^{161}Ta α decay 1986Ru05,1992Ha10,2012Th13

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 132,1 (2016)	4-Dec-2015

Parent: ^{161}Ta: E=95 *38*; J$^{\pi}$=(11/2^{-}); T$_{1/2}$=3.08 s *11*; Q(α)=5209 *39*; %α decay=7 *3*

^{161}Ta-E: from 2012Th13 based on measured metastable state energy in ^{173}Au, ΔE(^{173}Au)=214 *23* (1999Po09), from which they deduced the metastable state energy in ^{165}Re, ΔE(^{165}Re)=58 *37*; of which they deduced the metastable state energy in ^{161}Ta, ΔE(^{165}Re)=95 *38* (literature Q(α) values for the g.s.-to-g.s. and metastable-to-metastable α-decays listed on Fig. 1 of 2012Th13 were also used in these calculations).

^{161}Ta-J$^{\pi}$,T$_{1/2}$: from 2011Re14 evaluation.

^{161}Ta-Q(α): 2012Th13 measured Eα=5142 *5* from ^{161}Ta that yielded T$_{1/2}$=4.5 s *11* consistent with the 11/2^{-} metastable state in ^{161}Ta (T$_{1/2}$ of ^{161}Ta g.s. is not known) decaying to the metastable state of ^{157}Lu. Weighted average of experimental values listed in the α radiations table below is 5147 *2*, whence one gets Q(α,^{161m}Ta->^{157m}Lu)=5278 *2*. Consequently one gets the Q(β^{-})value of g.s.-to-g.s. α decay (ΔE denotes the metastable state energy): Q(α,^{161}Ta->^{157}Lu)=ΔE(^{157}Lu)+Q(α,^{161m}Ta−>^{157m}Lu)-ΔE(^{161}Ta)=26 *7* + 5278 *2* − 95 *38*=5209 *39*. Other value: 5330 *29* (2012Wa38).

^{161}Ta-%α decay: measured by 2012Th13 for ^{161m}Ta->^{157m}Lu α decay. A theoretical value that was reported before (1984Al36) from theoretical α and ε+β+ half−lives is 5%. 1983Al09 and 1984Al36 suggest that ^{161}Ta may also emit protons which would decrease this value.

Experimental methods:

1979Ho10: produced by ^{107}Ag(^{58}Ni,2p2n) on enriched (99.5%) target with E(^{58}Ni)=263, 275 MeV. Reaction products separated in velocity selector and implanted in position-sensitive detector.

1983Al09, 1984Al36: From β end-point energy and E(α) value, they deduce proton binding energy.

1986Ru05: produced by ^{130}Ba(^{35}Cl,4n) with E(^{35}Cl)=200 MeV and ^{133}Cs(^{36}Ar,8n) with E(^{36}Ar)=235 MeV. After He-jet transport, α's measured with Si detector.

1992Ha10: produced by ^{40}Ca(^{127}I,x) with E(^{127}I)=711 MeV.

2005Sc22: used ^{112}Sn(^{58}Ni,p), E(^{58}Ni)=266 MeV reaction to produce ^{169,169m}Ir and studied α-decay products ^{165,165m}Re, ^{161}Ta, ^{157}Lu. Recoils separated with He-filled magnetic separator (RITU) were transported to focal plane where they traversed isobutane-filled multiwire proportional chamber before implating into double-sided Si strip detectors (GREAT spectrometer); used array of 43 escape-suppressed Ge detectors for prompt γ-ray detection (JUROGAM). Measured Eγ, Iγ, $\gamma\gamma$-coin, (recoil)γ-coin.

2012Th13: used ^{92}Mo(^{84}Sr,X) E(^{84}Sr)=392, 400 MeV to produce g.s. and metastable ^{173}Au and their separate g.s.-to-g.s. and metastable-to-metastable α-decay chains to g.s. and metastable ^{161}Ta respectively. Same setup as that from 2005Sc22 was used, with extra 28 Si PIN diode detectors and four clover-type Ge detectors and one planar Ge detector, allowing recording energy loss and time-of-flight information. Measured Eγ, Iγ, $\alpha\gamma$-, $\gamma\gamma$-coin; deduced prompt γ and mass excesses and compared with 2012Wa38 evaluation.

A particularly of ^{177}Tl, ^{173}Au, ^{169}Ir, ^{165}Re, ^{161}Ta, and ^{157}Lu nuclei is that all ground states have J^{π}=1/2^{+} (based on πs$_{1/2}$ orbital) and all metastable states have J^{π}=11/2^{-} (based on πh$_{11/2}$ orbital); consequently all ground states form an α-decay chain connecting the 1/2^{+} spins, which is different from the α-decay chain of all metastable states connecting 11/2^{-} spins.

^{157}Lu Levels

E(level)	J$^{\pi}$	T$_{1/2}$	Comments
0.0†	(1/2^{+},3/2^{+})†	6.8† s *18*	no α-decay to ^{157}Lu g.s. was found.
26† *7*	(11/2^{-})†	4.79† s *12*	associated by 2012Th13 as daughter level of the α-decay branch.

† From Adopted Levels, Gammas dataset.

^{161}Ta α decay 1986Ru05,1992Ha10,2012Th13 (continued)

α radiations

Eα	E(level)	Iα[†]	Comments
5147 *2*	26	100	Eα: weighted average of experimental values 5142 *5* (2012Th13), 5151 *4* (2005Sc22), 5140 *7* (1996Pa01), 5149 *5* (1992Ha10), 5148 *5* (1979Ho10). HF: 1.6 *8* (2012Th13).

[†] For absolute intensity per 100 decays, multiply by 0.07 *3*.