Laboratoire de Physique Corpusculaire
CNRS – IN2P3 – ENSICAEN – UNICAEN
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Studies of fragmentation reactions with different projectiles and targets between 25 and 40 A MeV, obtained during the commissioning phase of the new FAZIA detectors.

The study of fragmentation reactions produced in nuclear reactions of heavy ions around Fermi energy has brought many information in the understanding of dynamic and thermodynamic of nuclear matter and stay today one of the most promising tool to determine its equation of state. It was studied in the past thanks to powerful charge particles detectors (like Indra, Chimera, Garfield, Nimrod, Multics, Miniball…) covering a large solid angular domain, ideally near of 4π, a large energy dynamic (from few MeV to GeV) and a big range in atomic number. Nevertheless, to go further, an experimental information was missing: the isotopic composition of the fragments produced during the nuclear reactions. It was obtained for light particles and small clusters, from Hydrogen to almost Oxygen but scarcely beyond. The FAZIA (Four π A&Z Identification Array) has started many years ago a deep R&D process to overcome this intrinsic experimental difficulty of isotopic identification, on a large range and brought a new standard in the field of particles detection in nuclear physics at intermediate energies. Fazia is now able to identify particles and fragments isotopes up to Z=25 on the very similar range of energy as before, i.e. covering the full dynamic spectra of heavy ion reactions at Fermi energy.

Many experiments have been performed since 2015 at the Laboratori Nazionali del Sud in Catania, Italy, during the commissioning phase of Fazia, with a still increasing number of detection elements. Collisions involving ^{80}Kr+^{48}Ca at 35 A MeV, $^{40-48}$Ca+$^{40-48}$Ca at 35 A MeV, ^{32}S+^{12}C at 25-50 A MeV, ^{20}Ne+^{12}C at 25-50 A MeV and recently (February 2018) $^{40-48}$Ca+^{12}C at 35-40 A MeV have been registered. The next step will be the coupling of 192 Fazia telescopes (covering the forward part) with Indra (for the backward part) at Ganil, starting from September 2018.

This stage will allow the candidate to have a full overview of charged particle identification techniques at his best, as well as first experiences in analyses of complex many body data in the field of heavy ion reactions. Studies concerning excited matter, multi fragmentation, isospin diffusion and equilibration, clustering… will be undertaken within the Fazia group of the Laboratoire de Physique Corpusculaire de Caen. A participation to the Fazia mounting phase at Ganil will be intended too.

Competence:

Nuclear physics, C&C++ computing knowledge

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