Adopted Levels, Gammas

Q(β^-)=−18.7×10^3 *10*; S(n)=15558 *20*; S(p)=1469 *8*; Q(α)=−9040 *10* 2017Wa10

Theoretical analyses of ^{17}Ne.

Nuclear Mass and Level Properties:

General analyses of the ^{17}Ne nuclear properties are given in (1973Re17,1978Gu10,2004Ge02,2018Fo04). Comparisons of the ^{17}Ne level properties with those of levels in the ^{17}N mirror nucleus are found in (1996Ti02, 2004Ga07,2006Fo08,2006Li18,2018Fo02).

Halo Character.

Because of the unbound nature of ^{16}F, the nucleus ^{17}Ne is considered a Borromean nuclear system similar to ^{6,8}He and ^{11}Li. The low binding energy suggests the ground or first excited states may exibit properties that can be described as a ^{15}O core surrounded by a diffuse 2-proton halo. Detailed studies on ^{17}Ne are found in (1990Ha29, 1995Zh35, 1997Li22, 1998Na01, 2001Fo05, 2003Zh29, 2004Ta40, 2005Gr11, 2008Ne13, 2013Zh27, 2016Hw01). More general analyses of one- and two- nucleon halo nuclides, including ^{17}Ne, are given in (1994Fe01, 1995Ta06, 1999Kn04, 2001Oz04, 2002Gu10, 2007Be58, 2011Al11, 2014Ch39, 2017Ah08).

Possible soft dipole excitations and pygme dipole resonances are discussed in (2011Ol01, 2012Ma12, 2017Lv02).

3-Body nature of ^{17}Ne.

Studies of the 2-proton correlations associated with the 3-body nature of ^{17}Ne are given in (2001Gr29, 2003Gr01, 2004Ga10, 2005Ga04, 2005Ga49, 2005Pf01, 2005Pf02, 2007Gr12, 2007Gr13, 2010Oi01).

The ^{15}O+2p resonances of ^{17}Ne are relevant for the 2p capture rate on ^{15}O, see (2006Gr20,2016Ca38). The Γ_{2p} width of the E_x=1288 keV: J^π=3/2$^-$ state is of particular interest (2000Gr16) since it is bound to one proton emission, unbound to 2p emission, but γ decays 100%.

3-body nature of ^{19}Mg.

Some states in ^{17}Ne are important for the 2p decay of ^{19}Mg and the 2p+^{17}Ne system, see (2001Mu23, 2003Gr04, 2003Gr24). See other results in (2000Gr18, 2004Pf02, 2007Fo07, 2010Gr06, 2013Ol02, 2017Go17, 2017Kw01).

β-decay studies.

The β decay of ^{17}Ne is rather complex. The first forbidden decay to ^{17}F is stronger than expected (1972To03, 1994Jo04, 1997Mi08, 1999Ba21, 2000Ni14, 2003Sm02); the observation may be connected with the halo nature of ^{17}Ne. See other general analyses and comparison with ^{17}N decay in (1965Ha31, 1970Wi02). The decay is dominated by β-p reactions to levels in ^{16}O (1963Ba63, 1964Da13, 1964Fl03, 1964Mc16, 1965Ha20, 1967Es02, 1988Bo39, 2002Ch61, 2002Mo19). Additional β-α branches to ^{13}C are also present. See theoretical discussion in (1973Ha77, 1977Ce05).

^{17}Ne Levels

Cross Reference (XREF) Flags

A	^{1}H(^{17}Ne,p)	H	^{9}Be(^{18}Ne,^{17}Ne)	O	^{20}Ne(^{3}He,^{6}He)
B	^{1}H(^{17}Ne,^{15}O2p)	I	^{9}Be(^{20}Ne,^{17}Ne)	P	MgO(p,^{17}Ne)
C	^{1}H(^{18}Ne,d)	J	^{16}O(^{3}He,2n)	Q	Mg(p,^{17}Ne)
D	^{9}Be(^{12}C,X),^{12}C(^{12}C,X)	K	^{16}O(^{14}N,^{13}B)	R	Si(^{17}Ne,X)
E	^{9}Be(^{17}Ne,^{17}Ne′)	L	^{18}Na p decay	S	Ni(^{20}Ne,^{17}Ne)
F	^{9}Be(^{17}Ne,X)	M	^{19}F(p,3n)	T	Au(^{17}Ne,^{17}Ne′γ)
G	^{9}Be,^{12}C,^{27}Al(^{17}Ne,X)	N	^{19}Mg 2p decay:4.0 ps	U	Pb(^{17}Ne,^{17}Ne)

E(level)	J^π	$T_{1/2}$	XREF	Comments
0.0	1/2$^-$	109.2 ms *6*	A CD FG IJ LMNOPQRSTU	%ε+%β^+=100; %εp=95.2 *46* (2002Mo19); %$\varepsilon\alpha$=2.77 *19* (2002Mo19) T=3/2 μ=+0.7873 *14* (2005Ge06) $T_{1/2}$: weighted average of: 109.3 ms *6* (1988Bo39), 109 ms *1* (1971Ha05). Other results can be found in (1967Es02,1967Fi10,1964Mc16) and Hardy, et al., Nucl. Isospin, Proc. 1969 Conf. (Academic Press, 1969) 725. ΔM=16500.4 keV *4*: From ISOLTRAP measurement in (2008Ge07). Note: most level energies are taken from (1998Gu10) who measured ΔM=16453 keV *32*. Since other measurements (2002Ch44,2017Br07) tend to support the level energy differences

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{17}Ne Levels (continued)

