Gamma spectroscopy of neutron-rich nuclei with the PRISMA/CLARA setup

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Multi-nucleon transfer reactions and deep inelastic collisions have become an increasingly popular tool to study medium and high-spin states in neutron-rich nuclei far from the stability line. Actually, before the planned Radioactive Ion Beam facilities start operation, these reaction mechanisms constitute the only possibility to populate such nuclei at beam energies near the Coulomb barrier and with sizeable cross sections, using the available combinations of stable beam and target nuclei. In-beam γ spectroscopy of the nuclei populated in these reactions is however quite a challenge, given the wide range of reaction products, each of them having a broad velocity distribution. This implies that not only a highly efficient and granular array of germanium detectors is needed, but that additional devices identifying the reaction products and measuring their velocities are essential in these kind of studies. One such example is the PRISMA/CLARA setup presently operating at the Laboratori Nazionali di Legnaro, where the high acceptance magnetic spectrometer PRISMA [1] has been coupled to the CLARA array of 25 Clover detectors [2] placed at the target position.

A campaign of measurements to study medium-mass neutron-rich nuclei with PRISMA/CLARA has been carried at the Laboratori Nazionali di Legnaro. Selected results are presented here, concerning topics such as the stability of the $N = 50$ shell closure close to ^{78}Ni, the "island of inversion" around $N = 20$ and the onset of deformation in the Cr-Fe region around $N = 40$, where a candidate nucleus for the E(5) symmetry [3] has been found [4]. The perspectives offered by the planned coupling of PRISMA with the AGATA Demonstrator Array [5,6] are also discussed.

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