C(^{41}Al,^{40}Mgγ) 2019Cr02

History

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

Includes H(^{41}Al,^{40}Mg), as the target is polyethylene $(C_2H_4)_n$.

First report of observation of two γ rays in ^{40}Mg, and a tentative excited state in ^{40}Mg, populated through one-proton knockout from ^{41}Al.

2019Cr02: ^{41}Al secondary beam was produced in ^{9}Be(^{48}Ca,X), E=345 MeV/nucleon primary reaction at RIBF-RIKEN facility. Rotating ^{9}Be target was 2.8 mg/cm^2 thick. Projectile-like secondary fragments were selected using Bρ-ΔE-Bρ method through the BigRIPS fragment separator. Cocktail beam (consisting of ^{41}Al and ^{40}Al) was incident on 3.82 g/cm^2 thick polyethylene ($(C_2H_4)_n$) target placed at the focal point of the ZeroDegree spectrometer (ZDS). Outgoing particles were identified in A/Q and Z through event-by-event analysis by the Bρ-ΔE-TOF method using the ZDS spectrometer, and γ rays were detected using DALI2 array of 186 NaI(Tl) detectors. Measured Eγ, Iγ, γ rays in coincidence with incoming ^{41}Al beam particles and ^{40}Mg outgoing particles. Deduced level and J^π in ^{40}Mg. Comparison with shell-model calculations.

^{40}Mg Levels

E(level)	J$^\pi$	Comments
0	0$^+$	
500 *14*	(2$^+$)	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).

γ(^{40}Mg)

E$_\gamma$	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Comments
500 *14*	500	(2$^+$)	0	0$^+$	Observed counts=74 *15*(stat) *9*(syst). As this γ ray is more intense by ≈2.5 times than the 670γ, it is assigned from the first excited state.
^{x}670 *16*					Observed counts=30 *10*(stat) *5*(syst). Due to limited statistics, coincidence relationship of 500γ and 670γ could not be determined. Several scenarios were considered by 2019Cr02 for the placement of this γ ray. From model calculations and experimental systematics of the first 2$^+$ and 4$^+$ states, a possible 4$^+$ state at 1170 keV, assuming cascade of 670γ and 500γ, was rejected, as the level energy, and E(first 4$^+$)/E(first 2$^+$) ratio of 2.34 were lower than expected. An oblate excited 0$^+$ state at 1170 keV was also considered unlikely by the authors, on the basis of level energy and systematics of proton removal cross sections in neighboring nuclides. Second excited 2$^+$ state at 1170 keV was also considered, but then there should be an 1170γ to the g.s. with an intensity comparable to that of the 670γ, or expected 5 *2* counts, which could not be ruled out within the experimental uncertainties.

^{x} γ ray not placed in level scheme.

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Level Scheme