E(level)	J^π	XREF	Comments
			found in (1998Gu10), those relative level energy spacings are preserved in the present evaluation.
1288 *8*	$(3/2,1/2)^-$	C K O T	%IT=100 (2002Ch44) B(E2)↑=0.0090 *18* (2016Ma42) E(level): From (1998Gu10), also see E_x=1275 keV *22* from (2002Ch44) Au(^{17}Ne,^{17}Ne′). J^π: $3/2^-$ is preferred based on comparison with the ^{17}N levels (1998Gu10). Γ_{2p}/Γ <1.6E−4 (2017Sh29).
1749 *8*	$(5/2,7/2)^-$	E H O TU	%p=100 (2017Br07) J^π: $5/2^-$ is preferred based on comparison with the ^{17}N levels (1998Gu10). E(level): From average of E_x=1764 keV *12* (1998Gu10) and E_x=1745 keV *7* (2018Ch25). Also see E_x=1770 keV *20* from (2017Br07) ^{9}Be(^{17}Ne,^{17}Ne′).
1908 *15*	$1/2^+,(3/2,5/2)^+$	C H K O TU	%p≈100 (2002Ch44) B(E1)↑<0.00007 (2016Ma42) J^π: $1/2^+$ is preferred (1998Gu10). E(level): From (1998Gu10), also see E_x=1900 keV *78* from (2002Ch44) Au(^{17}Ne,^{17}Ne′).
2651 *12*		C E O TU	%p=100 (2016Ma42,2017Br07) J=$5/2^+,5/2^-,3/2^+,7/2^-$ E(level): From (1998Gu10) ^{20}Ne(^{3}He,^{6}He). While only one peak has been observed in the region, the group is suggested as a possible doublet (1998Gu10) since relatively poor energy resolution may conceal two groups. An analysis of the angular distributions for the E_x≈2623 keV region is consistent with L=3 (J^π=$(5/2^-,7/2^-)$), while analysis of the E_x≈2765 keV region is consistent with L=2 (J^π=$(3/2^+,5/2^+)$). A later analysis of Pb(^{17}Ne,^{17}Ne′) (2016Ma42) suggests an unresolved doublet with ^{17}Ne*(2614 keV *20*:$5/2^+$) and ^{17}Ne*(2692 keV *21*:$3/2^-$).
2997 *11*	$(7/2,5/2)^-$	K O T	J^π: $7/2^-$ is preferred based on comparison with the ^{17}N levels (1998Gu10). E(level): From (1998Gu10).
3415 *38*	$(5/2^-)$	U	%p=100 (2016Ma42) E(level),J^π: From (2016Ma42).
3548 *20*	$(9/2,11/2)^-$	E K O T	%p=100 (2016Ma42,2017Br07) J^π: $9/2^-$ is preferred based on comparison with the ^{17}N levels (1998Gu10). E(level): From (1998Gu10).
4010 *10*	$(3/2,5/2)^+$	O T	J^π: $3/2^+$ is preferred based on comparison with the ^{17}N levels (1998Gu10). E(level): From (1998Gu10).
4487 *22*		O T	E(level): From (1998Gu10).
5141 *62*		O TU	E(level): From (1998Gu10), also see E_x=5210 keV *79* from (2016Ma42) Pb(^{17}Ne,^{17}Ne′).
≈5.3×10^3?		K	E(level): From (2000Ol01).
5722 *23*		O T	E(level): From (1998Gu10).
6132 *35*		O T	E(level): From (1998Gu10).
6366 *22*		O T	E(level): From (1998Gu10).
10.06×10^3 *15*		U	E(level): From (2016Ma42).

Adopted Levels, Gammas (continued)

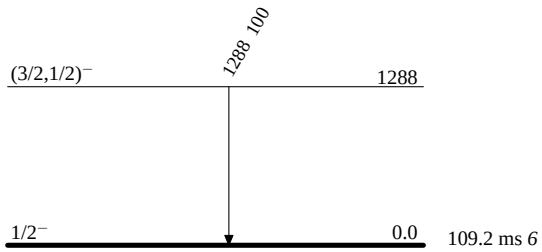
$\gamma(^{17}Ne)$

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π
1288	$(3/2,1/2)^-$	1288	100	0.0	$1/2^-$

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{17}_{10}Ne_7$

^{1}H(^{17}Ne,p) 2011As04

The excitation function of ^{17}Ne+p scattering was measured in the range of $E_{c.m.}$≈0.8 to 3.6 MeV. The beam of 4 MeV/nucleon ^{17}Ne ions, from the GANIL/SPIRAL facility, impinged on a polypropylene (C_3H_6) target assembly. The target assembly consisted of a fixed 50 μg/cm^2 C_3H_6 foil followed by a rotating (1000 rpm) C_3H_6 foil which stopped the beam and carried away the beams undesired decay radiation. The scattered protons were detected at θ_{lab}=5° to 20° with a annular position sensitive DE-E telescope. The excitation function is deduced using thick target inverse kinematics techniques, and ^{18}Na states are deduced. No clear evidence is observed for participation of ^{17}Ne excited states.

^{17}Ne Levels

E(level)	J^π
0	$1/2^-$

^{1}H(^{17}Ne,^{15}O2p) 2018Wa07

2018Wa07: XUNDL dataset compiled by TUNL, 2018. Includes ^{1}H,^{12}C,^{208}Pb(^{17}Ne,^{15}O+2p).

A beam of 500 MeV/nucleon ^{17}Ne ions, produced by fragmentation of a ^{20}Ne beam at GSI facility, impinged on either a 213 mg/cm^2 polyethylene (CH_2), 370 mg/cm^2 carbon or 199 mg/cm^2 lead target that was placed at the ALADIN-R3B setup target position. The complete kinematics of breakup protons and ^{14,15}O reaction products was determined using a series of Si strip detectors, the ALADIN dipole magnet and two other ΔE-E arrays centered at θ=16.7° and θ=31° with respect to the analyzing magnet exit, to detect ^{14,15}O and proton reaction products, respectively.

Events with one or two protons detected in coincidence with oxygen isotopes were analyzed; the ^{15}O+2p relative energy spectra were deduced for each target along with the 2p correlations. Considering the 1p and 2p separation energies are S_{1p}=1470 keV and S_{2p}=933 keV, the correlations are important for disentangling the reaction mechanism.

