Spectroscopy of moderately neutron-rich nuclei with the CLARA-PRISMA setup

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Multinucleon-transfer reactions and deep-inelastic collisions have been successfully used in the last two decades to study the structure of nuclei far from stability in the neutron-rich side of the nuclear chart. Recent cross section measurements, for selected multinucleon transfer reactions, with neutron rich stable targets have shown the potentiality of this reaction mechanism to populate neutron rich nuclei with sizeable cross section values [1]. The interest in studying phenomena only present in nuclei very far from stability, especially in neutron-rich medium mass or heavy nuclei, has led to the necessity of new techniques to assign the γ−transitions to the corresponding reaction product. In a joint effort, γ−spectroscopy and reaction mechanisms groups belonging to INFN, in collaboration with several European institutes, have developed a new setup by coupling the array of Euroball Clover detectors CLARA [2] to the large acceptance magnetic spectrometer PRISMA [3]. This setup is a step forward in the use of the multi-nucleon transfer and deep-inelastic collisions in γ spectroscopy, and aims at measuring in-beam prompt coincidences of γ−rays detected with CLARA and the reaction product seen by the PRISMA detectors. The setup allows in most cases to assign unambiguously the transitions to the emitting nucleus by identifying the mass (A) and atomic (Z) numbers of the product going into PRISMA. Therefore, it will lower the sensitivity limit in the measurements and consequently allow studying excited states of nuclei away from stability produced with low cross sections. The spectroscopic information provided by the setup is complementary to that provided by first generation radioactive beam facilities. Therefore, several topics are common to the mentioned facilities and our setup, for example, shell evolution at N=20, 28 and 50 and the onset of collectivity for the Cr and Fe isotopes towards N=40. The experimental program of the CLARA-PRISMA setup started on March 2004. A consistent fraction of the experimental activity is connected to the study of the evolution of the magic numbers in neutron-rich nuclei, as well as to the study of non-yrast states populated in quasi-elastic reactions. Results in connection with the mentioned topics will be shown.

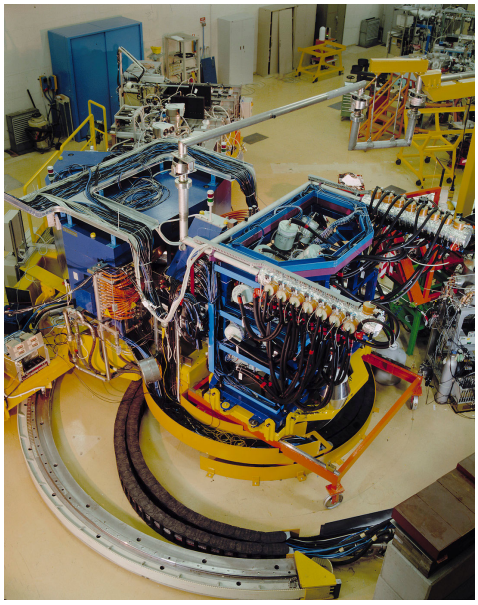

Figure 1. The CLARA-PRISMA setup installed at LNL

[1] L.Corradi et al., *Phys. Rev.* **C63**, 021601 (2001) and refs. therein.
[2] A.Gadea, *Eur. Phys. J.* **A Direct** in press
[3] A.M.Stefanini et al., *Nucl. Phys.* **A701**, 109c (2002)
A.Latina et al., *Nucl. Phys.* **A734**, E1 (2004).