Adopted Levels, Gammas

Q(β^-)=12523 *17*; S(n)=5328 *25*; S(p)=16350 *30*; Q(α)=−15527 *27* 2017Wa10

The ^{19}N nucleus is particle stable with respect to decay into ^{18}N+n by 5.33 MeV. Its mass excess is ΔM=15.856 MeV *16* (2017Wa10).

Theoy:

Predictions, calculations and analyses for ground-state and excited-state parameters of ^{19}N: 1972Wa07, 1975Be31, 1990Lo11, 1993Po11, 1996Re04, 1998De43, 1999He33, 2000Zh42, 2002Ka73, 2002Me12, 2003Gr01, 2004La24, 2004Ne16, 2013Au03, 2015Ci05, 2016Ma06.

Shell model calculations: 1988PoZS, 1992Wa22, 1988Wa17, 1993Po11, 2004Su23, 2012Yu04, 2012Yu07, 2016Zh05.

^{19}N mass estimates and calculations: 1966Ga25, 1969St07, 1972Ba25, 1972Th13, 1974Th01, 1975Je02, 1976Ja23, 1976Wa18, 1977Wa08, 1986An07, 2006Ko02.

^{19}N Levels

Cross Reference (XREF) Flags

A	^{19}C β^- decay	H	C(^{20}N,^{19}N)	O	^{207}Pb(^{18}O,^{19}N),^{208}Pb(^{18}O,^{19}N)
B	H(^{19}C,^{19}N),C(^{19}C,^{19}N)	I	^{18}O(^{18}O,^{19}N)	P	^{208}Pb(^{20}N,^{19}Nγ)
C	^{1}H(^{21}N,^{19}Nγ),^{208}Pb(^{21}N,^{19}Nγ)	J	^{20}C β^-n decay	Q	^{232}Th(^{18}O,^{19}N)
D	^{9}Be(^{36}S,Xγ)	K	Si(^{19}N,X)	R	^{232}Th(^{22}Ne,^{19}N)
E	^{9}Be(^{40}Ar,^{19}N)	L	^{48}Ca(^{18}O,^{19}N)	S	U(p,^{19}N)
F	^{10}Be(^{11}B,2p)	M	Ni(^{40}Ar,^{19}N),^{181}Ta(^{40}Ar,^{19}N)		
G	C(^{19}N,X)	N	Au(p,^{19}N)		

E(level)†	J^π	$T_{1/2}$	XREF	Comments
0.0	1/2$^-$	336 ms *3*	BCDEFGHIJKLMNOPQRS	%β^-=100; %β^-n=41.8 *9* (2006Su12) μ=0.305 *15* (2004Ka22) See also P_n=(33 *+34−11*)% (1988Mu08), P_n=(62.4 *26*)% (1991Re02) and (1993ReZX). $T_{1/2}$: From (2006Su12). Previous results are 0.32 sec *10* (1986Du07), 0.21 sec *+20−10* (1988Mu08), 0.235 sec *32* (1988Sa04), 0.300 sec *80* (1988DuZT), 0.329 sec *19* (1991Re02), 0.255 sec *10* (P.L. Reeder et al., Int. Conf. on Nucl. Data for Science and Technology, May 9-13, 1994, Gatlinburg, Tennessee) and 0.271 sec *8* (1995ReZZ). See also (1984Kl06, 1986JeZY,1987BaZI,1987DuZU,1987MiZU, 1988BaYZ, 1994KiZU) and (1988Wa17, 1982CuZZ: theory). *g*-factor(=0.61 *3*) (2004Ka22) is significantly smaller than the value of $g(^{17}N_{g.s.})$ which contradicts the shell-model predictions. μ: An upper limit $\lvert\mu(^{19}N)\rvert\leq 0.32\ \mu_N$ was deduced in (2004Ue03).
1143 *3*	(3/2$^-$)		CD I P	%IT=100 E(level): See also 1110 keV *20* (1989Ca25).
1676 *3*	(5/2$^-$)		CD I P	%IT=100 E(level): See also 1650 keV *20* (1989Ca25).
2132 *9*	(5/2$^+$,3/2$^-$)		D	%IT=100
2511 *5*	(1/2$^+$)		D I P	%IT=100 E(level): See also 2540 keV *30* (1989Ca25).
3170 *6*	(7/2$^-$)		D	%IT=100
3470 *30*			I	%IT=100 E(level): from (1989Ca25).
4023 *9*	(7/2$^-$)		D	%IT=100
4180 *20*			I	%IT=100 E(level): from (1989Ca25).
6400 *27*			A	%n≤100

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{19}N Levels (continued)

E(level)[†]	XREF	Comments
6508 *27*	A	%n≤100
7025 *33*	A	%n≤100

[†] E≤4023 keV from (2008So09), E≥6400 keV from (1995Oz02).

