Adopted Levels

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, M. S. Basunia, Jun Chen et al. ,	NDS 192,315 (2023)	25-Sep-2023

Q(β^-)=−7000 *60*; S(n)=8320 *90*; S(p)=3390 *80*; Q(α)=9480 *50* 2021Wa16

Q(ε)=2210 *100*, Q(εp)=40 *50*, S(2n)=14880 *110* (syst), S(2p)=4990 *50* (2021Wa16).

1983Hi12: W(^{40}Ar,xn) E(^{40}Ar)=180 MeV; products were separated from the primary beam by the velocity filter; parent of ^{214}Ra (7.16-MeV α). Tentative identification of ^{222}U nuclide.

2012Ya04: ^{100}Mo(^{124}Sn,2n)^{222}U,E(^{124}Sn)=505 MeV. Measured evaporation residues at the HRIBF-ORNL facility. Deduced production σ=21 nb *+38−21* from in-beam data, and <270 nb from post-irradiation collection of decay product ^{206}Po (from α decay chain: ^{222}U → ^{218}Th → ^{214}Ra → ^{210}Rn → ^{206}Po). No confirmed production and identification of ^{222}U nuclide.

2015Kh09: ^{222}U produced and identified in ^{176}Yb(^{50}Ti,4n), E(^{50}Ti)=231-255 MeV reaction. The $^{50}Ti^{12+}$ pulsed beam was produced by the UNILAC at GSI. Target=0.45 mg/cm^2 *5* thick $^{176}YbF_3$ mounted on a rotating wheel, synchronized with the beam pulses. Evaporation residues (ERs), separated by using gas-filled TransActinide Separator and Chemistry Apparatus (TASCA) with flight time of 0.53 μs *6* through the separator, were implanted in a double-sided silicon strip detector. The events due to radioactive decays of implanted residues were selected from the events related to beam using a multiwire proportional counter (MWPC). Measured Eα, Iα, from ER-α correlated events from subsequent α-decay chains, half-lives of the parent nuclei corresponding to the evaporation residues, and successive α-decay daughters, the latter identified by their known characteristics in literature. The identification of ^{222}U was made based on observed ER-α, two- or three-signal correlated events using a fast data acquisition and combined analog and digital (CANDI) readout system. A total of 81 ER traces were recorded for ^{222}U and analyzed with subsequent α decay chain: ^{222}U -> ^{218}Th -> ^{214}Ra. FWHM≈40 keV for 8.7 MeV α particles, recorded as single events, ≈110 keV and ≈180 keV for multiple α events stored in a single trace with time differences of 1 μs and 0.17 μs, respectively. Deduced α-decay reduced widths, and neutron shell gap, the latter compared with FRDM95 and HFB26 theoretical calculations for the Z=82-92,N=126 nuclei.

2023Lu04: ^{222}U produced in ^{186}W(^{40}Ar,4n),E(^{40}Ar)=188 MeV, followed by the separation of the evaporation residues (ERs) using the He-filled recoil separator SHANS at the HRIFL-Lanzhou facility. Measured α-α-correlated decay chains, Eα and $T_{1/2}$ for the decay of the g.s. of ^{222}U from a total of ten observed events. Deduced reduced α-decay width and hindrance factor in Rasmussen′s formalism.

Nuclear structure calculations:

2021Ch14: calculated equilibrium quadrupole deformations β_{20}, deformation energies using axial reflection-asymmetric Hartree-Fock-Bogoliubov theory with Skyrme energy-density functionals and density-dependent pairing force for multipole expansion of interaction energies in isospin and reflection-asymmetric deformations.

2021Gu26: calculated odd-even mass differences using deformed mean-field plus extended pairing model.

2021No02, 2021Ro02: calculated low-energy levels, J^π, B(E1), B(E2), B(E3), quadrupole and octupole deformation parameters using Hartree-Fock-Bogoliubov approximation, based on the Gogny-D1M energy density functional and corresponding mapped sdf-IBM.

2020Ca18: calculated deformation parameters β_2, β_3, octupole deformation energies, proton moments Q_{20} and Q_{30} using five Skyrme energy density functionals, and four covariant energy density functionals.

2017Xi15: calculated levels, J^π, B(E1), B(E2), B(E3), electric dipole moments, deformation energy surface in (β_3,β_3) plane using microscopic quadrupole-octupole collective Hamiltonian (QOCH) based on relativistic PC-PK1 energy density functional and δ-interaction pairing.

2016Ag06: calculated equilibrium β_2, β_3 deformation parameters for ground state using density functional models and ε_2, ε_3 parameters by mic-mac (MM) approach, potential energy surfaces in (β_2,β_3) plane using CEDF DD-PC1 theory, and covariant energy density functionals, with a nonlinear meson coupling, with density-dependent meson couplings, and pairing correlations within relativistic Hartree-Bogoliubov theory.

Theoretical calculations for α and cluster decays:

2022He18: calculated α-decay $T_{1/2}$, α-preformation factor using density-dependent cluster model with RMF NN interactions, M3Y NN interactions and universal decay law (UDL) formula.

2022Xu13: calculated α-decay $T_{1/2}$ using the Gamow model with a screened electrostatic barrier.

2021Sa52: calculated Q(2α), $T_{1/2}$ for 2α-decay with and without the deformation effects using used modified generalized liquid drop model, and Coulomb and proximity potential model with different preformation factors for double α decay.

2021Se10: calculated Q-values and $T_{1/2}$ for cluster decays, change in neutron-skin thickness, the isospin-asymmetry using self-consistent Hartree-Fock-Bogolyubov based on Skyrme-SLy4 effective nucleon-nucleon interaction.

2020Ni01, 2017Ni01: calculated α-branching ratios to vibrational states, α-decay $T_{1/2}$, partial half-lives for β^+/ε and α-decay

Adopted Levels (continued)

modes using multichannel cluster model (MCCM).
2018Se01: calculated driving potential vs cluster charge, $T_{1/2}$ for α-decay and for cluster decay, α and cluster Q values using Skyrme-SLy4 nucleon-nucleon interaction, within the frame work of the performed cluster model.
2017Sa39: calculated cluster decay $T_{1/2}$ using 12 different potentials.
Additional information 1.

^{222}U Levels

E(level)	J^π	$T_{1/2}$	Comments
0	0^+	4.6 μs *7*	%$\alpha\approx$100 Only the α decay has been observed. Decay mode of %$\alpha\approx$100 is based on theoretical half-lives of 17.4 μs for α decay and 17.5 s for β decay (2019Mo01). $T_{1/2}$: weighted average of 4.7 μs *7* (2015Kh09, fitting of the (ER)-α correlated decay curve for the 9310α peak from ^{222}U decay to a single exponential); and 4.0 μs *+19−10* (2023Lu04, ER-α correlated decay curve). Other: 1.0 μs *+12−4* (1983Hi12, from correlated 12.08 MeV and 7.16 MeV α peaks, the latter from ^{214}Ra decay; the 12.08 MeV composite peak was interpreted as the superposition of α peaks from decays of ^{222}U and ^{218}Th; the assignment of this α peak to ^{222}U was not that definite). Measured Eα=9.31 MeV *5* from the decay of ^{222}U to ^{218}Th (2015Kh09), 9246 keV *8* (2023Lu04). Evaluator′s note: the difference in the two values seems significant, however, it seems that the uncertainty of 8 keV in 2023Lu04 is underestimated, as this value was deduced from simply a spread of Eα values (without uncertainties) for only five events (#3, #4, #5, #6 and #9) in authors′ Table I.