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Production of heavy neutron-rich nuclei with the magic number N=126 in the multinucleon transfer reactions induced by radioactive beams

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The report is devoted to the theoretical study of the problem of producing heavy neutron-rich nuclei with a closed neutron shell N=126. Data on the lifetime of such new nuclei, as well as mass, decay modes, excited levels, etc., are of great value for testing and developing theoretical models of atomic nuclei. Also, these nuclei form one of the special waiting points in the r-process path, and hence their properties are of great importance in understanding the detailed scenario of the r-process of astrophysical nucleosynthesis.
Typically, nuclei from this region are obtained in fragmentation reactions of high-energy heavy projectiles on light targets. Currently, the possibility of studying new isotopes in this area using multinucleon transfer (MNT) reactions is widely discussed. One of the most optimal combinations of colliding nuclei, in which multinucleon transfers lead to the formation of heavy neutron-enriched nuclei with high probability, is ^{136}Xe + ^{198}Pt. The calculations performed within the framework of the dynamic model based on Langevin equations describe quite well the available experimental data for this reaction [1,2,3].
In this work, one of the possible extensions of this method is studied: the use of neutron-rich radioactive ion beams (RIBs) in MNT reactions [4]. On the one hand, this leads to an increase in the probability of formation of heavy nuclei with a neutron excess, but on the other hand, lower RIB intensities reduce the final yield of reaction products. In this work, we present the theoretical analysis of the yields of heavy neutron-rich isotopes with the magic number N=126 obtained in the ^{132}Sn, ^{136,138,140}Xe + ^{198}Pt MNT reactions.
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