γ(^{19}N)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π
1143	(3/2$^-$)	1141 *3*	100	0.0	1/2$^-$
1676	(5/2$^-$)	532 *2*	100 *8*	1143	(3/2$^-$)
		1681 *5*	39 *8*	0.0	1/2$^-$
2132	(5/2$^+$,3/2$^-$)	2132 *9*	100	0.0	1/2$^-$
2511	(1/2$^+$)	1368 *4*	100 *13*	1143	(3/2$^-$)
		2507[†] *11*	25 *13*	0.0	1/2$^-$
3170	(7/2$^-$)	1494 *6*	100 *19*	1676	(5/2$^-$)
		2016[†] *11*	38 *19*	1143	(3/2$^-$)
4023	(7/2$^-$)	2347 *9*	100	1676	(5/2$^-$)

[†] Placement of transition in the level scheme is uncertain.

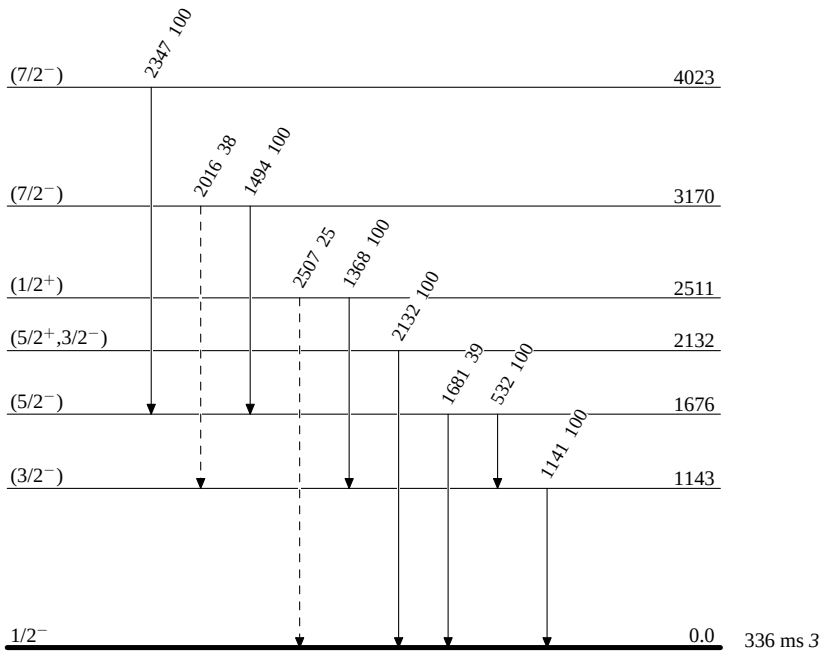
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

– – – – – – ► γ Decay (Uncertain)



$^{19}_{7}N_{12}$

^{19}C β^- decay 1995Oz02

Parent: ^{19}C: E=0; $T_{1/2}$=46.3 ms *40*; Q(β^-)=1.656×10^4 *10*; %β^- decay=100.0

^{19}C-$T_{1/2}$: weighted value of (1988Du09,1995OZ02 and P.L. Reeder et al., Int. Conf. on Nucl. Data for Science and Technology, May 9-13, 1994, Gatlinburg, Tennessee).

^{19}C-Q(β^-): From (2017Wa10).

^{19}C-Q(β^-n)=1.123×10^4 keV *10* (2017Wa10).

1995Oz02: A beam of ^{19}C ions, produced by fragmenting a ^{22}Ne beam on a ^{9}Be target, was magnetically separated and degraded to lower energies before being stopped in a plastic scintillator. The implantation detector was sandwiched between four other scintillator detectors; a valid event required a coincidence between three ajacent detectors. Three neutron walls surrounded the implantation target and covered about 1.4 sr. The decay neutron energy was deduced by the time of flight between the implantation detector and the neutron wall detectors. The time-of-flight (TOF) was calibrated by studying the decay of ^{17}N which has three visible known neutron groups. A set of two NaI detectors faced the target for use measuring γ-ray singles events and n-γ coincidence events.

The measured neutron spectrum shows several decay groups. A significant ^{17}B component was present in the beam, and its decay radiations presented a background that was analyzed and subtracted. The final analysis of the neutron energy spectrum revealed five neutron groups that are attributed to β delayed neutron decay of ^{19}C, or its daughter ^{19}N.

Throughout the experiment, ions were implanted for a 100 ms period followed by a 200 ms counting period; analysis of the time dependence for the neutron groups permitted assignment of four groups to decay of ^{19}C ($T_{1/2}$≈50 ms) and one group to decay of ^{19}N ($T_{1/2}$≈320 ms).

