

# NUCLEON TRANSFER PROCESSES IN LOW-ENERGY REACTIONS WITH HELIUM ISOTOPES

Thursday, 14 July 2022 12:30 (30 minutes)

Experimental cross sections for formation of isotopes  $^{44,46}\text{Sc}$  and  $^{45}\text{Ti}$  in reactions  $^{3,4,6}\text{He} + ^{45}\text{Sc}$ ,  $^{196,198}\text{Au}$  in reactions  $^{3,4,6,8}\text{He} + ^{197}\text{Au}$ , and  $^{194}\text{Au}$  in reaction  $^3\text{He} + ^{194}\text{Pt}$  have been analyzed. To calculate nucleon transfer probabilities and cross sections, the time-dependent Schrödinger equation for nucleons of  $^{3,4,6}\text{He}$ ,  $^{45}\text{Sc}$ ,  $^{197}\text{Au}$ , and  $^{194}\text{Pt}$  has been solved numerically with a special choice of the shell model mean field for  $^{3,4,6,8}\text{He}$  nuclei [1] (Fig. 1). Fusion-evaporation channels were taken into account using the code of the NRV web knowledge base [2]. It was shown that the contribution of fusion-evaporation to the experimental data is significant for reactions  $^{3,4,6}\text{He} + ^{45}\text{Sc}$ , whereas in the case of reactions  $^{3,4,6,8}\text{He} + ^{197}\text{Au}$  and  $^3\text{He} + ^{194}\text{Pt}$ , it is negligible. The results of calculation (Fig. 2) are in good agreement with experimental data [3, 4].

Fig. 1. Examples of time evolution of the probability density for the neutron of  $^3\text{He}$  in the collision  $^3\text{He} + ^{197}\text{Au}$  at  $E_{c.m.} = 20$  MeV and impact parameter  $b = 1$  fm. The course of time corresponds to panel locations (a), (b), (c), (d).

Fig. 2. Cross sections for formation of the isotope  $^{198}\text{Au}$  in the reaction  $^3\text{He} + ^{197}\text{Au}$ : experimental data [2] (filled squares) and [3] (empty squares) along with the results of calculations. The arrow indicates the position of the Coulomb barrier.

1. M.A. Naumenko, V.V. Samarin, Yu.E. Penionzhkevich, and N.K. Skobelev, Bull. Russ. Acad. Sci.: Phys. 81, 710 (2017).
2. NRV web knowledge base on low-energy nuclear physics, <http://nrv.jinr.ru/nrv/>.
3. N.K. Skobelev, Yu.E. Penionzhkevich, E.I. Voskoboinik et al., Phys. Part. Nucl. Lett. 11, 114 (2014).
4. Y. Nagame, K. Sueki, S. Baba, and H. Nakahara, Phys. Rev. C 41, 889 (1990).

## The speaker is a student or young scientist

No

## Section

1. Experimental and theoretical studies of nuclear reactions

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