The aim of the analysis focused on understanding the dynamics of nuclear breakup and Coulomb dissociation of ^{17}Ne for ^{17}Ne→^{15}O+2p reaction on ^{1}H, C and Pb targets. The decay mechanism was analyzed for broad regions of excitation. The evaluator deduced excitation energies of states visible in figures 7a, 7b and 7c. Some discussion refers to previously reported states at E_{res}=0.83, 1.76 and 2.48 MeV from analysis of the same data set reported in (2016Ma42).

The momentum distributions for the ^{14}O and ^{15}O recoils were also analyzed, for events with one or two coincident protons.

^{17}Ne Levels

E(level)	J^π	Comments
1764[†‡#@] *12*	5/2$^-$[†]	From E_{res}≈0.83 MeV.
2692[†‡#@] *21*	(3/2$^-$)[†]	From E_{res}≈1.76 MeV.
3415[†‡#] *38*	(5/2$^-$)[†]	From E_{res}≈2.48 MeV.
5.3×10^3[‡#@]		From E_{res}≈4.4 MeV.
9.9×10^3[‡#]		From E_{res}≈9.0 MeV.

† From (2016Ma42).
‡ Populated in ^{1}H+^{17}Ne→^{15}O+2p.
# Populated in ^{12}C+^{17}Ne→^{15}O+2p.
@ Populated in ^{208}Pb+^{17}Ne→^{15}O+2p.

^{1}H(^{18}Ne,d) 2017Sh29

2017Sh29: A beam of 35 MeV/nucleon ^{18}Ne ions, produced by fragmentation of a ^{20}Ne beam on a beryllium target at the JINR/Flerov Laboratory of Nuclear Reactions, was used to populated ^{17}Ne states via ^{1}H(^{18}Ne,d) reactions on a cryogenic hydrogen target. The ^{17}Ne excitation energy was determined by analyzing the scattered deuterons, while the Γ_{2p} decay branch was experimentally determined by kinematic reconstruction of the ^{15}O+p+p events. The overall angular coverage was $\Theta_{c.m.}\approx 3°-24°$. Two peaks corresponding to the ground and first excited state are resolved in the analysis of the scattered deuterons; a broad background and some enhancement that corresponds to higher excied states is also visible. On the other hand, analysis of the ^{17}Ne*$\geq^{15}$O+2p recoils showed groups corresponding to ^{17}Ne*(1916,2651) with only a suggestion of limited counts for the unbound first excited state. The analysis focused on obtaining the $\Gamma_{2p}/\Gamma_{\gamma}$ for the first excited state, which is relevant for nuclear astrophysics. The limit $\Gamma_{2p}/\Gamma_{\gamma}\leq 1.6\times 10^{-4}$ *3* was deduced by comparing the yield of deuterons to ^{17}Ne*(1288) with the yield deduced from a reconstruction of ^{15}O+2p events.

^{17}Ne Levels

E(level)	J^{π}[†]	Comments
0	$1/2^-$	
1288	$3/2^-$	E(level): From (1998Gu10). $\Gamma_{2p}/\Gamma\approx\Gamma_{2p}/\Gamma_{\gamma}\leq 1.6\times 10^{-4}$ *3*.
1916	$1/2^+$	E(level): Possibly contaminated by E*=1764 keV events.
2651	$5/2^+$	

[†] From (1998Gu10).

^{9}Be(^{12}C,X),^{12}C(^{12}C,X) 1964Da13

1964Da13: A beam of 120 MeV ^{12}C ions, from the Yale heavy ion accelerator, bombarded either a ≈12 mg/cm^2 ^{9}Be target or a ≈12 mg/cm^2 ^{12}C target. Reaction products, produced in the target were studied using a Si surface barrier detector for charged particles, a thick plastic scintallator for β^+ particles and a 3 inch × 3 inch NaI(Tl) crystal to detect γ rays.

Proton groups with E_p=2.3, 3.8, 4.55, 4.9 and 5.1 MeV are attributed to β-delayed proton emission from ^{17}Ne. The life-time T=690 ms 30 is deduced; the discrepancy with the accepted value is not understood.

^{17}Ne Levels

E(level)
0?

^{9}Be(^{17}Ne,^{17}Ne′) 2017Br07

2017Br07: XUNDL file compiled by TUNL 2017.

A variety of one-, two- and three-proton unbound levels were populated in the bombardment of a ^{9}Be target by either a 68 MeV/nucleon ^{9}C beam or a 58 MeV/nucleon ^{17}Ne beam. The reactions produced short-lived levels that proton decayed before exiting the target. The present result details the decay mode of ^{17}Ne*(1.76 MeV).

The ^{17}Ne beam was produced at the NSCL by fragmenting a ^{20}Ne beam in the A1900 beam separator. The beam impinged on a 1 mm thick ^{9}Be target, which populated ^{17}Ne states by inelastic scattering reactions. The unbound ^{17}Ne states quickly decayed via proton emission.

The complete kinematics of the charged-particle reaction products were measured using the HiRA array, which comprised a set of 14 64 mm × 64 mm position sensitive ΔE-E telescopes that covered the forward direction of the outgoing beam ($\theta_{lab}\approx2°$ to 13.9°). The telescopes were arranged in vertical towers with a 2-3-4-3-2 configuration where the central tower had a gap between the upper and lower two telescopes to permit the beam a downstream exit at θ=0°.

In addition, 158 CsI(Na) crystals from the CAESAR array covered polar angles between θ_{lab}=57.5° and 142.4° and measured the coincident γ-ray deexcitations.

The 2p+^{15}O invariant mass spectrum reveals three peaks corresponding to ^{17}Ne*(1.77, 2.65, 3.55 MeV) states. There is no evidence for the 2-p decay of a state previously reported at E_x=1.908 MeV (1998Gu10) that lies above the 1p-separation energy. Analysis of the Jacobi Y coordinates is consistent with the proton decay of ^{17}Ne*(1.76 MeV) sequentially through $^{16}F_{g.s.}$ to 2p+$^{15}O_{g.s.}$.

2018Ch25: XUNDL dataset compiled by TUNL, 2018.

