

Results of the first experiments at the ACCULINNA-2 separator and the scientific programme for 2024

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First experiments with high intensity ^8He ($I \sim 10^5$ pps), ^9Li and ^6He (both with $I \sim 10^6$ pps) radioactive beams obtained at the new fragment separator ACCULINNA-2 [1] at the U-400M cyclotron were carried out in 2018-2020. As a result, new information regarding the spectra of energy excitation and decay schemes of the neutron rich isotopes ^{5-7}H , $^{7,9}\text{He}$, ^{8-10}Li [2-8] were obtained. One of the interesting and still open question is the population of $4n$ system as a resonant state in the $^2\text{H}(^8\text{He}, ^6\text{Li})4n$ reaction which indication was found in the experimental data of the ^8He (26 AMeV) beam interacting with the ^2H target initially intended for population of ^7H [9]. In this work, we report observation of events at ~ 3.5 MeV in the energy spectrum of $4n$, consistent with the near-threshold bump observed in [10]. Results obtained from the analysis of these experimental data will be reported.

The upcoming work plan at the ACCULINNA-2 fragment separator following the U400M cyclotron upgrade in 2024 will be presented. Utilizing a ^6He beam directed at the ^2H target, the study aims to explore the transfer of neutron, protons, and alpha particle in reactions using combination of the ^8He beam with deuterium gaseous targets. First of all, the $^2\text{H}(^6\text{He}, 2n)^6\text{Li}$ reaction, along with the potential $^2\text{H}(^6\text{He}, ^6\text{Li})2n$ charge-exchange, is considered as a test for the reaction mechanism and the experimental setup. Furthermore, this reaction will provide a foundation for a precise study of the $4n$ system in reaction $^2\text{H}(^8\text{He}, ^6\text{Li})4n$. Besides, the combination $^6\text{He}+^2\text{H}$ makes it possible to study a number of other reactions, particularly $^2\text{H}(^6\text{He}, ^7\text{He})^1\text{H}$, $^2\text{H}(^6\text{He}, ^5\text{He})^3\text{H}$, $^2\text{H}(^6\text{He}, ^5\text{H})^3\text{He}$. Moreover, objects of the first experiments are $2n/4n$ transfer in the reactions $^4\text{He}(^8\text{He}, ^6\text{He})^6\text{He}$, $^4\text{He}(^6\text{He}, ^6\text{He})^4\text{He}$, $^4\text{He}(^8\text{He}, ^4\text{He})^8\text{He}$. An important role in new experiments is a new neutron detection system improving neutron detection efficiency by the factor of 10.

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