**THE HALF-LIFE OF 229*m*Th ISOMERS IN ACID SOLUTION**

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The 229*m*Th isomeric state with an energy of about 8 eV is formed in 2% of the cases of 233U α-decay (see ref. [1] and references therein). For neutral 229*m*Th atoms, the main decay channel is nonradiative – it is either electronic conversion or decay via an electronic bridge. An estimate of the probability of a decay with photon emission γTh gives a half-life *T*1/2 ≈ 2 h and is much smaller than the probability of a nonradiative transition. Photons can only be observed for 229*m*Th ions when the nonradiative channel is closed.

Here we give a detailed analysis of work [2], where γTh photons were observed for 4+ ions of 229*m*Th in HCl acid solution obtained in an ion exchange column from 0.1 g U (the relative α-activities of 233U and 232U were 99.8% and 0.02%, respectively). In each of several experiments four samples were sequentially prepared with 229*m*Th in 7*M* HCl aqueous solution by eluting once an hour fresh Th from U, which was previously purified from Th and its daughters. Sources for
α-spectrometry were prepared from the second and third samples; for each of them the α-activity of Th daughters increased with time. Thus, the α-activity of the samples could not lead to their damped photon emission.

The first and fourth liquid samples of 229*m*Th were placed into thin-layer quartz cuvettes, and *t* = 60 min after Th elution, the photon counting intensity *N(t)* from the samples was measured by a photomultiplier with a Sb-Na-K-CS photocathode, the photo efficiency was about 1% in the wavelength range of 300 – 800 nm. The time dependence of *N(t)* averaged over all experiments was approximated as , where *A* = 9 ± 3, *T*1 = 22 ± 3 min, *T*2 = 290 ± 50 min (errors are one standard deviation). *N*0 was proportional to the α-activity of 229Th in the samples with an accuracy of 20% and did not correlate with their total α-activity. It can be assumed that for the 229*m*Th isomer in an HCl solution, *T*1/2 is in the range of 20 – 400 min. To refine *T*1/2 and the isomeric transition energy, it is necessary to study the photon spectrum of such samples.

1. *B.S. Nickerson, M. Pimon, P.V. Bilous et al.//* PRA. **103**, 053120 (2021).
2. *V.V. Koltsov, T.E. Kuzmina, D.N. Suglobov*. Half-life measurement of the 229Th isomer. Proc. Int. Conf. on Nucl, Phys., Moscow, June 16–19, P. 266 (1999).