Analysis of the (2017Br07) results was extended in (2018Ch25), where the 2p decay of ^{17}Ne*(1.77 MeV) via $^{16}F_{g.s.}$ was the focus. A 62.9 MeV/nucleon ^{17}Ne impinged on a 1 mm thick ^{9}Be target populating ^{17}Ne states including ^{17}Ne*(1.77 MeV). As in (2017Br07), the complete kinematics of the charged-particle reaction products were measured using the HiRA array, that covered the forward direction of the outgoing beam ($\theta_{lab}\approx2°$ to 13.9°). The energies of the first and second sequential decay protons, which are similar, were resolved permitting a determination of the level energies. The two protons were analyzed along with the 2p correlations, which resulted in an improved precision in the level energy for ^{17}Ne*(1.76 MeV) and an improved precision on the width of $^{16}F_{g.s.}$. E_x=1745 keV *7* was deduced.

^{17}Ne Levels

E(level)	J^π	Comments
1745 *7*	5/2$^-$[†]	T=3/2 E(level): From (2018Ch25). See also E_x=1770 KeV *20* in (2017Br07). Decays 100% via p+$^{16}F_{g.s.}$ to 2p+$^{15}O_{g.s.}$.
2651[†] *12*	5/2$^+$[†]	T=3/2 Decays to 2p+$^{15}O_{g.s.}$.
3548[†] *20*	9/2$^-$[†]	T=3/2 Decays to 2p+$^{15}O_{g.s.}$.

[†] From (1998Gu10).

^{9}Be(^{17}Ne,X) 2003Ka43

2003Ka43, 2004Ka20, 2004Ka35, 2005Ka51: The 2-proton removal cross section and residual momentum distribution were measured by fragmenting ≈60-66 MeV/nucleon ^{17}Ne beams on a ^{9}Be target at the RIKEN/RIPS facility. The 168 MeV/c *17* parallel momentum distribution width of ^{15}O core fragments, following 2-proton removal, is narrower than expected and may suggest a 2-proton halo in ^{17}Ne. Analysis of the measured 2-p removal cross section, σ_{2p}=191 mb *48*, suggests uncorrelated valence protons (2003Ka43).

^{17}Ne Levels

E(level)
0

^{9}Be,^{12}C,^{27}Al(^{17}Ne,X) 1994Oz02

1994Oz02: In a systematic study of the A=17 isotopes, beams of ≈750 MeV/nucleon ^{17}Ne, ^{17}F and ^{17}N that were produced by fragmentation of ^{20}Ne, ^{22}Ne and ^{18}O, respectively, impinged on berylium, carbon and aluminium targets at the LBL/Bevalac facility. After the target position, particles were detected using a large acceptange spectrometer, and the interaction cross sections deduced using a transmission analysis method. Finally, the $R_{r.m.s.}$ radii were deduced for the proton, neutron, charged and matter distributions.

2005Ta33: The cross sections of 42 and 64 MeV/nucleon ^{17}Be ions on ^{9}Be, ^{12}C and ^{27}Al were measured at RIKEN. The ^{17}Ne beams were produced via fragmentation of a ^{20}Ne beam on a ^{9}Be target, and the cross sections were measured with an accuracy of 2% using the transmission method. A Glauber model was used to analyzed the σ(E) data, along with the earlier data of (1994Oz02), and the density profile of the ^{17}Ne valence protons was deduced. Evidence for a long spatial tail was found, which is consistent with the two protons occupying the $2s_{1/2}$ orbital. This suggests a level inversion in ^{17}Ne. See also (2010FuZS).

^{17}Ne Levels

E(level)	Comments
0	Deduced $R_{r.m.s.}^{protons}$=2.79 fm *7*, Deduced $R_{r.m.s.}^{charge}$=2.90 fm *7*, Deduced $R_{r.m.s.}^{neutrons}$=2.69 fm *7* and. Deduced $R_{r.m.s.}^{matter}$=2.75 fm *7*.

^{9}Be(^{18}Ne,^{17}Ne) 2004Ze05

2004Ze05: The two-proton decay of excited ^{17}Ne states was studied by analyzing the decay of states populated in 1-neutron removal reactions from ^{18}Ne. The 36 MeV/nucleon ^{18}Ne beam was produced at the GANIL/SISSI-ALPHA facility by fragmenting a ^{24}Mg beam on a ^{12}C production target. The incident trajectories of ^{18}Ne ions were traced as they impinged on a 47 mg/cm^2 Be foil placed at te SPEG spectrometer target position. Unbound ^{17}Ne states decayed by 2-proton emission to ^{15}O+2p. The momenta of protons were determined using the eight telescope MUST array, that covered $\theta_{lab}\approx 2°-25°$. The heavier ^{15}O recoils were momentum analyzed using the SPEG spectrometer, which was positioned along $\theta=0°$. Excitation energies were deduced from analysis of the invriant mass ($\Delta E\approx 250$ keV). Low statistics prevented an analysis of discrete states. The first excited state is not observed. The 2nd and 3rd excited states are observed around $\Delta M=19$ MeV; and their decays are consistent with emission of uncorrelated protons. Groups corresponding to other states with $\Delta M>20.2$ MeV are analyzed together; their decay is consistent with emission of correlated protons: (28 *9*)% sequential and (72 *12*)% ^{2}He decay. See further discussion on 2p correlations in (2004Bl19).

^{17}Ne Levels

E(level)†	Comments
1764	Decay is consistent with isotropic sequential 2-p decay.
1908	Decay is consistent with isotropic sequential 2-p decay.
x	X≥3500 keV. Decay is consistent with (28 *9*)% sequential and (72 *12*)% ^{2}He emission.

† All levels are unresolved.

^{9}Be(^{20}Ne,^{17}Ne) 1998Oz01

1998Oz01: Beams of ≈32 and 49 MeV/nucleon ^{17}Ne ions were produced by fragmenting a ^{20}Ne beam at the RIKEN/RIPS fragment separator. The ^{17}Ne ions were counted as they were implanted into a plastic plate beam stop. A high ^{15}O contamination was also present in the beam. The experiment was focused on determining the branching ratio for first forbidden β feeding to ^{17}F*(495). Detectors included a plastic telescope for β counting, and two HPGe detectors. The $T_{1/2}$=108.3 ms *31* and Iβ(^{17}F(495))=(1.56 *20*)% were deduced in the analysis.

