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Multinucleon transfer reactions in the ^{238}U + ^{238}U system studied with the VAMOS + AGATA + ID-Fix

A. Utepov

GANIL, Caen, France

Since the middle of the last century many efforts have been devoted to investigate the region of heaviest nuclei. Various models predict an existence of the island of stability of superheavy nuclei (SHN) with shell closure at a proton number between 114 and 126 and at a neutron number 172 or 184 [1]. However, the discovery of these nuclei is an experimental challenge. Also, the region of neutron-rich light actinides (uranium region) in the vicinity of the N = 152 deformed shell gap, where important nuclear structure features are expected, is beyond reach. The fusion-evaporation reaction, being so far successful in synthesis of SHN, faces significant limitations caused by low production cross sections and the lack of sufficiently neutron-rich projectile-target combinations. An alternative way to approach this region has been proposed via the employment of multinucleon transfer (MNT) reactions for which rather high cross sections were predicted in near-barrier deep-inelastic collisions of heavy ions [2,3]. Experimentally, the production of neutron-rich actinide nuclei up to Fm was observed via chemical separation techniques in cross section values ranging from mbarn to nbarn [4]. Within this context, an experiment aiming to investigate the MNT cross sections of exotic neutron-rich light actinides in the reaction of ^{238}U+^{238}U was carried out at GANIL in May 2021. The measurement was performed employing the VAMOS++ magnetic spectrometer for the atomic mass identification, the AGATA γ -ray spectrometer and the x-ray detection array ID-Fix for the identification of the atomic number through x-ray spectroscopy. In the talk, I will focus on the work done for preparation of the detection setup, in terms of absorber studies for a photon background from the ^{238}U+^{238}U reaction and optimization of the digital pulse processing for an efficient X-ray spectroscopy, and will report on preliminary results on the ^{238}U+^{238}U experiment.

References

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