$	5–33 %	605	DESIG=8;OUR EST
$N\rho$, <i>S</i> =1/2, <i>P</i> -wave	<10 %	605	DESIG=9
$N\rho$, <i>S</i> =3/2, <i>D</i> -wave	5–23 %	605	DESIG=23
$N\sigma$	3–9 %	–	DESIG=17;OUR EST
$N(1440)\pi$	4–14 %	544	DESIG=18;OUR EST
$N(1520)\pi$, <i>P</i> -wave	9–21 %	490	DESIG=19;OUR EST
$N(1680)\pi$, <i>S</i> -wave	8–22 %	353	DESIG=20;OUR EST
$\Lambda K^*(892)$	0.3–1.3 %	307	DESIG=22
$p\gamma$	0.03–0.19 %	840	DESIG=11;OUR EST
$p\gamma$, helicity=1/2	0.02–0.08 %	840	DESIG=12;OUR EST
$p\gamma$, helicity=3/2	0.01–0.10 %	840	DESIG=13;OUR EST
$n\gamma$	0.003–0.07 %	840	DESIG=14;OUR EST
$n\gamma$, helicity=1/2	0.001–0.02 %	840	DESIG=15;OUR EST
$n\gamma$, helicity=3/2	0.002–0.05 %	840	DESIG=16;OUR EST

***N*(2100) 1/2⁺**

$$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$$

Re(pole position) = 2050 to 2150 ($\approx$ 2100) MeV
 $-2\text{Im}(\text{pole position}) = 240$ to 340 ($\approx$ 300) MeV
 Breit-Wigner mass = 2050 to 2150 ($\approx$ 2100) MeV
 Breit-Wigner full width = 200 to 320 ($\approx$ 260) MeV

NODE=B132

NODE=B132RE;DTYPE=r;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B132IM;DTYPE=r;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B132M;DTYPE=M;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B132W;DTYPE=G;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$

<i>N</i>(2100) DECAY MODES	Fraction (Γ_i/Γ)	<i>p</i> (MeV/c)	
$N\pi$	8–32 %	834	NODE=B132225;DESIG=1
$N\eta$	5–45 %	729	DESIG=4
$N\eta'$	5–11 %	451	DESIG=14
$N\omega$	10–25 %	600	DESIG=12
ΛK	<1.0 %	644	DESIG=5
$N\pi\pi$	>55 %	814	DESIG=3;OUR EST
$\Delta(1232)\pi$, <i>P</i> -wave	6–14 %	680	DESIG=2
$N\rho$, <i>S</i> =1/2, <i>P</i> -wave	35–70	605	DESIG=6
$N\sigma$	14–35 %	–	DESIG=7
$N(1535)\pi$	26–34 %	478	DESIG=8
$\Lambda K^*(892)$	3–11 %	307	DESIG=13
$p\gamma$, helicity=1/2	0.001–0.13 %	840	DESIG=11;OUR EST
$n\gamma$, helicity=1/2	0.004–0.09 %	840	DESIG=15;OUR EST

***N*(2120) 3/2[−]**

$$I(J^P) = \frac{1}{2}(\frac{3}{2}^-)$$

Re(pole position) = 2050 to 2150 ($\approx$ 2100) MeV
 $-2\text{Im}(\text{pole position}) = 200$ to 360 ($\approx$ 280) MeV
 Breit-Wigner mass = 2060 to 2160 ($\approx$ 2120) MeV
 Breit-Wigner full width = 260 to 360 ($\approx$ 300) MeV

NODE=B024

NODE=B024RE;DTYPE=r;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B024IM;DTYPE=r;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B024M;DTYPE=M;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$
 NODE=B024W;DTYPE=G;OUR EST;
 $\rightarrow$ UNCHECKED $\leftarrow$

