

CHARGE-EXCHANGE REACTIONS ON LOW-ENERGY BEAMS OF HEAVY IONS

Skobelev N.K.

Joint Institute for Nuclear Research, Dubna, Russia

E-mail: skobelev@jinr.ru

Quasi-elastic charge-exchange nuclear reactions are of great interest, when the ejected particle in mass and other characteristics (including energy) differs little from the incident one, but has a different ratio of protons and neutrons.

Reactions of quasi-elastic scattering of neutrons and protons on nuclei often lead to charge exchange as well as to the excitation of isobar-analog states. In addition to the (p, n) reaction, these states can be excited in other charge-exchange reactions, for example, in the $({}^3\text{He}, t)$ reaction. This reaction has a certain advantage over the (p, n) reaction. First, it is easier to identify charged particles (t) than neutrons in the (p, n) reaction. Second, in the $({}^3\text{He}, t)$ reaction and in other charge-exchange reactions with heavy ions, multistage processes play a much smaller role; therefore, the extracted information on the properties of nuclear interaction is more reliable. The cross sections for such reaction channels reach significant values even when the energy of bombarding particles is close to the Coulomb barrier for the reactions on ${}^{45}\text{Sc}$ and ${}^{197}\text{Au}$ [1, 2]. Charge-exchange reactions on beams of heavy ions are also observed at higher energies of bombarding particles. For example, in the reactions on beams of the ${}^{18}\text{O}$ heavy ions with ${}^9\text{Be}$ [3] and ${}^{181}\text{Ta}$, charge-exchange channels (${}^{18}\text{O}, {}^{18}\text{F}$), (${}^{18}\text{O}, {}^{18}\text{N}$), as well as (${}^{18}\text{O}, {}^{18}\text{C}$) were registered at ${}^{18}\text{O}$ energy from 10 to 35 MeV/A.

Charge-exchange reactions on heavy-ion beams are interesting for the study of particle-hole states in a wide range of nuclei; from them, reliable information on the properties of excited isobar-analog states is extracted, and therefore – the model representations of the isobar-spin potential and isovector nucleon-nucleus interaction.

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