

Adopted Levels

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	B. Singh, J. K. Tuli, E. Browne		NDS 170, 499 (2020)	8-Oct-2020

$Q(\beta^-)=3026$ 16; $S(n)=4234$ 13; $S(p)=9028$ 16; $Q(\alpha)=2547$ 16 [2017Wa10](#)

$S(2n)=10025$ 14, $S(2p)=16700$ 300 (syst) ([2017Wa10](#)).

[1990Me13](#), [1992Bo44](#): U(p,X),E=1 GeV, measured γ radiation, half-life by γ decay curve; deduced delayed-fission probability.

[Additional information 1](#).

[2018Ly01](#): radioactive beams of radium isotopes ($A=222-233$) produced by impinging 1.4-GeV protons onto a thick uranium carbide (UC_x) target at the ISOLDE-CERN facility. Radium atoms diffusing out of the target were ionized by a combination of surface ionization and multistep laser resonance ionization, using the resonance ionization laser ion source (RILIS), then accelerated to 30 keV and mass separated using the high resolution separator (HRS). Finally, the ions were cooled and bunched using the ISOLDE linear Paul trap ISOLDE cooler (ISCOOL), re-accelerated to 30 keV and directed to the Collinear Resonance Ionization Spectroscopy (CRIS) beam line. Measured low-resolution hyperfine-structure spectra of the $7s^2\ ^1S^0 \rightarrow 7s7p^3P_1$ atomic transition in ^{233}Ra , change in rms charge radii, and isotope shifts.

[2014Kr09](#): mass measurement by TOF-ICR resonances, and frequency ratios.

[2012Ch19](#) (also [2008ChZI](#) thesis): mass measurement by Schottky Mass Spectrometry technique.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for four references dealing with theoretical calculations about structure or decay half-lives.

 ^{233}Ra Levels

E(level)	J^π	$T_{1/2}$	Comments
0	(1/2 ⁺)	30 s 5	$\% \beta^- = 100$ $T_{1/2}$: from 1992Bo44 (also 1990Me13). J^π : systematics of odd-A $N=145$ nuclei suggest 1/2 ⁺ and $\nu 1/2[631]$ Nilsson assignment, as for ground states of ^{235}Th , ^{237}U , ^{239}Pu , ^{241}Cm and ^{243}Cf . 1/2 ⁺ proposed from systematics in 2017Au03 . Also 1/2 ⁺ from $\Omega(\text{neutron})=1/2^+$ in theoretical calculations (2019Mo01). Measured change in rms radius: $\delta \langle r^2 \rangle(^{214}\text{Ra}, ^{233}\text{Ra}) = +2.225 \text{ fm}^2$ 18(stat) 113(syst) (2018Ly01). Measured isotope shifts: $\delta \nu(^{214}\text{Ra}, ^{233}\text{Ra}) = -62300 \text{ MHz}$ 500; $\delta \nu(^{226}\text{Ra}, ^{233}\text{Ra}) = -20600 \text{ MHz}$ 500 (2018Ly01).