

^{36}Mg β^- -n decay (6.9 ms) 2023Lu07

Parent: ^{36}Mg : $E=0$; $J^\pi=0^+$; $T_{1/2}=6.9$ ms $+7-8$; $Q(\beta^-n)=1.253\times 10^4$ 69; $\% \beta^-n$ decay=?

^{36}Mg - J^π : From the Adopted Levels of ^{36}Mg (2012Ni01).

^{36}Mg - $T_{1/2}$: Weighted average of 3.9 ms 13 (2004Gr20,2003Gr22, implant- β correlation), 7.6 ms $+5-8$ (2013StZY, implant- β correlation, original $T_{1/2}=7.6$ ms 1 (stat) $+5-8$ (syst)), 7.2 ms 12 (2022Cr03, implant- β correlation, original $T_{1/2}=7.2$ ms 1 (stat) 12 (syst)), and 6.8 ms 10 (2023Lu07, implant- $\beta\gamma$ correlation). Other: ≈ 5 ms (1999YoZW, implant- β correlation, preliminary).

^{36}Mg - $Q(\beta^-n)$: From 2021Wa16.

2023Lu07: Exp 1: ^{36}Mg and ^{36}Al were produced via the projectile fragmentation of a 140-MeV/nucleon, 80-pnA ^{48}Ca primary beam from the NSCL cyclotrons impinging on a 642-mg/cm²-thick ^9Be target. The secondary cocktail beam centered around ^{33}Na was selected by the A1900 separator and implanted into a CeBr₃ scintillator sandwiched between two plastic scintillator veto detectors. Surrounding the implantation array were the SeGA array of 16 segmented Ge detectors and 15 LaBr₃ detectors. Exp 2: ^{36}Mg and ^{36}Al were produced via the projectile fragmentation of a 172.3-MeV/nucleon, 120-pnA ^{48}Ca primary beam from the FRIB linac impinging on an 8.89-mm-thick ^9Be target. The secondary cocktail beam centered around ^{42}Si was selected by the ARIS separator and implanted into a 5-mm-thick YSO segmented scintillator sandwiched between two plastic scintillator veto detectors. Surrounding the implantation array were 11 HPGe clover detectors and 15 fast-timing LaBr₃ detectors, and the VANDLE array of 88 neutron detectors. Measured E_γ , I_γ , $\beta\gamma$ -coin, $\gamma\gamma$ -coin, implant- $\beta\gamma$ correlation and deduced $T_{1/2}$ of ^{36}Mg g.s., ^{36}Al g.s. and a ^{36}Al isomer. Comparisons with FSU shell-model calculations.

2013StZY: ^{36}Mg was produced via the projectile fragmentation of a 345-MeV/nucleon, 70-pnA $^{48}\text{Ca}^{20+}$ primary beam from the linear accelerator RILAC and the four cyclotrons RRC, fRC, IRC, and SRC at RIKEN impinging on an 15-mm-thick ^9Be target. The secondary cocktail beam was selected by the BigRIPS separator and the zero-degree spectrometer (ZDS) using the $B\rho$ - ΔE -ToF method, and implanted into the Cylindrical Active Implantation Target for Exotic Nuclei (CAITEN) consisting of a segmented movable hollow-cylindrical-shaped plastic scintillator and a stationary ring of 24 position-sensitive photomultiplier tubes (PSPMTs) arranged on a ring inside the scintillator at the height of the beam line. To reduce background buildup, the scintillator barrel was fastly rotated and slowly moved axially in vertical direction, resulting in a helix-shaped motion. β particles were detected by the CAITEN and γ rays were detected using three HPGe clover detectors. Measured E_γ , $\beta\gamma$ -coin, and implant- β correlation, and deduced the $T_{1/2}$ of ^{36}Mg . Comparisons with QRPA and shell-model calculations.

 ^{35}Al Levels

<u>E(level)</u>	<u>J^π</u>	<u>Comments</u>
0 803	(5/2) ⁺	J^π : From the Adopted Levels.

 $\gamma(^{35}\text{Al})$

<u>E_γ</u>	<u>$E_i(\text{level})$</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Comments</u>
803	803	0	(5/2) ⁺	<p>E_γ: From 2023Lu07.</p> <p>2023Lu07 observed the 803γ within the 100-ms window following the arrival of a ^{36}Mg ion in both NSCL and FRIB experiments.</p> <p>2013StZY observed a 804-keV γ ray that was not in coincidence with other γ rays. 2013StZY stated that the 804γ is a prompt line that predominantly appears in the time window 0-10 ms after an implantation of ^{36}Mg, so it must originate from a deexcitation in one of the daughter nuclei $^{34,35,36}\text{Al}$.</p>

$^{36}\text{Mg} \beta^- n$ decay (6.9 ms) 2023Lu07

Decay Scheme

