Contribution ID: **117** Type: **Oral report**

ON THE POSSIBILITY OF OBSERVING THE STIMULATED DE-EXCITATION OF THE NUCLEAR ISOMER 186mRe IN THE PLASMA OF Z-PINCH AT THE ANGARA-5-1 FACILITY

Monday, 20 September 2021 17:15 (25 minutes)

In ref. [1] a laser plasma with an electron temperature Θe ˜ 1 keV, a lifetime of about 0.3 ns and a mass of ˜ 1 μg was obtained from metallic rhenium containing isomeric nuclei of the 186mRe (T1/2, m = 2·105 y). In such a plasma, there was observed stimulated de-excitation of isomeric 186mRe nuclei with a probability Pstim ˜ 10 –7, which was determined after a laser shot by the degree of disequilibrium between the decay of the isomers and the 186Re nuclei in the ground state (T1/2, g = 91 h).
The probability Pstim is proportional to the plasma lifetime, and to enhance the effect, it was proposed in ref. [2] to use instead of laser plasma an electric discharge plasma with the 186mRe isomeric nuclei, the lifetime of which increases up to ˜ 10 ns while maintaining the temperature Θe ˜ 1 keV. Such a plasma can be obtained in high-current Z-pinches at the Angara-5-1 facility at the JSC TRINITY. The plasma is formed during the implosion of a two-cascade cylindrical multi-wire assembly (liner) when a current pulse of ˜ 4 MA passes through it, with a voltage of 1 MV and a duration of ˜ 100 ns [3]. The outer cascade with a diameter of 12 mm with mass of ˜ 300 μg/cm per unit liner length is composed of aluminum wires, the inner cascade with a diameter of 6 mm and a linear mass of ˜ 20 μg/cm is composed of tungsten wires with a diameter of 6 μm. The material of the pinch plasma is mainly deposited at the ends of the discharge gap 16 mm long, from where a sample can be taken to determine the probability Pstim according to the method of ref. [1]. For the experiments, a technique was developed for introducing the 186mRe isomer into the liner by electrodeposition of a rhenium layer about 0.5 μm thick onto tungsten wires. The mass of rhenium in the liner will be ˜ 10 μg. Thus, in the plasma of the Angara-5-1 facility, the amount of the 186mRe isomer can be an order of magnitude higher than in the laser plasma of the experiment [1], and the probability Pstim can be two orders of magnitude higher. All this shows that the proposed experiments at Angara-5-1 facility are promising.

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Session Classification: Section 6. Plasma physics and thermonuclear fusion.

Track Classification: Section 6. Plasma physics and thermonuclear fusion.