Four neutron groups at E_n=0.46, 1.01, 1.50 and 2.08 keV are observed; poor statistics prohibited full analysis of the E_n=2.08 MeV group. Three excited states of ^{19}N were deduced from these E_n energies. The results are presented by normalizing to %β^-1n=47% *3* from (1988Du09).

^{19}N Levels

E(level)	Comments
6400 *27*	From E_n=460 keV *10* (→^{18}N*(0.587 MeV)).
6508 *27*	From E_n=1010 keV *10* (→^{18}N*(0.115 MeV)).
7025 *33*	From E_n=1500 keV *20* (→^{18}N*(0.115 MeV)).

β^- radiations

E(decay)	E(level)	Iβ^-[†]	Log *ft*
(9.54×10^3 *11*)	7025	12.7 *15*	4.94 *8*
(1.005×10^4 *10*)	6508	20.0 *16*	4.86 *7*
(1.016×10^4 *10*)	6400	14.3 *20*	5.02 *8*

[†] Absolute intensity per 100 decays.

H(^{19}C,^{19}N),C(^{19}C,^{19}N) 2016Ta07

2016Ta07: The charge-exchange cross sections of $^{12-19}$C(p,n)$^{12-19}$N reactions were measured in inverse kinematics at the GSI/FRS facility. Beams of E($^{12-19}$C)≈950 MeV/nucleon ions were identified via ΔE-time-of-flight techniques before bombarding either a graphite (4.01 g/cm^2) or a polyethylene (3.625 g/cm^2) target. The reaction products were identified using the MUSIC2 multi-sampling segmented ion chamber. The charge exchange cross sections to ^{19}N are σ(H target)=1.88 mb *65* and σ(C target)=7.66 mb *80*.

^{19}N Levels

E(level)
0

^{1}H(^{21}N,^{19}Nγ),^{208}Pb(^{21}N,^{19}Nγ) 2010El05

2010El05: XUNDL dataset compiled by McMaster, 2010.

A beam of ≈50 MeV/nucleon ^{21}N ions, from the RIKEN/RIPS facility, impinged on either a hydrogen target or a ^{208}Pb target (thickness not given). Scattered particles were detected near θ<6.5° and identified based on total energy and time-of-flight measurements using an array of plastic scintillators, in addition an array of 160 NaI(Tl) crystals from the DALI2 array detected correlated γ rays. The populated levels and a partial level scheme were deduced.

Measured Eγ, Iγ, Doppler-corrected γ spectra.

The level scheme is based on that proposed in (2008So09).

^{19}N Levels

E(level)
0
1137 *26*
1666 *33*

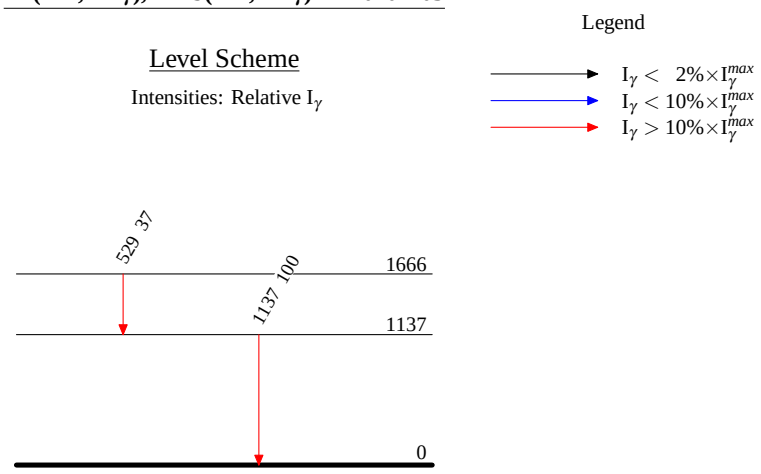
γ(^{19}N)

E$_\gamma$	I$_\gamma$	E$_i$(level)	E$_f$
529 *21*	37	1666	1137
1137 *26*	100	1137	0

^{1}H(^{21}N,^{19}Nγ),^{208}Pb(^{21}N,^{19}Nγ) 2010El05

Level Scheme

Intensities: Relative I$_\gamma$



$^{19}_{7}N_{12}$

^{9}Be(^{36}S,Xγ) 2008So09

2008So09: XUNDL dataset compiled by McMaster, 2008.

An E(^{36}S)=77.5 MeV/nucleon beam was delivered to the GANIL/SPEG spectrometer. In the first part of the experiment, the beam bombarded a 2.77 mg/cm^2 ^{9}Be target and the SPEG magnetic spectrometer was used to momentum analyze the reaction products and identify ^{19}N$_{g.s.}$.

