Cross section measurements for neutron-rich isotopes in grazing reactions

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Reactions at the grazing angle between heavy ions at energies close to the Coulomb barrier are presently considered a valuable tool for the production of neutron-rich nuclei [1,2]. In view of the future research which will become possible in the forthcoming years with radioactive ion beam facilities, the present experimental program (still using stable beams) being pursued at LNL on multinucleon transfer is providing precious inputs. With the new large solid angle magnetic spectrometer PRISMA [3] coupled to the gamma array CLARA [4], very high efficiency and good mass resolution can be achieved for the heavy ion beams provided by the superconducting ALPI booster coupled to the new positive ion injector PIAVE. With this unique experimental set-up it is now possible to measure production cross sections for most of the nuclides coming out from quasi-elastic and deep-inelastic reactions. Reliable values for these cross-sections are extremely important when one plans experiments aiming at studying the structure of very exotic nuclei.

^{82}Se+^{238}U is an example of recently investigated systems at energies close to the Coulomb barrier. The neutron-rich ^{82}Se projectile (Z=34,N=48) is a suitable candidate to investigate, via multiproton stripping channels, the population yield of neutron-rich nuclei in the Ni-Ge region. Absolute cross sections were measured with the time of flight spectrometer PISOLO [1] and, in a second experiment, we used PRISMA to measure the detailed A and Z distributions for almost all nuclear species populated in the binary reaction. Fig. [1] shows the comparison of the yields measured with PISOLO with what obtained with PRISMA where the detection sensitivity allowed to distinguish isotopes down to $\simeq$ 14 protons stripped from the projectile. PRISMA was used coupled to CLARA to obtain γ-spectroscopy information for many of the neutron-rich nuclei produced in the reaction. In this presentation we focus mainly on the aspects related to the production yield.

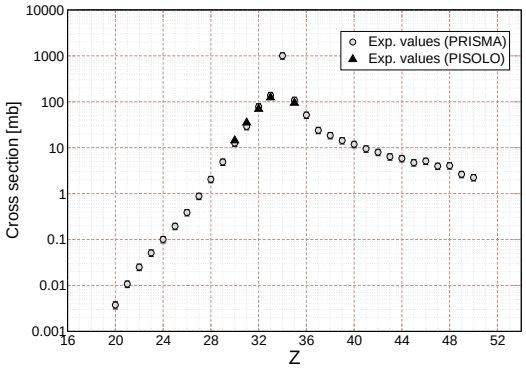

Figure 1: *Total angle- and Q-value integrated cross sections for the different nuclear charges integrated over neutron number, measured with PISOLO and PRISMA.*

[1] L. Corradi et al., Nucl.Phys. A 701, 109c (2002);
[2] Eurisol, "Key experiments", J.Cornell et al., GANIL Dec.2003 http://www.ganil.fr/eurisol/
[3] A.M. Stefanini et al., LNL-INFN (Rep) - 120/97 (1997); Nucl. Phys.A 701, 217c (2002);
[4] A. Gadea et al., Eur. Phys. J. A20, 193 (2004);