

Study of multinucleon transfers in reactions with ^{48}Ca ions on Au, U targets at an energy of 280 MeV

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Recently, there has been increased interest in experimental studies on the production of new isotopes in multinucleon transfer reactions [1,2]. Reactions on ^{48}Ca ion beams are successfully used for the synthesis of new nuclei in a wide range of masses and charges. In particular, it is of interest to obtain new isotopes with the number of neutrons $N = 126$ in the reaction channels of multinucleon transfers [3]. To estimate the cross sections for the formation of nuclei in these reactions, we conducted an experiment on their detection. In the experiment, nuclei with masses greater than the target mass values were measured.

The experiment was carried out on a ^{48}Ca (5,8 MeV/nucleon) ion beam using ^{197}Au (6 μm thick) and ^{238}U (1 μm thick) targets. Specially prepared targets were irradiated on a beam of accelerated ions, on a cyclotron U-400 at the FLNR JINR. The activation method was used to identify the nuclei formed in the reactions. Measurement of induced activity (gamma and alpha) was carried out in the "off-line" mode.

In the reaction of $^{48}\text{Ca}+\text{Au}$, neutron pickup channels for $1n$ and $3n$ were measured. The cross sections of these channels were $\sigma(+1n) \sim 150$ mb and $\sigma(+3n) \sim 0.5$ mb, respectively. The GRAZING [4] code used to analyze the obtained values gives a good agreement with the experimental results.

In the $^{48}\text{Ca}+\text{Au}$ reaction induced alpha activity of ^{206}Po nuclei was observed, which corresponds to the transmission channel ($+5p+9n$) from the projectile nucleus to the target nucleus.

The $^{48}\text{Ca}+\text{U}$ reaction products were measured using an alpha spectrometer. Among the products, the nuclei ^{228}Th , ^{239}Am , ^{255}Fm were identified by the measured half-lives and characteristic energies of alpha particles. These products correspond to the following channels $^{238}\text{U}(-2p-8n) \rightarrow ^{228}\text{Th}$, $^{238}\text{U}(+3p-2n) \rightarrow ^{239}\text{Am}$, $^{238}\text{U}(+8p+9n) \rightarrow ^{255}\text{Fm}$. The value of the section of these channels $\sigma(^{228}\text{Th}) \sim 55$ μb , $\sigma(^{239}\text{Am}) \sim 1.2$ μb , $\sigma(^{255}\text{Fm}) \sim 2.2$ μb .

Thus, the cross section data show that such reactions are suitable for obtaining nuclei of multinucleon transfers. Further analysis of the obtained data is underway.

The speaker is a student or young scientist

Yes

Section

1. Experimental and theoretical studies of nuclear reactions

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