In the second part, a ^{12}C target at the entrance of the SISSI device produced a cocktail beam of ^{24}F, ^{25,26}Ne, ^{27,28}Na, and ^{29,30}Mg that was purified in the α spectrometer and then delivered to a carbon target at the dispersive image of the SPEG spectrometer. The target was surrounded by the 74 element BaF_2 *Chateau de crystal* array and four HPGe detectors. The γ rays observed in coincidence with ^{19}N ions detected at the SPEG focal plane were analyzed to obtain information on the ^{19}N level structure. Eγ, Iγ, $\gamma\gamma$-coin were measured using 74 BaF_2 crystals and four HPGe detectors.

Energy levels and J$^\pi$ values were proposed from comparison with shell-model calculations. See also (2012Yu07).

^{19}N Levels

E(level)[†]	J$^\pi$[‡]	Comments
0	(1/2$^-$)	
1143 *3*	(3/2$^-$)	J$^\pi$: $\pi p^{-1}_{1/2}\otimes$(first 2$^+$ in ^{20}O).
1676 *3*	(5/2$^-$)	J$^\pi$: $\pi p^{-1}_{1/2}\otimes$(first 2$^+$ in ^{20}O).
2132 *9*	(5/2$^+$,3/2$^-$)	Possible intruder state if 5/2$^+$.
2511 *5*	(1/2$^+$)	Possible intruder state.
3170 *6*	(7/2$^-$)	
4023 *9*	(7/2$^-$)	

[†] From least-squares fit to Eγ's.
[‡] From comparison with shell-model calculations and decay pattern.

γ(^{19}N)

E$_\gamma$	I$_\gamma$	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$
532 *2*	38 *3*	1676	(5/2$^-$)	1143	(3/2$^-$)
1141 *3*	100 *5*	1143	(3/2$^-$)	0	(1/2$^-$)
1368 *4*	24 *3*	2511	(1/2$^+$)	1143	(3/2$^-$)
1494 *6*	16 *3*	3170	(7/2$^-$)	1676	(5/2$^-$)
1681 *5*	15 *3*	1676	(5/2$^-$)	0	(1/2$^-$)
2016[†] *11*	6 *3*	3170	(7/2$^-$)	1143	(3/2$^-$)
2132 *9*	8 *3*	2132	(5/2$^+$,3/2$^-$)	0	(1/2$^-$)
2347 *9*	11 *4*	4023	(7/2$^-$)	1676	(5/2$^-$)
2507[†] *11*	6 *3*	2511	(1/2$^+$)	0	(1/2$^-$)

[†] Placement of transition in the level scheme is uncertain.

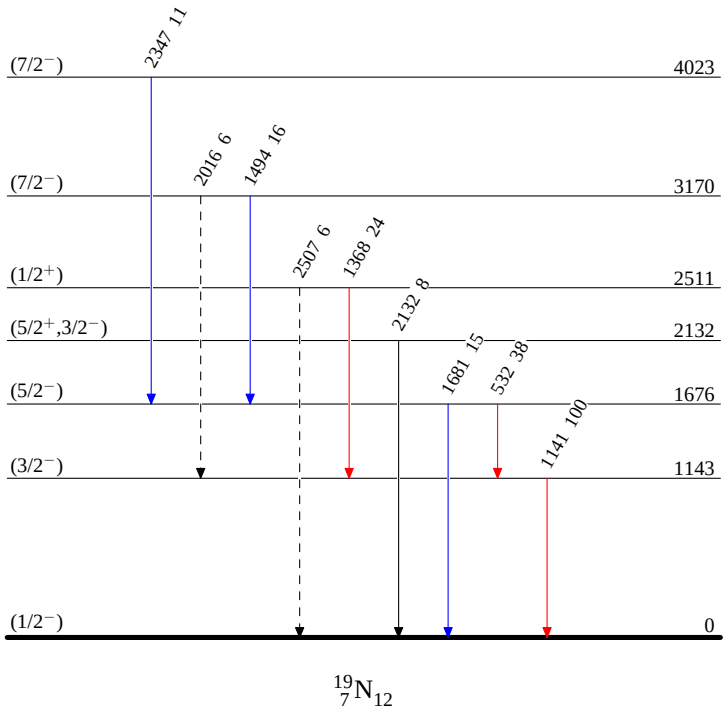
^{9}Be(^{36}S,Xγ) 2008So09

Level Scheme

Intensities: Relative I_γ

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)



$^{19}_{7}N_{12}$

^{9}Be(^{40}Ar,^{19}N) 2000Oz01

1986Du07: Thirteen nuclei of interest were produced by the fragmentation of a 60 MeV/nucleon ^{40}Ar beam on a Be (190 mg/cm^2) target at GANIL. The fragments were filtered by the LISE spectrometer and implanted in a Ge detector. Gammas in coincidence with betas along with their relative intensities were measured. The half-life of ^{19}N, $T_{1/2}$=0.32 s *10*, was deduced.

