Contribution ID: **24** Type: **Submitted**

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

Wednesday, 27 November 2013 15:00 (20 minutes)

We report on an exploratory experiment performed with MINIBALL coupled to T-REX [1-2], 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 gamma-spectroscopy study by transfer reactions of
neutron-rich Sr and Y nuclei beyond N=60 populated, so far, only via beta-decay and spontaneous fission experiments[3]. On the other hand we wanted to acquire experience in using cluster transfer reactions with the weakly bound 7Li target, in order to perform, at a later stage with HIE-ISOLDE, similar measurements induced by neutron-rich
radioactive beams of Sn and Hg, for which at least 5 MeV/nucleon are needed to overcome the Coulomb barrier. The present experiment is therefore meant as a first step of a research program aiming at
gamma-spectroscopy studies of the low-lying structures in Sb and Tl isotopes located close to 132Sn and 208Pb, respectively.
In the experiment, a 98Rb beam, and a strong component of its beta-daughter 98Sr, were accelerated at 2.85 MeV/A on a 1.5 mg/cm2 thick LiF target. The experiment lasted 3 days, with an average beam current of 2· 10ˆ4 pps. 7Li nuclei are particularly suited to study cluster transfer reactions since they can be described as an alpha and a t cluster that easily break up due to a small binding energy of 2.5 MeV, with a sizeable probability of one of the two fragments to
be captured [4]. The MINIBALL/T-REX [1-2] set-up allowed to detect the complementary charged particle emitted in coincidence with the
gamma-cascade of the excited system created by the transfer, giving a very clean trigger on the final populated residues.
gamma-rays have been detected after two or three evaporated neutrons and levels with spin up to 6 hbar have been observed. The reaction mechanism has been investigated by studying the cross section for both t and alpha transfer as a function of the excitation energy of the final nucleus and of the scattering angle. The experimental results have been compared with theoretical calculations, performed by the FRESCO code [5], considering a DWBA transfer of a cluster-like particle in 7Li to the continuum, showing that the model can predict with qualitative agreement the excitation energy distribution of the final products. Furthermore, the calculated angular distributions can reproduce the ratio between t and alpha cross sections measured experimentally, 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 heavier neutron-rich HIE-ISOLDE beams.

[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

Primary authors: Dr FORNAL, BOGDAN (INSTITUTE OF NUCLEAR PHYSICS PAN); Prof. RAABE, Riccardo (KU Leuven); Dr BOTTONI, Simone (Università degli Studi e INFN Milano (IT) & KU Leuven (B)); Prof. LEONI, silvia (Università degli Studi e INFN Milano (IT))

Co-authors: Dr MORALES LÓPEZ, Anabel (Università degli studi e INFN Milano); BRACCO, Angela (Università di Milano e INFN); PIOTR, Bednarczyk (IFJ PAN Krakow); JAKE, Bouma (KU Leuven); MARTEN, Callens (KU Leuven); NATALIA, Cieplika (IFJ PAN Krakow); Dr FABIO, Crespi (Università di Milano); Mr MÜCHER, Dennis (Institut for nuclear physics, UNiversity of Cologne); BALABANSKI, Dimiter (INRNE, Bulgarian Academy of Sciences); RAPISARDA, Elisa (CERN); FLAVIGNY, Freddy (Katholieke Universiteit Leuven (BE)); GEORGIEV, Georgi (CSNSM Centre de Spectrometrie Nucle aire et de Spectrometrie de); ELSEVIERS, Jytte (Katholieke Universiteit Leuven (BE)); WOJCIECH, Krolas (IFJ PAN Krakow); Dr KOWALSKA, Magdalena (CERN); ADAM, Maj (IFJ

PAN Krakow); SEIDLITZ, Michael (Universitaet zu Koeln (DE)); Prof. REITER, Peter (University Cologne, Nuclear Physics Institut); ORLANDI, Riccardo (Katholieke Universiteit Leuven (BE)); KRZYSZTOF, Rusek (Heavy Ion Laboratory Warsaw (PL)); MICHELE, Sferrazza (ULB); KLUPP, Stefanie Christine (Technische Universitaet Muenchen (DE)); BARTOLOMIEJ, Szpak (IFJ PAN Krakow); BENZONI, giovanna (INFN sezione di Milano)

Presenter: Dr BOTTONI, Simone (Università degli Studi e INFN Milano (IT) & KU Leuven (B))

Session Classification: Medium towards Heavy Nuclei I