<i>N</i>(2120) DECAY MODES	Fraction (Γ_i/Γ)	<i>p</i> (MeV/c)	
<i>N</i> π	5–15 %	846	NODE=B024225;DESIG=1
<i>N</i> η	1–5 %	743	DESIG=18
<i>N</i> η′	2–6 %	474	DESIG=16
<i>N</i> ω	4–20 %	617	DESIG=14
Λ <i>K</i>	6–11 %	660	DESIG=17
<i>N</i> ππ	>27 %	827	DESIG=6;OUR EST
Δ(1232)π	>23 %	693	DESIG=7;OUR EST
Δ(1232)π, <i>S</i> -wave	15–70 %	693	DESIG=4
Δ(1232)π, <i>D</i> -wave	8–45 %	693	DESIG=5
<i>N</i> ρ, <i>S</i> =3/2, <i>S</i> -wave	< 3 %	622	DESIG=20
<i>N</i> σ	4–15 %	–	DESIG=3
<i>N</i> (1535)π	7–23 %	494	DESIG=2
Λ <i>K</i> *(892)	< 0.2 %	339	DESIG=15
<i>p</i> γ	0.16–2.1 %	852	DESIG=8;OUR EST
<i>p</i> γ, helicity=1/2	0.07–0.80 %	852	DESIG=9;OUR EST
<i>p</i> γ, helicity=3/2	0.09–1.3 %	852	DESIG=10;OUR EST
<i>n</i> γ	0.04–0.72 %	852	DESIG=11;OUR EST
<i>n</i> γ, helicity=1/2	0.04–0.60 %	852	DESIG=12;OUR EST
<i>n</i> γ, helicity=3/2	0.001–0.12 %	852	DESIG=13;OUR EST

***N*(2190) 7/2[−]**

$$I(J^P) = \frac{1}{2}(\frac{7}{2}^-)$$

Re(pole position) = 1950 to 2150 ($\approx$ 2050) MeV
 −2Im(pole position) = 300 to 500 ($\approx$ 400) MeV
 Breit-Wigner mass = 2140 to 2220 ($\approx$ 2180) MeV
 Breit-Wigner full width = 300 to 500 ($\approx$ 400) MeV

NODE=B071

NODE=B071RE;DTYPE=i;OUR EST;
 → UNCHECKED ←
 NODE=B071IM;DTYPE=i;OUR EST;
 → UNCHECKED ←
 NODE=B071M;DTYPE=M;OUR EST;
 → UNCHECKED ←
 NODE=B071W;DTYPE=G;OUR EST;
 → UNCHECKED ←
 NODE=B071225;NODE=B071

<i>N</i>(2190) DECAY MODES	Fraction (Γ_i/Γ)	<i>p</i> (MeV/c)	
<i>N</i> π	10–20 %	882	DESIG=1
<i>N</i> η	1–5 %	785	DESIG=2
<i>N</i> ω	8–20 %	667	DESIG=178
Λ <i>K</i>	0.2–0.8 %	705	DESIG=3
<i>N</i> ππ	22–51 %	864	DESIG=5;OUR EST
Δ(1232)π, <i>D</i> -wave	19–31 %	734	DESIG=17
<i>N</i> ρ, <i>S</i> =3/2, <i>D</i> -wave	<11 %	672	DESIG=6
<i>N</i> σ	3–9 %	–	DESIG=16
Λ <i>K</i> *(892)	0.2–0.8 %	423	DESIG=179
<i>p</i> γ	<0.08 %	888	DESIG=11;OUR EST
<i>p</i> γ, helicity=1/2	<0.06 %	888	DESIG=7;OUR EST
<i>p</i> γ, helicity=3/2	<0.02 %	888	DESIG=8;OUR EST
<i>n</i> γ	<0.04 %	888	DESIG=19;OUR EST
<i>n</i> γ, helicity=1/2	<0.01 %	888	DESIG=9;OUR EST
<i>n</i> γ, helicity=3/2	<0.03 %	888	DESIG=10;OUR EST

***N*(2220) 9/2⁺**

$$I(J^P) = \frac{1}{2}(\frac{9}{2}^+)$$

Re(pole position) = 2130 to 2200 ($\approx$ 2150) MeV
 −2Im(pole position) = 360 to 480 ($\approx$ 400) MeV
 Breit-Wigner mass = 2200 to 2300 ($\approx$ 2250) MeV
 Breit-Wigner full width = 350 to 500 ($\approx$ 400) MeV

NODE=B090

NODE=B090RE;DTYPE=i;OUR EST;
 → UNCHECKED ←
 NODE=B090IM;DTYPE=i;OUR EST;
 → UNCHECKED ←
 NODE=B090M;DTYPE=M;OUR EST;
 → UNCHECKED ←
 NODE=B090W;DTYPE=G;OUR EST;
 → UNCHECKED ←

