Contribution ID: **50**　　　　Type: **Oral Presentation**

Nuclear symmetry energy constraint from isospin diffusion with INDRA-FAZIA

Heavy-ion collisions offer a unique opportunity to probe the equation of state (EoS) of baryonic matter across a range of densities. However, extracting quantitative constraints from comparisons with transport model predictions requires careful consideration of several factors, such as the choice of observables and ensuring comparable conditions between experimental and simulated data. In particular, an accurate treatment of reaction centrality is crucial to properly account for the latter aspect.

In this contribution, we present a model-independent experimental determination of isospin diffusion effects in ^{58,64}Ni+^{58,64}Ni collisions at 32 MeV/nucleon, directly reported as a function of the impact parameter. This result is obtained by combining two datasets with common characteristics, but that include complementary information. The first, collected with the INDRA detector [1], was used to implement a model-independent impact parameter reconstruction employing the method of Ref.[2]. The second dataset, acquired during the first experimental campaign of the INDRA-FAZIA setup at GANIL [3-5], provides neutron-to-proton ratio measurements of the quasiprojectile remnant thanks to FAZIA's identification performance [6,7]. The isospin transport ratio technique [8] was applied to quantify isospin diffusion, revealing a clear evolution toward equilibration as a function of impact parameter [9].

The experimental result is then compared with predictions from the BUU@VECC-McGill transport model [10], which, through the metamodeling approach of Ref. [11], employs various nuclear equation of state parametrizations from the literature. In particular, two extreme χ-EFT interactions were tested, a good agreement is found within the chiral constraint [12]. Additionally, the BUU@VECC-McGill model was used to study the isospin current and baryonic densities evolution during the collision, in order to provide a consistent determination of the density region significantly probed by the experiment.
Finally, we present the resulting symmetry energy constraint from the new INDRA-FAZIA isospin diffusion experimental assessment, which can be used to inform Bayesian inference of the neutron star EoS.

References

[1] J. Pouthas et al., Nucl. Instr. Meth. A 357, 418 (1995), J. Pouthas et al., Nucl. Instr. Meth. A 369, 222 (1996)
[2] J. D. Frankland et al., Phys. Rev. C 104, 034609 (2021)
[3] G. Casini and N. Le Neindre, Nucl. Phys. News 32, 24 (2022)
[4] C. Ciampi et al., Phys. Rev. C 106, 024603 (2022)
[5] C. Ciampi et al., Phys. Rev. C 108, 054611 (2023)
[6] R. Bougault et al., Eur. Phys. J. A 50, 47 (2014)
[7] S. Valdrè et al., Nucl. Instr. and Meth. A 930, 27 (2019)
[8] F. Rami et al., Phys. Rev. Lett. 84, 1120 (2000)
[9] C. Ciampi et al., accepted Phys. Rev. C (2025)
[10] S. Mallik et al., J. Phys. G: Nucl. Part. Phys. 49, 015102 (2021)
[11] J. Margueron et al. Phys. Rev. C 97, 025805 (2018)
[12] C. Ciampi, S. Mallik et al., submitted (2025)

Authors: CIAMPI, Caterina (GANIL); MALLIK, Swagata Mallik (LPC Caen)

Co-authors: CHBIHI, Abdou (GANIL); Dr GRUYER, Diego (LPC Caen); GULMINELLI, Francesca (LPC/Ensicaen); Dr FRANKLAND, John (IN2P3); LE NEINDRE, Nicolas (Normandie Univ, ENSICAEN, UNICAEN, CNRS/IN2P3, LPC

Caen, 14000 Caen, France); BOUGAULT, Rémi (LPC Caen)

Presenter: CIAMPI, Caterina (GANIL)

Session Classification: Parallel session

Track Classification: Heavy Ion Collisions and QCD Phases