^{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(β^-n)=1.253×10^4 *69*; %β^-n decay=48 *12*

^{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(β^-n): From 2021Wa16.

^{36}Mg-%β^-n decay: From 1999YoZW (preliminary).

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/cm^2-thick ^{9}Be target. The secondary cocktail beam centered around ^{33}Na was selected by the A1900 separator and implanted into a $CeBr_3$ scintillator sandwiched between two plastic scintillator veto detectors. Surrounding the implantation array were the SeGA array of 16 segmented Ge detectors and 15 $LaBr_3$ 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 ^{9}Be 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 $LaBr_3$ detectors, and the VANDLE array of 88 neutron detectors. Measured Eγ, Iγ, $\beta\gamma$-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 $^{48}Ca^{20+}$ primary beam from the linear accelerator RILAC and the four cyclotrons RRC, fRC, IRC, and SRC at RIKEN impinging on an 15-mm-thick ^{9}Be target. The secondary cocktail beam was selected by the BigRIPS separator and the zero-degree spectrometer (ZDS) using the Bρ-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 Eγ, $\beta\gamma$-coin, and implant-β correlation, and deduced $T_{1/2}$. Comparisons with QRPA and shell-model calculations.

^{35}Al Levels

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

$\gamma(^{35}Al)$

E_γ	E_i(level)	E_f	J^π_f	Comments
803	803	0	$(5/2)^+$	E_γ: From 2023Lu07. 2023Lu07 observed the 803γ within the 100-ms window following the arrival of a ^{36}Mg ion in both NSCL and FRIB experiments. 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}Al.

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Decay Scheme