<i>N</i>(2220) DECAY MODES	Fraction (Γ_i/Γ)	<i>p</i> (MeV/c)
<i>N</i> π	15–30 %	924

***N*(2250) 9/2[−]**

$$I(J^P) = \frac{1}{2}(\frac{9}{2}^-)$$

Re(pole position) = 2100 to 2200 ($\approx$ 2150) MeV
 $-2\text{Im}(\text{pole position}) = 350$ to 500 ($\approx$ 420) MeV
 Breit-Wigner mass = 2250 to 2320 ($\approx$ 2280) MeV
 Breit-Wigner full width = 300 to 600 ($\approx$ 500) MeV

<i>N</i>(2250) DECAY MODES	Fraction (Γ_i/Γ)	<i>p</i> (MeV/c)
<i>N</i> π	5–15 %	941
<i>N</i> η	<5 %	852
Λ <i>K</i>	1–3 %	777

***N*(2600) 11/2[−]**

$$I(J^P) = \frac{1}{2}(\frac{11}{2}^-)$$

Breit-Wigner mass = 2550 to 2750 ($\approx$ 2600) MeV
 Breit-Wigner full width = 500 to 800 ($\approx$ 650) MeV

<i>N</i>(2600) DECAY MODES	Fraction (Γ_i/Γ)	<i>p</i> (MeV/c)
<i>N</i> π	3–8 %	1126

NOTES

- [a] The masses of the *p* and *n* are most precisely known in u (unified atomic mass units). The conversion factor to MeV, 1 u = 931.494061(21) MeV, is less well known than are the masses in u.
- [b] The $|m_p - m_{\bar{p}}|/m_p$ and $|q_p + q_{\bar{p}}|/e$ are not independent, and both use the more precise measurement of $|q_{\bar{p}}/m_{\bar{p}}|/(q_p/m_p)$.
- [c] The limit is from neutrality-of-matter experiments; it assumes $q_n = q_p + q_e$. See also the charge of the neutron.
- [d] The μp and $e p$ values for the charge radius are much too different to average them. The disagreement is not yet understood.
- [e] There is a lot of disagreement about the value of the proton magnetic charge radius. See the Listings.
- [f] There is some controversy about whether nuclear physics and model dependence complicate the analysis for bound neutrons (from which the best limit comes). The first limit here is from reactor experiments with free neutrons.
- [g] Lee and Yang in 1956 proposed the existence of a mirror world in an attempt to restore global parity symmetry—thus a search for oscillations between the two worlds. Oscillations between the worlds would be maximal when the magnetic fields *B* and *B'* were equal. The limit for any *B'* in the range 0 to 12.5 μT is >12 s (95% CL).
- [h] The parameters g_A , g_V , and g_{WM} for semileptonic modes are defined by $\bar{B}_f[\gamma_\lambda(g_V + g_A\gamma_5) + i(g_{WM}/m_{B_i})\sigma_{\lambda\nu}q^\nu]B_i$, and ϕ_{AV} is defined by $g_A/g_V = |g_A/g_V|e^{i\phi_{AV}}$. See the “Note on Baryon Decay Parameters” in the neutron Particle Listings.
- [i] Time-reversal invariance requires this to be 0° or 180°.
- [j] This coefficient is zero if time invariance is not violated.
- [k] This limit is for γ energies between 0.4 and 782 keV.

NODE=B090225;NODE=B090

DESIG=1;OUR EST

NODE=B113

NODE=B113RE;DTYPE=i;OUR EST;
 → UNCHECKED ←
 NODE=B113IM;DTYPE=i;OUR EST;
 → UNCHECKED ←
 NODE=B113M;DTYPE=M;OUR EST;
 → UNCHECKED ←
 NODE=B113W;DTYPE=G;OUR EST;
 → UNCHECKED ←
 NODE=B113225;NODE=B113

DESIG=1

DESIG=4

DESIG=5

NODE=B120

NODE=B120M;DTYPE=M;OUR EST;
 → UNCHECKED ←
 NODE=B120W;DTYPE=G;OUR EST;
 → UNCHECKED ←

NODE=B120215;DESIG=1;OUR EST

LINKAGE=SEB

LINKAGE=MQ

LINKAGE=SS

LINKAGE=CHR

LINKAGE=MCR

LINKAGE=SNN

LINKAGE=NOS

LINKAGE=SBD

LINKAGE=CR

LINKAGE=TVC

LINKAGE=GL