^{17}Ne Levels

E(level)	$T_{1/2}$
0	108.3 ms *31*

^{16}O(^{3}He,2n) 1967Es02

1967Es02: Beam of 26 to 32 MeV ^{3}He ions, from the Brookhaven 60 inch cyclotron, impinged on either a gaseous O_2 or thin Al_2O_3 target producing ^{17}Ne residuals. An array of two Si detector telescopes were used to measure the energy spectrum of β-delayed particle emissions. Ten groups were observed in the energy spectrum. The target was irradiated for periods of 300 ms, while counting lasted for 500 ms. Analysis of the decay curve yielded T=105 ms *5*. A careful study of the excitation function for the reaction indicated Q=−22.42 MeV *19* for the (^{3}He,2n) reaction, which corresponds to ΔM=14.52 MeV *19* using the 1964 mass tables.

^{17}Ne Levels

E(level)	$T_{1/2}$
0	105 ms *5*

^{16}O(^{14}N,^{13}B) 2000Ol01

2000Ol01: The products of ^{16}O(^{14}N,^{13}B) reactions were measures at 30 MeV/nucleon using the GANIL/SPEG spectrometer. While the main focus of the experimental endeavor was on ^{10}B(^{14}N,^{13}B)^{11}N studies, background reactions were also analyzed including that resulting from oxygen in the target. At θ=1.2° to 4.5° the ^{14}N reactions on ^{16}O were mainly found to populate the low-lying ^{17}Ne doublet at E_x=3.02 & 3.55 MeV; evidence is also found for groups at E_x=1.28, 1.86 and 5.3 MeV.

^{17}Ne Levels

E(level)
1.28×10^3
1.86×10^3
3.02×10^3
3.55×10^3
5.30×10^3

^{18}Na p decay 2008Mu13

Parent: ^{18}Na: E=0; $J^{\pi}=1^-$; $T_{1/2}=1.3\times10^{-21}$ s *4*; Q(p)=1469 *8*; %p decay=100.0
^{18}Na-Q(p): from (2017Wa10).
^{18}Na-$T_{1/2}$: from (2017Au03).
^{18}Na-%p decay: presumably 100% proton decay to ^{17}Ne.
2008Mu13: XUNDL dataset compiled by McMaster, 2008.
The sequential two-proton radioactive decay of ^{19}Mg that populates $^{17}Ne_{g.s.}$, via levels in ^{18}Na, was studied at the GSI/FRS facility. The ^{19}Mg was produced using the ^{9}Be(^{20}Mg,^{19}Mg) one-neutron removal reaction. An analysis of the ^{17}Ne+p+p kinematics revealed involvement of sequential proton decay via ^{18}Na states and direct decay to ^{17}Ne+2p. The reconstruction of $^{17}Ne_{g.s.}$ and 2p residuals was analyzed to obtain information on ^{18}Na states. See related work in (2009Mu17,2010Mu12,2012Mu05).

^{17}Ne Levels

E(level)
0

^{19}F(p,3n) 1963Ba63,1964Mc16

1963Ba63: Barton et al., are credited with the discovery of ^{17}Ne. a variety of targets were bombarded by a 97 MeV proton beam from the McGill synchrocyclotron. The results on ^{17}Ne were obtained by comparing the delayed protons emitted following bombardment of NaF and LiF targets. Proton groups with $E_p \approx 3.6$ and 4.6 were measured using a silicon detector telescope and were attributed to β-delayed proton decay from ^{17}Ne. The lifetime was longer than the 2.5 ms period between cyclotron beam bursts.

1964Mc16: An activation target assembly was mounted on a probe that could be inserted into the McGill synchrocyclotron. Various targets containing LiF or CF_2 (teflon) were inserted into the cyclotron for proton bombardment at E_p=40 to 80 MeV. The cyclotron was operated in a mode to provide an activation period, a beam dissipation period of 100 ms and a ≈500 ms counting period. Three proton groups at E_p=4.10, 4.92 and 5.40 are consistent with β-delayed proton emission. The different target compositions yielded different lifetime results, suggesting some diffusion from the target. A half-life of T=102 ms *7* is measured, though 103 ms *7* is arbitrarily suggested to account for neon diffusion from the target. Analysis of the excitation function indicates a reaction threshold of 36.6 MeV *3*.

1965Ha20: In this follow-up of (1964Mc16) additional statistics were obtained and further analysis was carried out on ^{17}F levels fed in the decay of ^{17}Ne. See also (1966Ha22,1966Ma12).

^{17}Ne Levels

E(level)	$T_{1/2}$
0	102 ms *7*

^{19}Mg 2p decay:4.0 ps 2007Mu15,2008Mu13

Parent: ^{19}Mg: E=0; $J^{\pi}=1/2^-$; $T_{1/2}$=4.0 ps *15*; Q(2p)=750 *50*; %2p decay=100.0

^{19}Mg-E,$T_{1/2}$,Q(2p): from (2007Mu15) from (p)(^{17}Ne) correlations. Other: Q(2p)=−750 *50* (2017Wa10).

^{19}Mg-J^{π}: from (2008Mu13).

^{19}Mg-%2p decay: presumably 100% two-proton decay to ^{17}Ne.

2007Mu15,2008Mu13: XUNDL dataset compiled by McMaster 2008.

Two-proton radioactive decay of ^{19}Mg to ^{17}Ne was measured at the GSI/FRS facility using a ^{19}Mg beam produced via the ^{9}Be(^{20}Mg,^{19}Mg) one-neutron removal reaction. A kinematic reconstruction of the $^{17}Ne_{g.s.}$ and 2p residuals was analyzed to obtain information on the ^{19}Mg ground state. Sequential proton decay of ^{19}Mg via ^{18}Na states was also analyzed. See related work in (2009Mu17,2010Mu12,2012Mu05,2016Xu08,2018Xu04).