2000Oz01: A beam of ^{40}Ar at E≈1 GeV/nucleon impinged on a Be target (4007 mg/cm^2) at the GSI SIS/FRS facility. The ^{19}N fragments of interest were identified using Bρ settings along with scintillators to measured ΔE and time-of-flight. ^{19}N production cross sections was measured as σ_F=7.1×10^{-5} b *22*.

2007No13: Production of ^{19}N via projectile fragmentation was studied at RIKEN using ^{40}Ar beams at E=90, 94 MeV/nucleon that impinged on either a 95 mg/cm^2 thick ^{9}Be target or a 17 mg/cm^2 thick ^{nat}Ta target. The beams were momentum analyzed using the RIPS doubly achromatic spectrometer before being identified using two surface-barrier silicon counters and a plastic scintillator to identify products via ΔE and time-of-flight at the focal plane. The fragment momentum distribution and production cross sections were deduced. See also (2015Mo17) for transverse momentum (P_T) distribution and width (σ_T) analysis.

2012Kw02: Several light neutron-rich nuclides, produced by projectile fragmentation of an ^{40}Ar beam at E=140 MeV/nucleon, bombarded one of three targets, 668 mg/cm^2 ^{9}Be, 775 mg/cm^2 ^{nat}Ni, or 1086 mg/cm^2 ^{181}Ta at the National Superconducting Cyclotron Laboratory (NSCL). Fragments were momentum analyzed using the A1900 separator and identified at the final focus using time-of-flight and a telescope consisting of five Si ΔE detectors. The fragmentation cross sections, parallel momentum transfers, and parallel momentum distribution widths were measured and compared to the theoretical predictions.

^{19}N Levels

E(level)	$T_{1/2}$	Comments
0	0.32 s *10*	$T_{1/2}$: From (1986Du07).

^{10}Be(^{11}B,2p) 1974Gu19

1974Gu19: The ^{10}Be(^{11}B,2p)^{19}N reaction was used in an early search for the ^{19}N isotope by bombarding an E(^{11}B)=30 MeV ion beam on a 700 μg/cm^2 thick ^{10}BeO target. No evidence was found for ^{19}N in a search for delayed γ-rays from ^{19}N(β^-) decay, though evidence for delayed neutron emission was observed with ($T_{1/2}$=420 ms *40*), the neutrons groups are tentatively assigned to the neutron-unbound states in ^{19}O. See also (1974JuZX).

1976Fi03: The β-delayed neutron decay of ^{19}N following the bombardment of a 700 μg/cm^2 thick ^{10}BeO target by an E(^{11}B)=30-40 MeV ion beam showed no support for ^{19}N production as discussed in (1974Gu19). The result is consistent with a low predicted cross section for the reaction obtained using the EVA 67 (evaporation) code.

^{19}N Levels

E(level)
0?

C(^{19}N,X) 2001Oz03

2001Oz03: A secondary beam of E(^{19}N)≈1005 MeV/nucleon ions, produced at the GSI/FRS, impinged on a carbon target. Interaction cross sections, σ_i were measured and r.m.s. matter radii, r_m were deduced using Glauber-model, optical-limit calculations. r_m(^{19}N)=2.71 fm *3* was deduced. See also (2001Oz04,2017Ah08,2018Fo17).

^{19}N Levels

E(level)
0

C(^{20}N,^{19}N) 2000Sa47,2004Sa14

2000Sa47,2004Sa14: An E(^{20}N)=48 MeV/nucleon beam, produced by fragmentation of ^{40}Ar ions at GANIL, impinged on a 170 mg/cm^2 C target. The beam energy spread was ΔE/E=1% (2% in 2000Sa47). The one-neutron removal cross sections and core fragment longitudinal and transverse momentum distributions were measured using the SPEG spectrometer.

σ_{-1n}=86 mb *9* was measured; this compares the value $\sigma_{-1n}^{Glauber}$=83 mb (99 mb in 2004Sa14) calculated using a Glauber model. The longitudinal momentum distribution width FWHM$_{pz}^{cm}$=177 MeV/c *3*, transverse momentum width FWHM$_{px}^{cm}$=226 MeV/c *5* (2004Sa14), and $J^{\pi}=1/2^-$ (see also 1989Ca25) for the ground state were also deduced.

In (2004Sa14), the longitudinal momentum distribution width FWHM$_{pz}^{cm}$=176 MeV/c *11* was deduced using tantalum target, but no reliable σ_{1n} cross section could be estimated owing to the very broad transverse momentum distributions.

