Position Offered: PREDOCTORAL RESEARCHER

Project: *AI for hypernuclear event search*

Technological and scientific fields: Artificial Intelligence, experimental nuclear physics

Location: Madrid, Comunidad de Madrid, Instituto de Estructura de la Materia IEM – CSIC https://www.iem.cfmac.csic.es/

Research Group/PI: Group of Experimental Nuclear Physics, IP Christophe Rappold & Luis Acosta https://fnexp.iem.csic.es/

PROJECT SUMMARY

The stellar properties of a neutron star are widely affected by the baryonic interactions. The constraints from heavy-ion experimental observations show remarkable consistency with the astrophysical measurements, providing complementary information at intermediate densities. In that aspect, the production of exotic hypernuclei in ion-induced reaction is envisioned to add precise observables at higher density. The PhD project aims to enhance our understanding of hypernuclear events in ion-induced reactions and nuclear emulsions by leveraging Artificial Intelligence techniques. The research will focus on two key experiments: the WASA-FRS experiment at GSI-FAIR (Germany) and the E07 emulsion experiment at JPARC (Japan). The primary objectives are to develop innovative AI approaches for hypernuclear spectroscopy experiments, with the goal of improving the separation of the background contributions from the hypernuclear signal. By applying segmentation models and graph neural networks, we expect to enhance observation efficiency for various hypernuclei, including potentially unknown double-strangeness hypernuclei. Through clearer observations, this project aims to shed light on the structure of hypernuclei and baryon-baryon interactions. Specifically, It will address existing puzzles surrounding light hypernuclei, demonstrating the viability of those innovative experimental approaches.

PROFESSIONAL PROFILE

Minimum requirements:

* Master's degree in Nuclear Physics recognized by Spanish institutions. * Strong foundation in nuclear and hypernuclear physics. * In-depth knowledge of ion optics, particle tracking in magnetic fields, and data analysis techniques for nuclear collisions. * Proficiency in machine learning development and data analysis. * Mandatory programming skills: Python and C++. * Excellent English language proficiency (fluent) and ability to work effectively in an international environment

Merits to be considered:

* Familiarity with high-energy nuclear physics data analysis techniques. * Practical experience with machine learning models, including: Supervised learning for classification, regression and Automatic Machine Leanring. * Proficiency in popular machine learning development frameworks: scikit-learn, Pytorch. * Working knowledge of Linux operating systems.

WHAT IS OFFERED

As a successful candidate in this PhD program, you will have the opportunity to work in an international environment, applying innovative AI methods to data analysis in experimental nuclear physics. During the four-year program, you will gain valuable experience in international research at renowned institutions. Primary destinations for your research stay will be leading international partners, including: GSI-FAIR International Facility in Germany, collaborating with the SuperFRS experiment and HENP Laboratory of RIKEN in Japan. In addition to these research opportunities, you will also have the chance to participate in various summer schools and expert workshops on machine learning, deep learning, and AI. Throughout the program, you will be expected to complete a total of 260 ECTS credits within four years.

Contract conditions:

Predoctoral Researcher contract of 4 years' duration. Gross annual salary of 23,871.33 €.

Start of contract: before 31 December 2024

PRINCIPAL INVESTIGATOR CONTACT

Email: christophe.rappold@csis.es / Phone: +34 917 040 797 (Ext: 442407)

momentum@csic.es | https://momentum.csic.es/

Financiado por la Unión Europea NextGenerationEU
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