2014Vo05: At the NSCL/A1200/S800 facility, ^{19}Mg ions were similarly produced by 1-neutron knockout reactions from a 91 MeV/nucleon ^{20}Mg beam on a ^{9}Be target. The ^{19}Mg nuclides decayed in flight to $^{17}Ne_{g.s.}$+2p, and the beam composition was measured as a function of distance from the target in order to obtain the ^{19}Mg lifetime. A ^{19}Mg lifetime on the order of a few ps was deduced.

^{17}Ne Levels

E(level)
0

^{20}Ne(^{3}He,^{6}He) 1970Me11,1998Gu10

1970Me11: Beams of ≈ 60 MeV ^{3}He ions, from the Berkeley 88-inch cyclotron impinged on a gas target filled with 97% enriched ^{20}Ne (and CO_2). Two Si ΔE-ΔE-E-VETO telescopes, placed at equal angles on either side of the beam detected and identified reaction products. The ^{6}He spectrum was analyzed and the mass excess ΔM=16.508 MeV *23* was deduced. The A=17 mass multiplet was analyzed using the IMME equation. The ^{12}C(^{3}He,^{6}He)^{9}C reaction was used for calibrations.

1995Gu08,1995Gu17,1998Gu10: The (^{3}He,^{6}He) three neutron transfer reaction was studied at the University of Tokyo/Center for Nuclear Studies by impinging a 70.08 MeV ^{3}He beam on a 99.95% enriched ^{20}Ne filled gas cell. The ^{6}He reaction products were momentum analyzed using a QDD magnetic spectrometer before detection in a typical position sensitive focal plane array. The overall energy resolution for ^{6}He ions was ≈180 keV. The reaction was measured at 12 angles between θ_{lab}=7.0° and 38.0°, and the angular distributions were analyzed via DWBA to obtain L values. The J^π values for some states was deduced based on comparison with known levels in the ^{17}N mirror nucleus. The mass excess ΔM=16.453 MeV *32* was deduced, and the IMME was evaluated for six sets of A=17 T=3/2 states.

^{17}Ne Levels

E(level)	J^π	L	Comments
0.0	$(1/2,3/2)^-$	1	J^π: $1/2^-$ is preferred based on comparison with the ^{17}N levels (1998Gu10). ΔM=16.508 MeV *23* (1970Me11). ΔM=16.453 MeV *32* (1998Gu10).
1288 *8*	$(3/2,1/2)^-$	1	J^π: $3/2^-$ is preferred based on comparison with the ^{17}N levels (1998Gu10).
1764 *12*	$(5/2,7/2)^-$	3	J^π: $5/2^-$ is preferred based on comparison with the ^{17}N levels (1998Gu10).
1908 *15*	$1/2^+,(3/2,5/2)^+$	0,(2)	J^π: $1/2^+$ is preferred (1998Gu10).
2651 *12*		(3,2)	J=$5/2^+,5/2^-,3/2^+,7/2^-$ E(level): Possible doublet. Only one peak is observed. However the relatively poor energy resolution may conceal two groups in this region. An analysis of the angular distributions for the E_x≈2623 keV region is consistent with L=3 ($J^\pi=(5/2^-,7/2^-)$), while analysis of the E_x≈2765 keV region is consistent with L=2 ($J^\pi=(3/2^+,5/2^+)$).
2997 *11*	$(7/2,5/2)^-$	3	J^π: $7/2^-$ is preferred based on comparison with the ^{17}N levels (1998Gu10).
3548 *20*	$(9/2,11/2)^-$	5	J^π: $9/2^-$ is preferred based on comparison with the ^{17}N levels (1998Gu10).
4010 *10*	$(3/2,5/2)^+$	2	J^π: $3/2^+$ is preferred based on comparison with the ^{17}N levels (1998Gu10).
4487 *22*			
5141? *62*			
5722 *23*			
6132 *35*			
6366 *22*			

MgO(p,^{17}Ne) 2002Ch61,2002Mo19

A series of experiments on ^{17}Ne decay were carried out at the TRIUMF/TISOL facility (1997Ki19, 1998Ch05, 2002Ch61, 2002Mo19). The aim of the measurements was to exploit the ^{17}Ne(βp) reaction as a means to populate astrophysically important states in ^{16}O. Proton spallation of a MgO target resulted in ^{17}Ne ions that were implanted on a collection tape that was positioned at the center of various counting station configurations.

In (1997Ki19), a four sector annular detector was upstream of the implantation site, while a plastic scintillator β counter and HPGe γ counter were placed downstream of implantation site. The γ-p coincidences were analyzed and 16 proton groups were identified.

In (1998Ch05), a set of four ΔE-E telescopes were used to study the decay ^{17}Ne(β)^{17}F*(11193 keV)≥p+^{16}O*(9590) and ^{17}Ne(β)^{17}F*(11193 keV)≥α+^{13}N(2365,3502+3547); a total of 11 decay branches were observed for the decay of ^{17}F*(11193 keV).

In (2002Ch61), the configuration of (1998Ch05) was improved by implementing double-sided Si strip detectors into parts of the counting station; this lowered the pile-up and random coincidence rates. It is noted that the reported branching ratios show a significant systematic dependence on the detector configuration.

Finally, in (2002Mo19) the full results of the TRIUMF studies are presented. New data along with prior results on βp, $\beta\alpha$, βpγ, βpγ angular corelations, and βpα and $\beta\alpha$p, are combined to give the best overall description of ^{17}Ne decay. The values %βp=95.2 *46* and %$\beta\alpha$=2.77 *19* are deduced from the tables given in this work.