^{19}N Levels

E(level)	J^{π}
0	$1/2^-$

^{18}O(^{18}O,^{19}N) 1977De14

1977De14: An E(^{18}O)=91 MeV beam, produced by the Orsay MP tandem, impinged on a self-supported 100 μg/cm^2 thick Ai_2O_3 (90% enriched) target. The emitted nuclei were analyzed by a double-focusing 180° magnetic spectrograph at θ=10° with $\Delta\Omega$=1 msr and were detected using two resistive-wire counters and a set of four Si position-sensitive detectors. The fragments were identified based on ΔE-E information and their masses were deduced from the measured Q-values. The mass excess of ^{19}N ΔM=15.81 MeV *9* deduced in this experiment is located nearly halfway between the two conflicting predictions of the Garvey-Kelson formula and the modified shell-model mass equation. The cross section σ(lab)=0.8 μb/sr was also deduced.

1982Na08: A beam of ^{18}O from the Orsay MP-Tandem impinged on a self-supported 72 μg/cm^2 thick Al_2O_3 target (90% enriched). The emitted nuclei were analyzed by a 180° magnetic spectrometer at θ=4°−8° and $\Delta\Omega$=4.8 msr. The fragments were detected using two resistive-wire proportional counters and an ionization chamber and were identified by ΔE-E method with 2% and 1.5% resolution for ^{19}N and ^{21}O respectively.

The mass excess of ^{19}N ΔM=15.856 MeV *50* and three levels of ^{19}N*(0, 1.12, 1.59 MeV) were measured with proposed J^π=1/2$^-$, 3/2$^-$ and 5/2$^-$ respectively according to the shell-model prediction and comparison to the ^{17}N level scheme. The cross section of $^{19}N_{g.s.}$ was also measured as $\sigma\approx 0.5\mu$b/sr.

1989Ca25: Excitation energies for low-lying ^{19}N states (T=5/2) were derived from two reactions A: ^{18}O(^{18}O,^{17}F)^{19}N and B: ^{18}O(^{18}O,^{19}N). Beams of ^{18}O ions at E=117 MeV(A), 119 MeV(B) from the 14US Pelletron accelerator at Australian National University bombarded a 195 μg/cm^2 thick enriched SiO_2 target (70 μg/cm^2 ^{18}O content). The ejectiles were detected using an Enge split-pole spectrometer at θ_{mean}=10°(A) ($\Delta\Omega$=3.4 msr and acceptance angle of 4.5°) and θ_{mean}=4.5°(B) ($\Delta\Omega$=1.5 msr and acceptance angle of 2.0°). In the coincidence measurements, recoil nuclei were detected using a silicon surface barrier detector mounted 150 mm from the target and at the θ_{lab}=−42.0°. The other ejectile was measured in the focal plane and was identified using ΔE-E-B$_\rho$ techniques.

The mass excess of ^{19}N was deduced as ΔM=15.819 MeV *35* which is in agreement with the value measured in (1983Ho08). Excitation levels of ^{19}N*(1.68 *4*,2.57 *5*,3.54 *5*,4.22 *4* MeV) and ^{19}N*(1.11 *2*,1.65 *2*,2.53 *3*,3.45 *3*,4.16 *3* MeV) were measured by reaction A and B, respectively.

See also (1976DeZH,1980Na12,1981NaZQ).

^{19}N Levels

E(level)†	J$^\pi$‡	Comments
0	1/2$^-$	ΔM=15.819 MeV *35* (1989Ca25).
1110 *20*	3/2$^-$	
1650 *20*	5/2$^-$	
2540 *30*		
3470 *30*	7/2$^-$	
4180 *20*	9/2$^-$	

† From average of values in (1989Ca25).
‡ From shell model calculations.

^{20}C β^-n decay 1989Le16,2003Yo02

Parent: ^{20}C: E=0; $J^\pi=0^+$; $T_{1/2}$=16.3 ms *+40−35*; Q(β^-n)=1.358×10^4 *23*; %β^-n decay=65 *19*

^{20}C-$T_{1/2}$: from weighted average of (1989Le16,1990Mu06,2003Yo02 and P.L. Reeder et al., Int. Conf. on Nucl. Data for Science and Technology, May 9-13, 1994, Gatlinburg, Tennessee).

^{20}C-Q(β^-n): from (2017Wa10).

1989Le16,1990Mu06: ^{20}C particles were filtered using magnetic analysis in the LISE spectrometer and identified with energy loss and ToF measurements. The fragments were implanted in a Si detector surrounded by a plastic scintillator for β-ray detection. The target was placed inside a 4π neutron detector that had a neutron energy threshold of 350 keV. The ^{20}C $T_{1/2}$ reported in this work was 16 ms *+14−7* and P_n=(50 *30*)% was determined; values of $T_{1/2}$=14 ms *+6−5* and P_n=(72 *14*)%, which are apparently revised, were published in (1990Mu06). See also (1989MuZU).

