

Neutron capture on the s-process branching point ^{171}Tm via time-of-flight and activation

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Resonance parameters of ^{171}Tm from the n_TOF experiment

Each of the 28 resonances from ^{171}Tm observed in the experimental capture yield at n_TOF has been analysed and parameterized using the Bayesian R -matrix analysis code SAMMY. Based on the statistical properties of the resonance, all of those observed in this experiment have been considered s -waves, with the spin assigned according to the quality of the corresponding SAMMY fits. The set of resonance parameters obtained from the iterative SAMMY analysis consists of the energy, spin, capture (Γ_γ) and neutron (Γ_n) widths together with their correlation. The radiative width of each resonance has been studied individually, but for those for which the value was not accurately determined by the fit, the average value from the rest, 78(4) meV, has been considered. The table includes as well the resonance radiative kernels (RK) (with the uncertainty propagated from that of Γ_γ and Γ_n and their correlation) and the uncertainty (Δ_{stat}) associated to the statistics accumulated in each resonance. The latter indicates the actual accuracy limit that can be reached for the radiative kernel of each individual resonance, varying between a few percent at low energies and several tens of percent above 500 eV.

Resonance's energy, spin (J), capture width (Γ_γ), neutron width (Γ_n), correlation ($\rho_{\Gamma_\gamma\Gamma_n}$), radiative kernel (RK) and statistical uncertainty (Δ_{stat}) of the 28 ^{171}Tm resonances observed at n_TOF and analysed with SAMMY.

E_n (eV)	J	Γ_γ (meV)	Γ_n (meV)	$\rho_{\Gamma_\gamma\Gamma_n}$ (%)	RK (meV)	Δ_{stat}
4,952(2)	0	73(4)	1,15(3)	61	0,283(7)	2.2%
24,534(3)	0	80(9)	123(5)	-	12,09(18)	1.1%
62,78(3)	0	80(9)	7,0(9)	-	1,61(18)	12%
82,198(13)	0	86(13)	86(13)	-79	10,8(5)	5%
97,210(23)	1	76(27)	8(1)	-18	5,14(28)	8%
106,723(8)	1	80(9)	126(8)	-	36,6(9)	3%
131,34(3)	0	80(9)	74(10)	-	9,6(7)	9%
151,921(17)	1	80(9)	53(3)	-	23,7(9)	5%
181,39(5)	0	80(9)	63(10)	-	8,8(8)	13%
218,59(6)	0	94(11)	322(96)	1	18,1(2,1)	10%
224,074(24)	1	104(16)	105(16)	-72	39,2(2,2)	6%
244,29(4)	1	80(9)	165(27)	-	40,3(2,2)	9%
244,84(9)	1	80(9)	34(5)	-	18,0(1,9)	9%
249,13(7)	1	80(9)	19(3)	-	11,5(1,2)	14%
291,58(11)	0	80(9)	88(28)	-	10,5(1,6)	19%
361,53(6)	1	98(13)	181(62)	-56	48(6)	11%
395,00(9)	1	80(9)	62(13)	-	26(3)	18%
401,35(19)	0	80(9)	133(60)	-	12,5(2,1)	32%
455,76(14)	1	80(9)	47(11)	-	22(3)	24%
497,72(10)	1	80(9)	181(57)	-	41(4)	15%
547,92(13)	1	80(9)	134(44)	-	37(5)	22%
554,82(13)	1	80(9)	297(129)	-	47(4)	18%
597,85(23)	1	80(9)	46(15)	-	22(4)	38%
617,2(3)	1	80(9)	30(13)	-	16(5)	51%
636,2(3)	1	80(9)	32(13)	-	17(5)	59%
641,60(18)	1	80(9)	90(28)	-	32(5)	26%
684,12(19)	1	80(9)	351(162)	-	49(4)	22%
705,19(19)	1	80(9)	124(42)	-	36(5)	27%

Comparison of the MACS values

In the manuscript the MACS values obtained in this work by the activation and time-of-flight techniques are compared to previously reported data. The detailed values displayed in Fig. 5 are summarized in the following table.

Comparison of the MACS values at 30 keV from this work, previous measurements and calculations. The two values reported from this work correspond to the more accurate activation experiment at LiLiT, and the less accurate FITACS calculation using the n_TOF average resonance parameters as input.

Type	$\langle\sigma\rangle_{30\text{keV}}$ (b)	Difference with respect to this work (LiLiT)	
		%	# of σ
This work (LiLiT)	Activation	384(40)	
This work (n_TOF)	ToF+FITACS ^a	570(220)	+48% 0.85
KADoNiS ^b	Activation ^b	228(20)	-41% 8
[Bao:2000]	Systematics	486(144)	+27% 0.7
[Mughabghab:2018]	Systematics	320(30)	-17% 2.1
TENDL-2012 ^c	Model	970	+153% -
TENDL-2015 ^d	Model	1010	+163% -
TENDL-2017	Model	520	+35% -

^aUsing $S_1=2\cdot 10^{-4}$ and $\langle\Gamma_{\gamma 1}\rangle=\langle\Gamma_{\gamma 0}\rangle$ in addition to the n_TOF s -wave parameter.

^bActivation value from [Reifarth:2003b] renormalized and extrapolated to 30 keV.

^cAdopted in the JEFF-3.2 and ENDF/B-VIII evaluations.

^dAdopted in the JEFF-3.3 evaluations.