Adopted Levels 2021Ji15

S(p)=−17. *70* 2021Ji15

In (2021Ji15) S_{4p}=−4865 keV *35*; using masses from (2021Wa16) this implies ΔM=42025 keV *35*, S_{2p}=−3462 keV *40* and S_p=−17 keV *70*.

Theoretical Developments:

In (1997Pa38) a relativistic mean field theory approach was utilized that predicted binding energies of either E_b=93.286 MeV or 95.238 MeV.

A time dependent Hartree-Fock-Bogoliubov theory study of even A Mg isotope ground state properties (2011Eb04) predicted ^{18}Mg should be stable with respect to proton decay by 200 keV. These results are also reported in (2014Eb02).

An improved Kelson-Garvey model mass analysis of proton rich nuclei (2013Ti01) deduced ^{18}Mg was bound with E_b=92.589 MeV *32*, ΔM=43.306 MeV *32*, S_p= −0.672(39) MeV and S_{2p} = −4.233 MeV *34*.

In (2013Fo13), a simple potential model used known spectroscopic factors to calculate the ^{18}Mg ground state as the mirror image of ^{18}C. Results were given as E(2p+^{16}Ne)=3.87 MeV *10*, corresponding to S_{1p}=−820 keV *140* and S_{2p}=−3870 keV *100*. Later, in (2016Fo20) the same author developed a simple parameterization of the mirror image differences of several Mg isotopes to obtain the 2 proton separation energies. For ^{18}Mg, S_{2p}= −3.84 MeV *35* was obtained and found in agreement with the (2013Fo13) prediction.

In (2019Sa58), predictions of ^{18}Mg ground state properties (charge density, neutron and proton radii, deformation parameter, etc.) obtained from both a relativistic mean field theory analysis and the Nillson-Strutinsky method were compared.

A Gamov shell model was used by (2021Mi10) to calculate ground state energies and widths of the $^{15-18}$C isotopes along with the mirror ^{15}F, ^{16}Ne, ^{17}Na and ^{18}Mg parameters. The model framework assumed a ^{14}O core plus valence nucleon picture. For ^{18}Mg a $J^\pi=0^+$ ground state and a 2^+ excited state are predicted around S_{2p}≈−3.8 MeV and S_{2p}=−5.3 MeV, respectively. Note: S_{2p}(^{16}Ne)≈−1.4 MeV, so $^{18}Mg_{g.s.}$ is predicted with S_{4p}≈−5.2 MeV. See also (Li, et al., Physics 3 977 (2021)).

^{18}Mg Levels

Cross Reference (XREF) Flags

A ^{9}Be(^{20}Mg,^{18}Mg)

E(level)	J^π †	Γ	^{14}O+4p Invariant Mass (MeV)	XREF	Comments
0	0^+	0.12 MeV *10*	4.865 *35*	A	%2p=100
1.84×10^3 *14*	2^+	0.27 MeV *15*	6.71 *14*	A	%2p=100

† From systematics.

^{9}Be(^{20}Mg,^{18}Mg) 2021Ji15

2021Ji15: XUNDL dataset compiled by TUNL (2022).

The authors analyzed the ^{18}Mg (^{14}O+4p) excitation spectra produced in ^{20}Mg reactions on a ^{9}Be target. The present letter reports the first observation of ^{18}Mg resonances produced via 2n knockout reactions from ^{20}Mg.

A beam of 103 MeV/nucleon ^{20}Mg ions, from the NSCL/A1900 fragment separator, impinged on a 1 mm thick ^{9}Be target positioned at the S800 target position. Residual protons were momentum analyzed using a position sensitive annular Si-CsI(Tl) ΔE-E array that covered θ_{polar}=1.2° to 10.1°. The scintillating-fiber array (SFA) provided precise emission angle information for heavier products ejected along the beam direction before they were momentum analyzed using the S800 spectrometer. The invariant mass spectrum (E_T) was deduced from analysis of the complete ^{14}O+4p particle kinematics.

