Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	21-May-2021

Q(β^-)=20730 *SY*; S(n)=1300 *SY*; S(p)=27720 *SY*; Q(α)=−24850 *CA* 2021Wa16,2019Mo01

Q(α) from 2019Mo01 (theory), others from 2021Wa16.

Estimated uncertainties (2017Wa10): ΔQ(β^-)=580, ΔS(n)=720, ΔS(p)=900.

S(2n)=670 *710*, Q(β^-n)=19990 *580* (syst,2021Wa16). S(2p)=53360 (theory,2019Mo01).

Q(β^-2n)=16940 *520*, Q(β^-3n)=15930 *530*, Q(β^-4n)=11320 *530*, Q(β^-5n)=9820 *500*, Q(β^-6n)=4120 *500*, Q(β^-7n)=1550 *500*, deduced by evaluator from mass values in 2021Wa16.

First identification of ^{40}Mg nuclide as particle stable by 2007Ba71.

2007Ba71: W(^{48}Ca,Xγ),E=141 MeV/nucleon beam from the National Superconducting Cyclotron Laboratory (NSCL). The fragments were separated with the A1900 fragment separator. Isotopic identification by multiple ΔE signals, magnetic rigidity, total energy and time of flight analysis. Detectors: plastic scintillators, parallel-plate avalanche counters (PPACs) and silicon PIN diodes. A total of three events were assigned to ^{40}Mg. This establishes stability of ^{40}Mg against particle emission.

2014Cr02: C(^{42}Si,^{40}Mg), two-proton knockout reactions from ^{42}Si at RIBF-RIKEN facility. Deduced inclusive cross section for 2p knockout from ^{42}Si. A total of five events of ^{40}Mg were observed for 9.65×10^5 incident ^{42}Si nuclei.

2002Lu19 and 2002No11 (also 2003Pe31) searched for evidence for the production of ^{40}Mg nuclide in fragmentation of ^{48}Ca beam at 59, 64 MeV/nucleon bombarding a ^{181}Ta target at RIKEN-RIPS facility. With a predicted cross section of 0.01 pb, only one event was expected; but none was observed. Thus the identification and particle stability of ^{40}Mg remained uncertain in this work.

As concluded by 2019Cr02, level structure of ^{40}Mg differs from that of the neighboring ^{38}Mg and ^{36}Mg nuclei, which the authors ascribe to possible weak-binding effects in the low-lying excitation spectrum. Their shell-model calculations are also not successful in reproducing the observed level energy of the first 2$^+$ state.

Theory references: consult the NSR database (www.nndc.bnl.gov/nsr/) for 80 references for structure calculations.

Additional information 1.

^{40}Mg Levels

Cross Reference (XREF) Flags

A C(^{41}Al,^{40}Mgγ)
B C(^{42}Si,^{40}Mg)

E(level)	J$^\pi$	XREF	Comments
0	0$^+$	AB	%β^-=100; %β^-n=?; %β^-2n=?; %β^-3n=?; %β^-4n=? %β^-5n=?; %β^- ^{6}n=?; %β^- ^{7}n=? β^- is the only possible decay mode, followed by β-delayed neutron emissions, thus 100% β^- decay is assigned by inference. Theoretical T$_{1/2}$=4.9 ms, %β^-n=61, %β^-2n=14, %β^-3n=6, %β^-4n=0, %β^-5n=0, %β^-6n=0, %β^-7n=0 (2019Mo01). Theoretical T$_{1/2}$=5.5 ms, %β^-n=15.8, %β^-2n=51.0, %β^-3n=3.4, %β^-4n=5.2, %β^-5n=0.5 (2016Ma12). Theoretical T$_{1/2}$=2.4 ms (2013Li39). T$_{1/2}$: half-life of the decay of ^{40}Mg has not yet been measured. T$_{1/2}$>170 ns from time-of-flight of ≈170 ns (Fig. 3 in 2007Ba71). From a general decreasing trend of half-lives with increasing neutron number, T$_{1/2}$ for ^{40}Mg g.s. is expected to be <5 ms, based on measured half-lives of 20 ms for ^{34}Mg, 11.3 ms for ^{35}Mg, and 3.9 ms for ^{36}Mg available in the ENSDF database (as of May 13, 2021). Other:
500 *14*	(2$^+$)	A	E(level),J$^\pi$: tentative level proposed by 2019Cr02. Authors note that energy is ≈20% lower than that predicted by shell-model calculations and experimental systematics of ^{38}Mg and ^{36}Mg (Fig. 3 in 2019Cr02).

Adopted Levels, Gammas (continued)

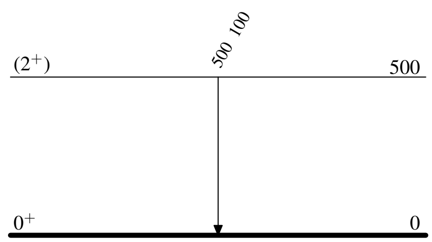
$\gamma(^{40}Mg)$

E_i(level)	J^π_i	E_γ	I_γ	E_f	J^π_f
500	(2^+)	500 *14*	100	0	0^+

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{40}_{12}Mg_{28}$