### Adopted Levels, Gammas

History									
Туре	Author	Citation	Literature Cutoff Date						
Full Evaluation	Balraj Singh	ENSDF	20-Jul-2015						

 $Q(\beta^{-})=9060 \ 40; \ S(n)=5628 \ 7; \ S(p)=12640 \ SY; \ Q(\alpha)=-862\times10^{1} \ 53 \ 2012Wa38$ 

Estimated uncertainty=200 for S(p) (2012Wa38).

 $Q(\beta^{-})n=4746 \ 10, \ S(2n)=9932 \ 11, \ S(2p)=28510 \ 300 \ (syst) \ (2012Wa38).$ 

1992Ay02: <sup>113</sup>Tc produced and identified in <sup>238</sup>U(p,F),E=20 MeV reaction followed by on-line isotopic separator at IGISOL facility in JYFL, measured half-life.

1999Wa09: measured  $T_{1/2}$  and  $\%\beta^-n$ , source from <sup>238</sup>U(p,F) at the IGISOL facility in JYFL. Earlier  $T_{1/2}$  measurement by 1998Ku17.

2009Pe06: <sup>113</sup>Tc formed by fragmentation of <sup>136</sup>Xe beam at 120 MeV/nucleon at NSCL-MSU facility using Coupled Cyclotrons and A1900 fragment separator. The time-of-flight and transversal positions of each particle was measured using two plastic scintillators. The  $\Delta E$  energy loss in a Si PIN detector was measured which, when combined with time-of-flight (tof) and transversal position measurements, allowed for an event-by-event identification of the transmitted nuclei. Transmitted nuclei and their  $\beta$  decays were measured using the  $\beta$  counting system consisting of four Si PIN detectors and a double-sided Si strip detector.  $\beta$ -delayed neutrons were measured in coincidence with  $\beta$ -decay precursor using neutron emission ratio observer (NERO) detector consisting of 60 proportional gas counter tubes embedded in polyethylene moderator matrix. The  $\gamma$  rays were measured with SeGA Ge detectors. Measured isotopic half-lives and delayed neutron emission probabilities Isotopic half-life was measured by 2009Pe06 from maximum likelihood method of time differences of implantations and correlated  $\beta$  decay events.

2015Lo04: <sup>113</sup>Tc nuclide produced at RIBF-RIKEN facility in <sup>9</sup>Be(<sup>238</sup>U,F) reaction at E=345 MeV/nucleon with an average intensity of  $6\times10^{10}$  ions/s. Identification of <sup>113</sup>Tc was made by determining atomic Z and mass-to-charge ratio A/Q, where Q=charge state of the ions. The selectivity of ions was based on magnetic rigidity, time-of-flight and energy loss. The separated nuclei were implanted at a rate of 50 ions/s in a stack of eight double-sided silicon-strip detector (WAS3ABi), surrounded by EURICA array of 84 HPGe detectors. Correlations were recorded between the implanted ions and  $\beta$  rays. The half-life of <sup>113</sup>Tc isotope was measured from the correlated ion- $\beta$  decay curves and maximum likelihood analysis technique as described in 2014Xu07. Comparison of measured half-lives with FRDM+QRPA, KTUY+GT2 and DF3+CQRPA theoretical calculations.

Mass measurement: 2011Ha48.

2013Fa05: theoretical calculation of  $T_{1/2}$  and  $\%\beta^-n$ .

#### <sup>113</sup>Tc Levels

#### Cross Reference (XREF) Flags

#### **A** <sup>113</sup>Tc IT decay (0.526 $\mu$ s)

E(level)	$\mathbf{J}^{\pi}$	T <sub>1/2</sub>	XREF	Comments
0.0	(5/2+)	152 ms 8	A	$\%\beta^{-}=100; \%\beta^{-}n=2.1 \ 3 \ (1999Wa09)$ J <sup><math>\pi</math></sup> : configuration= $\pi5/2[422]$ , oblate minimum from PES calculations (2010Br15). J <sup><math>\pi</math></sup> =5/2 <sup>+</sup> or >5/2 is also proposed by 2007Ku23 from $\beta$ feeding pattern and log <i>ft</i> values from <sup>113</sup> Tc decay to levels in the daughter nucleus <sup>113</sup> Ru.
				T <sub>1/2</sub> : measured by 2015Lo04 from (implanted ions)β correlated curves in time and position using maximum likelihood method. Others: 160 ms +50–40 (2009Pe06, MLH analysis of ion-β correlated decay curve, systematic uncertainty=5 ms, statistical uncertainty= $^{50-40 \text{ ms}}$ ); 170 ms 20 (1999Wa09, earlier measured values of 110 ms 30 by 1998Ku17 and 130 ms 50 by 1992Ay02). See 2015Lo04 for comparison of their experimental value with theoretical values.
114.4 5	(5/2 <sup>-</sup> )	0.526 μs +16–15	A	$J^{\pi}$ : proposed by 2010Br15 from PES calculations, which show a deep triaxial minimum at $\beta_2=0.29$ , $\beta_4=-0.02$ , $\gamma=29.8^{\circ}$ with $J^{\pi}=5/2^{-}$ . Also E1 hindrance factors are consistent with systematics (2010Br05). T <sub>1/2</sub> : from $\gamma$ (t) (2012Ka36). Other: 0.50 $\mu$ s 10 (2010Br15).

## Adopted Levels, Gammas (continued)

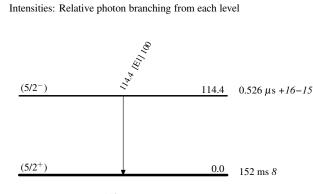
# $\gamma(^{113}\text{Tc})$

E <sub>i</sub> (level)	$\mathbf{J}_i^{\pi}$	Eγ	$I_{\gamma}$	$E_f  J_f^{\pi}$	Mult.	$\alpha^{\dagger}$	Comments
114.4	(5/2-)	114.4 5	100	0.0 (5/2+)	[E1]	0.091	$B(E1)(W.u.) = 3.37 \times 10^{-7} + 11 - 12$

<sup>†</sup> Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on  $\gamma$ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

### **Adopted Levels, Gammas**

Level Scheme



<sup>113</sup><sub>43</sub>Tc<sub>70</sub>