

$^{180}\text{Ta}(\gamma,\gamma')$: target= 9^- isomer 2002Be18,2002La01

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	E. A. Mccutchan	NDS 126, 151 (2015)	1-Feb-2015

The ^{180}Ta (Target= 9^- isomer)(γ,γ') reaction is important in nuclear astrophysics for explaining the abundance of ^{180}Ta in stellar matter. The unusually large integrated cross section ($\sigma \Gamma$) for the ^{180}Ta (Target= 9^- isomer) (γ,γ') ^{180}Ta (8.1 h) reaction reported by 1988Co04, 1989Ca19 have raised the concern that evolution of this isotope may be affected by photoexcitation at the s-process temperatures. However, the energies of the resonant states (2.8-3.6 MeV) measured by 1990Co24 are high enough to insure the survival of this nucleus in an s-process environment. A disagreement between 1992Ne02 and 1990Co24 regarding the magnitude of the integrated cross sections still remains an open question.

2002Be18, 2001Vo13, 1999Be65: Target: Ta_2O_5 target enriched 5.45% $^{180\text{m}}\text{Ta}$ containing 6.7 mg of $^{180\text{m}}\text{Ta}$ ($>1.2 \times 10^{15}$ y); 123 mg/cm² of Ta_2O_5 powder and natural Ta metal targets. Bremsstrahlung with 1.5 MeV end point energy. Measured E_γ , I_γ in photon scattering experiment with three Ge detectors at 90°, 127°, and 150°. The detector at 127° was surrounded by a BGO anti-Compton shield. In activation measurement, measured E_γ , I_γ , x-rays with two high resolution LEP detectors; deduced $T_{1/2}$ of ground state.

2002La01: Target: natural Ta disc of diameter 40 mm and thickness 0.33 mm. Projectile: 1.85 PBq ^{60}Co source. Planar Ge detector surrounded by NaI anti-coincidence shield. Partial lifetime for intermediate states.

2001Wa45: Interpretation of the states observed in 2002Be18, 1999Be65.

1990Co24: Target: 99.95% enriched ^{180}Ta containing ^{180}Ta ($>1.2 \times 10^{15}$ y) in its natural abundance. Bremsstrahlung from tantalum irradiated with electrons. Fourteen different endpoints of the bremsstrahlung were arranged to span the interval from 2 to 5 MeV. Uncertainties in the end points were less than 50 keV. Standard calculations provided the photon flux for the various electron energies, and these calculated values were verified using the $^{87}\text{Sr}(\gamma,\gamma')^{87}\text{Sr}$ (2.8 h) reaction. A measurement of HF K x-ray with α decay rate consistent with $T_{1/2}=8.1$ h suggested that these high-energy states cascade through the levels of ^{180}Ta leading finally to the ground state. Detector: hyperpure germanium. Measured integrated cross sections of $\sigma \Gamma=120$ mb keV 20 and $\sigma \Gamma=350$ mb keV 50 for depopulating ^{180}Ta ($>1.2 \times 10^{15}$ y) through resonant states at 2.8 MeV 1 and 3.6 MeV 1, respectively. The 3.6 MeV resonance has not yet been observed in other experiment.

Others: 1988Ca04, 1989Ca19, 1992Ca01, 1992Ca01, 1992Ne02, 1994Ka54, 1995BeZX, 1997Be58, 1997Be76, 1998BeZY, 1998Ka14, 1999Bi08, 1999Bi21, 1999To05, 2001Kn02, 2001So17, 2002Ga14, 2011Vy02.

 ^{180}Ta Levels

E(level) [†]	J^π	$T_{1/2}$	Comments
0.0	1^+	8.18 h 2	$T_{1/2}$: from $K\alpha$ x-ray(t) (2002Be18). Other: 8.15 h 3, early result by same group (1999Be56).
77.1 8	9^-	$>7.1 \times 10^{15}$ y	E(level), $T_{1/2}$: from the Adopted Levels.
1087 10		≤ 35 ps	$T_{1/2}$: from partial meanlife of 40 ps 11 (2002La01). E(level): identified as the 1076 keV $J^\pi=(8^+)$ level in 2001Wa45.
1300 20		≤ 7 ps	E(level): identified as the 1278 keV $J^\pi=(9^+)$ level in 2001Wa45. $T_{1/2}$: from partial meanlife of 9.3 ps 4 (2002La01).
1510 20			E(level): identified as the 1499 keV $J^\pi=(10^+)$ level in 2001Wa45.
1630 30			
1930 50			
2240 20			
2480 60			
2720 30			
2880 40			

[†] From 2002Be18, except for the 1087-keV level which is from 1999Be65. Excitation energy of the 9^- isomer (77 keV) has been added by the evaluator to the energies given in 2002Be18 and 1999Be65.