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Cluster-transfer reactions with radioactive 98Rb and 98Sr beams on a 7Li target

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We report on an exploratory experiment performed with MINIBALL coupled to T-REX [1-2] at ISOLDE, to investigate neutron rich Sr and Y nuclei around mass A = 100, by cluster transfer reactions of neutron rich 98Rb/98Sr beams on a 7Li target. The aim of the experiment was on one hand to perform a γ-spectroscopy study by transfer reactions of neutron-rich Sr and Y nuclei beyond N=60 populated, so far, only via β-decay and spontaneous fission experiments [3]. On the other hand, we wanted to investigate the reaction mechanism exploiting weakly-bound nuclei in inverse kinematics by using radioactive beams.
It has been shown that multi-nucleon transfer reactions represent a powerful tool to study neutron-rich nuclei and, in particular, cluster-transfer reaction can be used to populate exotic nuclei at medium-high spin and excitation energy [4]. 7Li is especially suitable for this purpose, since it has a pronounced cluster structure with an α and t as components. Owing to a separation energy of 2.5 MeV, it easily breaks up and one of the two fragments has a sizeable probability to be captured. In this work, for the first time, the combination of a radioactive beam with cluster transfer reactions is presented. This technique may turn out to be very useful in future and the present test experiment is meant as a first step of a research program aimed at spectroscopy studies of the low-lying structures of neutron-rich nuclei produced employing cluster-transfer reactions.
In the experiment, a 98Rb beam, and a strong component of its β-daughter 98Sr, were accelerated at 2.85 MeV/A on a 1.5 mg/cm2 thick LiF target with an average intensity of 2x10^4 pps. The MINIBALL/T-REX [1-2] set-up allowed to detect the complementary charged particle emitted in coincidence with the γ-cascade of the excited system, giving a very clean trigger on the final populated residues. γ -rays have been detected after two or three evaporated neutrons and levels with spin up to 6 ħ have been observed. The reaction mechanism has been investigated by studying the cross section for both t and α transfer. Experimental results have been compared with theoretical calculations, performed by the FRESCO code [5], considering a one-step DWBA transfer of a cluster-like particle, showing that the model can predict with qualitative agreement the dynamics of the reaction and suggesting a proper description of the direct nature of the process.
In conclusion, the present study shows that cluster transfer reactions can be consider as a valuable tool to study nuclear structure far from stability, encouraging their future application with new radioactive beam facilities of higher energy and intensity and with different weakly-bound target-nuclei.

[1] N. Warr et al., EPJ, A(2013)49.
[2] V. Bildstein et al., EPJ, A48(2012)85.
[3] F. K. Wohn et al., PRL, 51(1983)873.
[4] G. D. Darcoulis et al., JPG: Nucl.Part. Phys.23(1997)1191.
[5] I. J. Thompson, Comp. Phys. Rep., 7(1988)167.

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