Probing nuclear isospin equilibration : the INDRA-FAZIA experiment in GANIL

J. Quicray[1]
On behalf of the INDRA and FAZIA collaborations
[1]*Normandie Univ, ENSICAEN, UNICAEN, CNRS/IN2P3, LPC Caen, 14000 Caen, France*

The study of fragmentation reactions produced in heavy-ion collisions has permitted major advances in the understanding of the dynamics and thermodynamics of nuclear matter [1, 2] and is still one of the most promising tools to constrain its equation of state. This fundamental feature in nuclear physics is also a crucial ingredient in the understanding of various astrophysical objects or phenomena: dynamics of supernovae explosion and structure of the remanent neutron star, or interpretation of signals coming from neutron star merger [3, 4].

Up to now, a crucial ingredient was missing in most fragmentation experiments: the isotopic composition of reaction products, it was only accessible for the lightest fragments with existing multi-detectors such as INDRA in GANIL. In this context, the FAZIA collaboration has developed a new generation detector [7, 8] able to measure the charge and mass of fragments up to Z=25 over a broad angular and energy range. Results of first experiments with FAZIA in stand alone mode have been published by the collaboration on the isotopic distribution of measured fragments [5, 6]. Now, twelve FAZIA modules are mounted in GANIL to replace the forward part of INDRA. This INDRA-FAZIA coupling is one of the most powerful detector to constrain the nuclear equation of state asymmetry term. The identification quality and large angular coverage also allow to investigate nuclear collision dynamics, clusterization process at low density, and light nuclei structure and decay modes.

The first INDRA-FAZIA experiment at GANIL was performed in 2019. The main goal is to study the isospin tranport properties of nuclear matter by measuring the evolution of the N/Z equilibration between projectile and target of different initial isospin contents as a function of the collision centrality. In this contribution, I will present the context and first results of this experiment.

References

[1] J. Xu *et al.*, Phys. Rev. C **93**, 044609 (2016).

[2] Y. X. Zhang *et al.*, Phys. Rev. C **97**, 034625 (2018).

[3] J. M. Lattimer *et al.*, Science **304**, 1090720 (2004).

[4] J. Margueron *et al.*, Phys. Rev. C **97**, 025806 (2018).

[5] S. Piantelli *et al.*, Phys. Rev. C **99**, 064616 (2018).

[6] A. Camaiani *et al.*, Phys. Rev. C **102**, 044607 (2020).

[7] R. Bougault *et al.*, Eur. Phys. J. A **50**, 47 (2014).

[8] S. Valdré *et al.*, Nucl. Instrum. Methods. Phys. Res. A **930**, 27-36 (2019).