STUDY OF STRUCTURE OF NEUTRON HALO USING NEUTRON TRANSFER REACTION

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To estimate the probability of two-neutron configuration in Borromean nuclei, we propose an experimental method of studying neutron-neutron correlations at periphery of such nuclei by measuring two-neutron transfer reaction. The experimental study of $^{6}He+A \rightarrow {}^{4}He+B$ reaction for various targets is performed using radioactive nuclear beams of Flerov Laboratory of Nuclear Reactions (JINR, Dubna) at energy of about 15 MeV/u. The theoretical analysis shows that simultaneous registration of recoil nucleus B and ^{4}He(^{9}Li)-nucleus allows one to obtain information on relative momentum distribution of two halo neutrons in the region of small values of the momentum.

Secondary particles ^{4}He(^{9}Li) and B-nuclei are detected by the technique of nuclear photoemulsions (NPE). Thus, the nuclei of photoemulsion (^{1}H, ^{12}C, ^{14}N, $^{79,81}Br$, $^{107,109}Ag$) are used as target nuclei. One of the important problems is a separation of the events caused by two-neutron transfer from those of one-neutron transfer. The simulation performed shows that these reactions can be separated by the difference in their kinematics (different Q-values, presence of neutron in the case of one-neutron transfer) studying the energy and angular dependencies of emission of secondary ^{4}He(^{9}Li) nuclei.

Search of events of transfer reaction and further processing was performed using automated measuring setup PAVIKOM at P.N. Lebedev Physical Institute. In this setup the images of consecutive (with step of several μm) NPE layers using special camcorder and interface were obtained and transferred to computer. At further processing of these images, we select darkening areas (globes) with darkening degree, shape, and size inherent for tracks of given charged particle ($^{4,6}He$). Coordinates (x, y) of centers of mass of all globes in each layer (z-coordinate) are determined and stored. Then, particle trajectories $X_i(z)$ and $Y_i(z)$ are determined by center-of-mass coordinates in consecutive layers of NPE.

Further the trajectories obtained are processed to determine their parameters. The characteristic trajectory corresponding to the given reaction must consist of: trajectory of primary particle (^{6}He), bend of trajectory corresponding to the interaction point, trajectory of secondary particle emitting from interaction point (^{4}He), and presence or absence of recoil nucleus trajectory in the case of light (^{1}H, ^{12}C, ^{14}N, ^{16}O) or heavy ($^{79,81}Br$, $^{107,109}Ag$) target nucleus, respectively. Trajectories before and after interaction are approximated by straight lines, but at the interaction point the direction of trajectory (first derivative of trajectory) changes. Therefore, z-coordinate of this point is determined by the position of extremum in the dependence of second derivative of trajectory in respect to z. For trajectories having a bend, the program determines coordinates (x,y,z) of the interaction point, angle of emission of secondary particle, range (energy) of the primary particle at the interaction point, and range (energy) of the secondary particle. Thus, all data needed to obtain angular distribution of the reaction studied are determined.