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CONFIRMATION OF A NEW ISOMERIC STATE IN THE 186Re NUCLEUS

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In laser plasma, stimulated de-excitation of the 186mRe isomer (T1/2, $m = 2.0 \cdot 105$ y) was observed from the time dependence of the intensity I137 of 137 keV gammas from the decay of the ground state of the 186Re nucleus after laser irradiation of the 186mRe target [1]. The nonmonotonicity of this time dependence made it possible to assume the existence in the 186Re nucleus of a new low-lying isomeric level with a half-life of 10 d order, which is populated upon de-excitation of 186mRe in the laser plasma.

In ref. [2], we tried to observe this new isomer by obtaining the 186Re nuclei in the (p, n) reaction irradiating 186W target with 15 MeV protons. Population in this reaction of a new isomer for γ -quanta from an irradiated source would lead to the dependence of the intensity I137 (t) on the time t after the formation of 186Re nuclei, which differs from the simple exponential dependence associated with the decay of the ground state of 186Re with a period of T1/2, g = 89.239\pm0.026 h [3] (error is at the level of one standard deviation). In ref. [2], the measurement of I137 (t) was started at small t and at the beginning there was no noticeable deviation of the decay curve from a simple exponential with T1/2, g. However, at t > 30 d at a low intensity of I137, a hint of a deviation of the decay curve from a net exponent appeared. This deviation could be associated with the formation of a new isomer. The known isomer with T1/2, m = 2.0.105 y cannot be observed in such experiments due to its very low radioactivity.

In this work, the source with 186Re was prepared according to the method [2], to reduce the relative activity of the ground state of the 186Re nucleus, we waited 30 d and only then began to measure I137 (t) of the irradiated source in the well of the HPGe

 γ -detector at the initial intensity I137 \approx 50 s –1. Due to the later start of measurements, it was possible to measure the I137 (t) dependence at much longer times t than in ref. [2]. This dependence unambiguously indicates the presence of a new long-lived isomeric level in the 186Re nucleus. At t = 60 d, the I137 (t) dependence corresponds to a half-life of 24 ± 0.4 d.

References:

1. V.V. Vatulin, N.V. Zhidkov, A.A. Rimskii-Korsakov, V.V. Karasev, V.V. Koltsov, A.I. Kostylev, G.V. Tachaev, Bull. Russ. Acad. Sci.: Phys. 81, 1159 (2017).

V. V. Karasev, V. V. Koltsov, A. A. Rimskii-Korsakov, Bull. Russ. Acad. Sci: Phys. 82, 1237 (2018).
C.L. Baglin, NDS 99, 1 (2003).

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