2003Yo02: ^{20}C ions were produced at the RIKEN/RIPS facility and implanted a plastic scintillator detector. An array of 13 liquid scintillator detectors surrounded the implantation target. Following implantation, β and β+n coincidence counting were carried out for 100 ms (to permit decay of daughter & grandaughter activity). Standard pulse shape analysis was used to identify high-energy neutrons, while for 50 keV≤E_{eq}≤200 keV the time of flight information was used to separate neutrons and γ rays. Analysis of the 1n- and 2n- coincidence events yielded values of P_{1n}=(65 *+19−18*)% and P_{2n}<18.6%. $T_{1/2}=21.8^{+15.0}_{-7.4}$ ms was also measured.

In summary, $T_{1/2}$=14 ms *+6−5* (1990Mu06) appears most reliable. In (2003Yo02), limited statistics on ^{20}C were obtained since it was a contaminant to their beams of interest. The measured P_{1n} and P_{2n} values are consistent with the P_n values deduced in (1989Le16,1990Mu06), hence P_{1n}=(65 *+19−18*)% and P_{2n}<18.6% are accepted; this implies %β-0n≈35 *20*. No information on neutron-emission energies is given, but P_{1n}=(65 *+19−18*)% implies that $^{19}N_{g.s.}$ will be fed (by some decay path) in a significant fraction of decays.

See also (1973To16).

^{19}N Levels

E(level)
0.0

Delayed Neutrons (^{19}N)

E(^{19}N)	I(n)†	Comments
0.0	65 *19*	I(n)=65 *+19−18*.

† Absolute intensity per 100 decays.

Si(^{19}N,X) 2006Kh08

2006Kh08: A ^{19}N secondary beam was produced by fragmentation of a ^{48}Ca 60.3 MeV/nucleon beam using the GANIL/SISSI beam facility. The beams were analyzed using the α spectrometer and delivered to the SPEG focal plane, where they impinged on a telescope stack of 4 cooled (−10°C) silicon detectors that were surrounded by a 4π array of 14 NaI γ-detectors. The energy dependent cross sections and the mean radius were measured as σ(41.79 MeV/nucleon)=2.20 b *21*, σ(47.77 MeV/nucleon)=2.048 b *14*, r_0^2(mean radius)=1.224 fm^2 *8*.

See earlier work in (1991Vi04).

^{19}N Levels

E(level)
0

^{48}Ca(^{18}O,^{19}N) 1983Ho08

1983Ho08: Two measurements have been performed at the Australian National University 14UD Pelletron accelerator, where either an E(^{18}O)=117 MeV beam impinged on a 50 μg/cm ^{48}Ca target or an E(^{18}O)=119 MeV beam impinged on an 85 μg/cm^2 ^{48}Ca target. Reaction products were momentum analyzed using an Enge split-pole spectrometer with a mean reaction angle of θ_{lab}=6° or 5°, respectively. The $\Delta\Omega$=3.4 msr in both measurements. The differential cross sections for ^{19}N production is σ=47 μb/sr (E(^{18}O)=119 MeV). The ground state Q-values deduced from the reactions are in good agreement and resulted in ΔM(^{19}N)=15.872 MeV *20*.

^{19}N Levels

E(level)	Comments
0	ΔM=15.872 MeV *20* was deduced.

Ni(^{40}Ar,^{19}N),^{181}Ta(^{40}Ar,^{19}N) 2012Kw02

2012Kw02: Several light neutron-rich nuclides, produced by projectile fragmentation of an ^{40}Ar beam at E=140 MeV/nucleon, bombarded one of three targets, 668 mg/cm^2 ^{9}Be, 775 mg/cm^2 ^{nat}Ni, and 1086 mg/cm^2 ^{181}Ta at the National Superconducting Cyclotron Laboratory (NSCL). Fragments were momentum analyzed using the A1900 separator and identified at the final focus using time-of-flight and a telescope consisting of five Si ΔE detectors. The fragmentation cross sections, parallel momentum transfers, and parallel momentum distribution widths were measured and compared to theoretical predictions.

^{19}N Levels

E(level)
0

Au(p,^{19}N) 1968Th04

1968Th04: A 3-GeV proton beam bombarded a gold target (10mg/cm^2) at the Princeton-Pennsylvania Accelerator. The fragments produced were detected using a telescope consisting of four Si surface barrier detectors (ΔE-ΔE-E-VETO) placed at θ_{lab}=45° relative to the incident beam. Reaction products were identified by ΔE, E and the time-of-flight between the first two ΔE detectors. The result provided the first observation of ^{19}N; see also (1960Ze03,2012Th01).