^{17}Ne Levels

E(level)	Comments
0	%β^+p=95.2 *46*; %β+α=2.77 *19*

Mg(p,^{17}Ne) 1988Bo39

1988Bo39: A beam of ^{17}Ne ions was produced at the CERN/ISOLDE facility, using proton spallation reactions on a MgO target. Neon ions from the target were collected, post-accelerated to 60 keV and magnetically separated to obtain the ^{17}Ne beam, which was implanted in a 50 μg/cm^2 carbon foil. An annular plastic scintillator detector was placed on the upstream side of the target (w.r.t. beam) while a series of different ΔE Si surface-barrier detectors (covering $\approx$0.2% of 4π) were separately placed on the downstream side of the target. The Si detectors ranged had thicknesses of 10, 15, 27 and 1000 μm and were used to characterize the proton and α groups the delayed particle spectrum. Twenty-eight different groups of β-delayed protons and αs were identified. The lifetime was measured by collecting ^{17}Ne ions for 0.2 s and counting for 1.0 s. The value T=109.3 ms *6* was obtained.

See other results on decay to ^{17}F in (1993Bo36).

2004Ba12: A beam of 260 keV ^{17}Ne ions, produced in spallation reactions of protons on a MgO target at the CERN/REX ISOLDE facility, was polarized via the tilted foil technique and implanted in a Pt stopper foil. The induced polarization was 2-3%. Analysis of the β asymmetry, mainly to ^{17}F*(4700,5520), indicated μ=0.74 *3*.

2005Ge06: A followup of (2004Ba12) measured the magnetic moments of ^{17,23,25}Ne at CERN/ISOLDE; the ^{17}Ne production technique is not detailed in the text. The fast-beam collinear laser spectroscopy technique was utilized to analyze the β activity and to deduce the hyperfine structures for the J^π=1/2$^-$ ground state. The value μ=0.7873 *14* was deduced.

2008Ge07: ^{17}Ne ions, produced via proton spallation of a MgO target at CERN/ISOLDE, were investigated in the ISOLTRAP Penning trap, where the mass was measured. The mass 17.01771475 u *57* was deduced. See also (2006HeZS).

In addition, a collinear laser spectroscopy technique was utilized to study the isotope shifts of $^{17-22}$Ne ions; by comparing with the known charge radius of ^{20}Ne, it was possible to deduce r_{charge}(^{17}Ne)=3.042 fm *21*. Using a fermionic molecular dynamics model, r_{matter}=2.75 fm was deduced. See related work reported in (2011Ma48).

^{17}Ne Levels

E(level)	J^π	$T_{1/2}$	Comments
0	1/2$^-$	109.3 ms *6*	μ=+0.7873 *14* (2005Ge06) r_{charge}(^{17}Ne)=3.042 fm *21* (2008Ge07).

Si(^{17}Ne,X) 2006Wa18

2006Wa18: A beam of 53 MeV/nucleon ^{17}Ne ions, produced by fragmenting an 80 MeV/nucleon ^{20}Ne beam at the NSCL/A1200 facility, impinged on a stack of ten Si ΔE detectors. An analysis of the energy spectra in each ΔE detector yielded the energy dependent reaction cross section, σ_R(E), for E=28-53 MeV/nucleon. A Glauber model analysis of the cross sections indicates a matter radius of $R_{r.m.s.}$=2.84 fm *23*.

^{17}Ne Levels

E(level)
0

Ni(^{20}Ne,^{17}Ne) 1964Fl03

1963Ka36,1964Fl03: A beam of 140 MeV ^{20}Ne ions, from the JINR cyclotron, bombarded a 10 μm thick ^{nat}Ni target that was upstream of a rotating aluminum disk. The reaction products escaping from the target were implanted in the disk and transported to a counter telescope comprising a thin aluminum absorber, a gas proportional counter and two Si surface barrier detectors. An E≈5 MeV proton group was observed in the β-delayed particles emitted from reaction products. The activity was also produced in ^{20}Ne bombardment of tantalum, copper and aluminum target, indicating the activity results from a multi-nucleon transfer on ^{20}Ne; ^{17}Ne or ^{20,21}Mg were most favored. Analysis of the decay curve indicated $T_{1/2}$=85 ms 15.

^{17}Ne Levels

E(level)	$T_{1/2}$
0	85 ms *15*

Au(^{17}Ne,^{17}Ne′γ) 1997Ch09,2002Ch44

1997Ch09: A 60 MeV/nucleon ^{17}Ne beam, from the NSCL/A1200, impinged on a 532.7 mg/cm^2 Au target that was position at the center of an annular NaI γ-ray array covering 55°<θ<125°. Scattered ^{17}Ne ions were detected and identified using a fast-plastic/slow-plastic phoswich detector that was placed at θ_{lab}=4.05°.

The 1275 keV *22* peak from photons corresponding to decay from the first excited state were analyzed, after Doppler correction of of the spectrum, to obtain the Coulomb excitation yield and associated B(E2).

2002Ch44: A 58.7 MeV/nucleon ^{17}Ne beam, from the NSCL/A1200 was purified in a RPMS/Wein filter and delivered to a 112 mg/cm^2 Au target. Reaction products were detected using a position sensitive telescope that was configures to measure the momenta of ejectiles from Au(^{17}Ne,^{17}Ne′≥^{15}O+2p) reactions.

A reconstruction of the ^{15}O+2p events showed a clear indication of the sequential 2p decay of ^{17}Ne*(1900 keV) via $^{16}F_{g.s.}$. No evidence for simultaneous 2p emission was found; a limit of $\Gamma_{2p}/\Gamma(^{17}Ne^*(1275))<0.0077$ was obtained. The article gives a discussion on the $J^\pi=1/2^+$ and $5/2^-$ state positions and highlights the 5/2+(?) state was previously reported at E_x=1764 keV (**add**). See other discussion in (2007Be54).

2010Li33: A 49.92 MeV/nucleon ^{17}Ne was produced by fragmentation of ^{20}Ne on a ^{9}Be target Lanzhou/RIBLL facility. The ^{15}O+2p momenta were measured using a position sensitive, multi-layer ΔE(silicon)-E(CsI) telescope. The data was analyzed to obtain the ^{17}Ne excitation energies and to search for evidence of ^{2}He emission from the visible groups. Figure 4 shows the ^{17}Ne* excitation energies reconstructed from the ^{15}O+2p events; the peak energies do not appear to be deduced in the present experimental work, but they are compared with the energies deduced in (1998Gu10) and are found in reasonable agreement. See also (2009XuZZ,2011LiZV,2016Li45).

