$^{1}H(^{30}Mg,P)$:IAR 2014Im02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 184, 29 (2022)	24-Jun-2022

Dataset adapted from compiled dataset from 2014Im02 in the XUNDL database by M.S. Basunia (LBNL), Oct 20, 2014.

Includes $^{12}C(^{30}Mg,p)$ due to the presence of carbon in the target, but contribution from this reaction is found to be negligible (2014Im02).

2014Im02: E=2.92 MeV/nucleon ^{30}Mg beam was produced by bombarding 1.4-GeV protons on Uranium Carbide (UC) target and separated by the ISOLDE facility at CERN. Target was 5.6 mg/cm^2 thick polyethylene. Outgoing protons were detected by two layers of Si detectors (FWHM=80 keV). Measured $\sigma(E_p)$. Deduced resonance energy E_R, L-transfer, Γ_p, and spectroscopic factor from R-matrix analysis. Studied ^{31}Mg g.s. and first two excited states through their isobaric analog resonances (IAR) in ^{31}Al. Comparisons of spectroscopic factors with shell-model calculations.

Determination of structural differences between ^{30}Mg and ^{31}Mg, nuclei at the boundary of the 'island of inversion' through the study of IAR (in ^{31}Al) of low-lying states in ^{31}Mg (2014Im02).

^{31}Al Levels

E(level)†	Jπ@	Γ@	L	S#	Comments
15804‡ *5*	1/2+	15 keV *8*	0‡	0.07 *8*	Γ_p=13 keV *5* (2014Im02) E(level): IAR of ^{31}Mg ground state, J^π=1/2+. Quenched spectroscopic factor suggests drastic change in shell structures of ^{31}Mg and ^{30}Mg. Measured E_R=2446 keV *4* (stat) (2014Im02). S: from 0.07 *3*(stat)*7*(syst) (2014Im02).
15867‡ *3*	3/2+	1.3 keV *13*	2‡	0.10 *11*	Γ_p=1.3 keV *5* (2014Im02) E(level): IAR of first excited state in ^{31}Mg at 50 keV, J^π=3/2+. E_{ex}(in ^{31}Mg)=63 keV *4* (2014Im02) from energy difference of 2509- and 2446-keV proton resonances with only the statistical uncertainties, which is not in good agreement with the adopted E(level)=50 keV. Note that the 2446- and 2509-keV resonances are unresolved. Consideration of systematic uncertainties in resonance energies may resolve the discrepancy. Quenched spectroscopic factor suggests drastic change in shell structures of ^{31}Mg and ^{30}Mg. Measured E_R=2509 keV *4* (stat) (2014Im02). S: from 0.10 *4*(stat)*10*(syst) (2014Im02).
16026 *4*	(3/2)−	109 keV *2*	1	0.68 *20*	Γ_p=79 keV *4* (2014Im02) E(level): IAR of second excited state in ^{31}Mg at 221 keV, J^π=(3/2)−. E_{ex}(in ^{31}Mg)=222 keV *5* (2014Im02) from energy difference of 2668- and 2446-keV proton resonances with only the statistical uncertainties. Measured E_R=2668 keV *3* (stat) (2014Im02). Large spectroscopic factor indicates similar shell structure of ^{31}Mg and ^{30}Mg. S: from 0.68 *4*(stat)*20*(syst) (2014Im02).

† Deduced by evaluators from E_R+S(p)(^{31}Al), with S(p)=13358.3 *26* (2021Wa16). Resonance energies were obtained from R-matrix analysis of excitation functions of the proton elastic scattering. The three resonances (IARs) observed here correspond to parent states at 0, 50 and 221 keV in ^{31}Mg.

‡ 2446- and 2509-keV proton resonances are unresolved as shown in figure 2 of 2014Im02. Choice of values given here is based on R-matrix analysis and minimum χ^2 using MINUIT computer code. Final values are listed in column 9 of table I in 2014Im02.

From R-matrix analysis of the excitation functions of the proton elastic scattering.

@ From R-Matrix analysis in 2014Im02. Identification as IAR of states in ^{31}Mg is also used for J^π assignments. For first excited state, consideration of a 7/2− gave a somewhat higher χ^2 than 3/2+.