Two peaks are found in the spectrum; the ground state is identified at E_T=4865 keV *35* while a second state (presumably with $J^{\pi}=2^{+}$) is observed at E_T=6.71 MeV 14. After correcting for the experimental resolution, the widths Γ=115 keV *100* and 266 keV *150* are deduced for the ground and first excited states, respectively.

The authors developed a Monte Carlo model to analyzed the energy spectra of the four sub-systems (i.e. ^{14}O+p, ^{14}O+2p, ^{14}O+3p and p+p) and to gain insight into details of the $^{18}Mg_{g.s.}$ decay process. The measured data are consistent with two sequential 2p emissions, i.e. $^{18}Mg_{g.s.}\rightarrow 2p+^{16}Be_{g.s.}\rightarrow 2p+(2p+^{14}O_{g.s.})$. However, the authors caution that their model is not strongly sensitive to contributions from ^{18}Mg sequential 2p decay via broad ^{17}Na states.

Analysis of the $\Delta E(0^{+}-2^{+})$ systematics for nearby nuclei suggests a disappearance of N=8 magicity in the Mg isotopes.

^{18}Mg Levels

E(level)	J^{π}†	Γ	^{14}O+4p Invariant Mass (MeV)	Comments
0	0^{+}	0.12 MeV *10*	4.865 *35*	%2p≈100
1.84×10^{3} *14*	2^{+}	0.27 MeV *15*	6.71 *14*	%2p≈100

† From systematics.

REFERENCES FOR A=18

1997Pa38 S.K.Patra, R.K.Gupta, W.Greiner - Int.J.Mod.Phys. E6, 641 (1997).
Relativistic Mean-Field Theory and the Structural Properties of Ne,Mg,Si,S,Ar and Ca Nuclei from Proton- to Neutron-Drip Lines.

2011Eb04 S.Ebata, T.Nakatsukasa, K.Yabana - J.Phys.:Conf.Ser. 312, 092023 (2011).
Linear response calculation using the canonical-basis TDHFB with a schematic pairing functional.

2013Fo13 N.Fotiades, M.Devlin, R.O.Nelson, T.Granier - Phys.Rev. C 87, 044336 (2013).
Low-spin states in ^{86}Kr from the (n,n′) reaction.

2013Ti01 J.Tian, N.Wang, C.Li, J.Li - Phys.Rev. C 87, 014313 (2013).
Improved Kelson-Garvey mass relations for proton-rich nuclei.

2014Eb02 S.Ebata, T.Nakatsukasa, T.Inakura - Phys.Rev. C 90, 024303 (2014); Erratum Phys.Rev. C 92, 069902 (2015).
Systematic investigation of low-lying dipole modes using the canonical-basis time-dependent Hartree-Fock-Bogoliubov theory.

2016Fo20 H.T.Fortune - Phys.Rev. C 94, 044305 (2016).
Masses of ^{17,18,19,20}Mg.

2019Sa58 G.Saxena, M.Kumawat, M.Aggarwal - Int.J.Mod.Phys. E28, 1950101 (2019).
Search for exotic features in the ground state light nuclei with $10 \leq Z \leq 18$ from stable valley to drip lines.

2021Ji15 Y.Jin, C.Y.Niu, K.W.Brown, Z.H.Li et al. - Phys.Rev.Lett. 127, 262502 (2021).
First Observation of the Four-Proton Unbound Nucleus ^{18}Mg.

2021Mi10 N.Michel, J.G.Li, F.R.Xu, W.Zuo - Phys.Rev. C 103, 044319 (2021).
Proton decays in ^{16}Ne and ^{18}Mg and isospin-symmetry breaking incarbon isotopes and isotones.

2021Wa16 M.Wang, W.J.Huang, F.G.Kondev, G.Audi, S.Naimi - Chin.Phys.C 45, 030003 (2021).
The AME 2020 atomic mass evaluation (II). Tables, graphs and references.