^{17}Ne Levels

E(level)	J^π	Comments
0	$1/2^-$	
1275†‡ *22*	$3/2^-$	B(E2)↑=0.66 *+18−25* (2002Ch44).
1.76×10^3‡		
1900†‡ *78*	$5/2^-$	$T_{1/2}$: T_{mean}=1.1 ps *2* (2002Ch44). B(E2)↑=1.24 *18* (2002Ch44). Decays ≈100% via 1p emission to $^{16}F_{g.s.}$ (2002Ch44).
2.65×10^3‡		
3.00×10^3‡		
3.55×10^3‡		
4.01×10^3‡		
4.49×10^3‡		
5.14×10^3‡		
5.72×10^3‡		
6.13×10^3‡		
6.37×10^3‡		

† Level energy deduced in (2002Ch44).
‡ Peak observed in (2010Li33) and related to level reported in (1998Gu10).

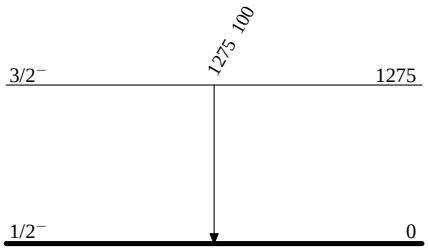
γ(^{17}Ne)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Comments
1275 *22*	100	1275	$3/2^-$	0	$1/2^-$	$\Gamma_{2p}/\Gamma(^{17}Ne^*(1275))<0.0077$ (2002Ch44).

Au(^{17}Ne,^{17}Ne′γ) 1997Ch09,2002Ch44

Level Scheme

Intensities: Relative I_γ



$^{17}_{10}Ne_7$

Pb(^{17}Ne,^{17}Ne) 2016Ma42

2016Ma42: XUNDL file compiled by TUNL 2017. See earlier analysis in (2012Ma39,2016Mazy,2016PaZX).

Nuclear and Coulomb excitation of 500 MeV/nucleon ^{17}Ne projectiles on either 199 mg/cm^2 lead, 370 mg/cm^2 carbon or a 213 mg/cm^2 polyethylene targets was measured at the GSI/R^{3}B-LAND target position. After the target, particles were momentum analyzed using position, ΔE, Time-of-Flight and/or magnetic rigidity analysis techniques. In addition, the γ rays from reactions in the target were detected using the 4π Crystal Ball array.

Events with ^{15}O+p+p particles in coincidence were analyzed to obtain the ^{17}Ne excitation spectra. Five peaks, corresponding to unbound ^{17}Ne states are observed in the polyethylene and carbon target data, while only three states are observed in the lead target data. The lowest peak apparently corresponds to an unresolved doublet, first reported by (1998Gu10). The second peak agrees well in excitation energy with the $J^\pi=5/2^+$ 2651 keV *12* state, also reported by (1998Gu10); however because this region is populated in both Coulomb and nuclear mechanisms, it is suggested that a $5/2^+$ and $3/2^-$ doublet is present in this region.

The 3-body kinematics are also analyzed to estimate the branching ratios for sequential decay via ^{16}F states (assuming only the ^{15}O ground state is populated.

Lastly, the Coulomb excitation results are analyzed to obtain the transition strengths.

See (2018Pa43) for theoretical analysis and discussion of astrophysical reactions.

^{17}Ne Levels

E(level)	J^π	Comments
0		
1764† *12*	$5/2^-$	B(E2)↑=0.0090 *18* $\sigma(CH_2)$=4.04 mb *20*, σ(C)=2.44 mb *18*, σ(Pb)=11.6 mb *15*, σ(H)≈0.80 mb *14*. Analysis of 3-body kinematics suggests decay via ^{16}F*(1468:$J^\pi=0^-$).
1908† *15*	$1/2^+$	B(E1)↑<0.00007 $\sigma(CH_2)$=0.85 mb *15*, σ(C)=0.81 mb *15*, σ(Pb)=2.5 mb *12*, σ(H)≈<0.1 mb. Analysis of 3-body kinematics suggests decay via ^{16}F*(1468:$J^\pi=0^-$).
2614‡ *20*	$5/2^+$	$\sigma(CH_2)$=0.97 mb *51*, σ(C)=1.14 mb *10*, σ(Pb)=7.68 mb *74*, σ(H)≈<0.2 mb. Analysis of 3-body kinematics suggests decay via ^{16}F*(1892:$J^\pi=2^-$).
2692‡ *21*	$(3/2^-)$	B(E2)↑=0.0069 *10* $\sigma(CH_2)$=1.40 mb *53*, σ(C)<0.3 mb, σ(Pb)=0 mb, σ(H)≈0.70 mb *26*. Analysis of 3-body kinematics suggests decay via ^{16}F*(1892:$J^\pi=2^-$).
3415 *38*	$(5/2^-)$	$\sigma(CH_2)$=1.37 mb *12*, σ(C)=0.62 mb *10*, σ(Pb)=0 mb, σ(H)≈0.38 mb *8*. Analysis of 3-body kinematics suggests 50% decay via ^{16}F*(1892:$J^\pi=2^-$) and 50% decay via ^{16}F*(2180:$J^\pi=3^-$).
5210 *79*	$(3/2^+)$	B(E1)↑=0.00071 *9* $\sigma(CH_2)$=1.13 mb *22*, σ(C)=0.46 mb *19*, σ(Pb)=14.4 mb *17*, σ(H)≈0.33 mb *15*. Table 4 lists E_x=5141, which is the value reported in (1998Gu10). $\sigma(CH_2)$=2.10 mb *35*, σ(C)=0.91 mb *46*, σ(Pb)=0 mb.

† Unresolved doublet with ^{17}Ne*(1764) and ^{17}Ne*(1908); E, J^π from (1998Gu10).

‡ Suggested unresolved doublet with ^{17}Ne*(2614 keV *20*:$5/2^+$) and ^{17}Ne*(2692 keV *21*:$3/2^-$).

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