



ID de la contribución : 838

Tipo : no especificado

## Momentum Inference of the Ion-optics of WASA-FRS based on machine learning models

*martes, 19 de noviembre de 2024 17:47 (7)*

Multimessenger measurements in astrophysics have become a key element in constraining the nuclear equation of state and the characteristics of neutron stars. The stellar characteristics of a neutron star are strongly affected by baryonic interactions. Constraints from experimental observations of heavy ions show remarkable consistency with astrophysical measurements and provide complementary information at intermediate densities. In this respect, the production of exotic hypernuclei in ion-induced reactions is expected to add precise observables at higher densities than those obtained in previous experiments.

The WASA-FRS HypHI Experiment focuses on the study of light hypernuclei by means of heavy-ion induced reactions in  ${}^6\text{Li}$  collisions with  ${}^{12}\text{C}$  at  $1.96\text{GeV/u}$ . It is part of the WASA-FRS experimental campaign, and so is the eta-prime experiment [1]. The distinctive combination of the high-resolution spectrometer FRS [2] and the high-acceptance detector system WASA [3] is used. The experiment was successfully conducted at GSI-FAIR in Germany in March 2022 as a component of the FAIR Phase-0 Physics Program, within the Super-FRS Experiment Collaboration. The primary objectives of this experiment are twofold: to shed light on the hypertriton puzzle [4] and to investigate the existence of the previously proposed  $\text{nn}\Lambda$  bound state [5]. Currently, the data from the experiment is under analysis.

Part of the data analysis is to provide a precise ion-optics of the measurement of the fragment originated from the mesonic weak decay of the hypernuclei of interest. The reconstruction the ion-optics of fragments is based on the calibration run of FRS optics. We have proposed to implement machine learning models and neural networks to represent the ion-optics of FRS: While the current state of the problem involves solving equations of motion of particles in non-ideal magnetic fields - which leads to the application of approximations in the calculations - the implementation of artificial intelligence models allows us to obtain accurate results with possible better momentum resolution.

In this presentation, we will present the current status of the R&D in machine learning model of the ion-optics and the prospect of the inference of the measured momentum of the fragments based on the calibration data recorded during the WASA-FRS experimental campaign of 2022.

[1] Y.K. Tanaka et al., J. Phys. Conf. Ser. 1643 (2020) 012181.

[2] H. Geissel et al., Nucl. Instr. and Meth. B 70 (1992) 286-297.

[3] C. Bargholtz et al., Nucl. Instr. and Meth. A 594 (2008) 339-350.

[4] T.R. Saito et al., Nature Reviews Physics 3 (2021) 803-813.

[5] C. Rappold et al., Phys. Rev. C 88 (2013) 041001.

### Abstract

**Primary author(s)** : CALONGE GONZÁLEZ , David (IEM CSIC); ESCRIG, Samuel (IEM, CSIC); RAPPOLD, Christophe (IEM, CSIC)

**Presenter(s)** : CALONGE GONZÁLEZ , David (IEM CSIC)

**Clasificación de la sesión :** Red FNUC (Red Temática de Física Nuclear)

**Clasificación de temáticas :** Red Temática de Física Nuclear (FNUC)