^{19}N Levels

E(level)
0

^{207}Pb(^{18}O,^{19}N),^{208}Pb(^{18}O,^{19}N) 1979Ba31

1979Ba31: A beam of 93 MeV ^{18}O ions impinged on either a ^{208}Pb (98.2% enriched) or a ^{207}Pb (92.4% enriched) lead target (each was ≈250 μg/cm^2 on 5 μg/cm^2 carbon foil backings). Reaction products were detected at θ=80° and θ=85° using the Chalk River QD^3 spectrometer focal plane with energy resolutions that were typically ΔE≈260 keV. The Q-value =−18.44 MeV *15* was deduced for the reaction on ^{208}Pb, which corresponds to ΔM(^{19}N)=15.96 MeV *15*.

^{19}N Levels

E(level)	Comments
0	ΔM(^{19}N)=15.96 MeV *15* was deduced.

^{208}Pb(^{20}N,^{19}Nγ) 2016Ro13

2016Ro13: The Coulomb dissociation of ^{20}N was studied at the GSI LAND/R3B facility using a secondary beam produced by fragmenting an 490 MeV/nucleon ^{40}Ar beam. The ^{20}N beam impinged on a 0.176 mm *4* thick natural lead target for the Coulomb excitation measurements, while measurements on a 5.08 mm thick carbon target were used to estimate the nuclear breakup contributions. Reaction γ-rays were detected using the 162 NaI Crystal Ball array; neutrons from Coulomb breakup reactions were detected in the LAND neutron wall array, and the core ejectiles were deflected in the ALADIN magnet and detected and identified in a two-dimension position sensitive plastic scintillator ΔE wall.

Analysis of the γ-ray data from the Crystal Ball indicated the ^{20}N levels populated in the Coulomb excitation reactions neutron decay to ^{19}N*(0,1150) states. The γ-ray spectrum measured in coincidence with n+^{19}N shows a dominant peak with $E_\gamma \approx$ 1150 keV.

The Coulomb dissociation cross section of ^{20}N integrated over 0-20 MeV excitation energy for the total reaction was measured as σ(^{20}N,total)=90 mb *12*; σ(^{20}N,^{19}N$_{g.s.}$)= 15 mb *16*; σ(^{20}N,^{19}N*1150)= 36 mb *6*; σ(^{20}N,^{19}N*(all excited states))=76 mb *10*. The quoted uncertainties are statistical only since the systematic uncertainties from the identification of the incoming particles, from the single neutron detection efficiency of LAND, from the Crystal Ball efficiency and from the measurement of the areal density of the target were negligible compared to the statistical uncertainty.

^{19}N Levels

E(level)[†]	Comments
0	σ(^{20}N, gs) = 15 mb *16*.
1150	σ(^{20}N, 1150) = 36 mb *6*.
1600	
2500	

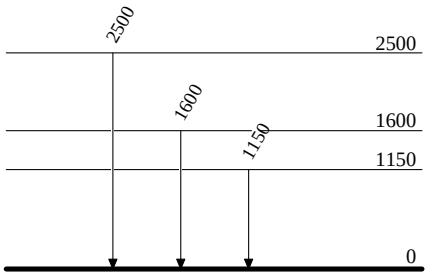
[†] Estimated: multiple unresolved states may be present in Fig 3(a).

γ(^{19}N)

E_γ	E_i(level)	E_f
1150	1150	0
1600	1600	0
2500	2500	0

^{208}Pb(^{20}N,^{19}Nγ) 2016Ro13

Level Scheme



$^{19}_{7}N_{12}$

^{232}Th(^{18}O,^{19}N) 1969Ar13

1969Ar13: The particle stability of ^{19}N was confirmed by analysis of the transfer reaction products resulting from E(^{18}O)=122 MeV bombardment of a 5 mg/cm^2 metalic ^{232}Th foil at Dubna. The reaction products were momentum analyzed in a magnetic spectrometer and then focused on a ΔE-E Si detector telescope, which provided particle identification.

^{19}N Levels

E(level)
0

^{232}Th(^{22}Ne,^{19}N) 1977Ar06

1977Ar06: The transfer reaction products resulting from E(^{22}Ne)=172 MeV bombardment of a 2.5 mg/cm^2 metalic ^{232}Th foil were measured at Dubna. The reaction products were momentum analyzed in a magnetic spectrometer positioned at either θ=12° or 40° and then focused on a ΔE-E Si detector telescope, which provided particle identification.

^{19}N Levels

E(level)
0

U(p,^{19}N) 1986Pi09

1986Pi09: Spallation products from 800 MeV proton bombardment of a uranium target at LAMPF were detected using a series of detectors that provided ΔE, E and time-of-flight information. The products were analyzed to obtain A and Z identification, and mass excesses were deduced for a few carbon, nitrogen, oxygen, florine and neon isotopes.

The ^{19}N mass excess ΔM=14.3 MeV *30* was obtained.

^{19}N Levels

E(level)	Comments
0	ΔM=14.3 MeV *30*.

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