Doctoral INPhINIT - INCOMING Fellowship Programme 2021 Call for applications

Position: Unveiling the structure and dynamics of nuclear exotic systems

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Centre description

The Galician Institute of High Energy Physics (Instituto Galego de Física de Altas Enerxías, IGFAE) is a joint research institute of the University of Santiago de Compostela and Xunta de Galicia (the Galician Autonomous Government). It was officially created on July 2nd 1999. The main goal of the Institute is to coordinate and foster the scientific and technical research in the field of High Energy Physics, Particle and Nuclear Physics and related areas as Astrophysics, Medical Physics and Instrumentation. Of primary importance is the planning and promotion of the relation with large experimental facilities, especially with CERN, GSI/FAIR, the Pierre Auger Observatory and LIGO at present.

The experimental groups at IGFAE coordinate the Spanish participation in the LHCb Collaboration at CERN (being the third group in size in the Collaboration), in the Pierre Auger Observatory, and in the GSI/FAIR nuclear facility. Members of the Institute have relevant participation in the LHCb upgrade planning and the HL-LHC activities. Besides, they are involved in the design of future facilities like in the EIC and FCC physics cases, the LHeC project development and planning, etc. In the last years, a new line has also been opened with the building of a new facility (L2A2) at the University of Santiago de Compostela aiming to produce radioisotopes for medical use by a laser-induced plasma accelerator. Moreover, the theory section of the Institute, with groups working on QCD, string theory and, more recently, on BSM, holds an excellent international reputation, with participation in many international committees, invitations to plenary talks in top conferences and large-impact publications. The institute holds two ERC grantees, one StG and one StG+AdG.

Research project and research line description

Nuclear Physics concentrates on the understanding of the structure of atomic nuclei and forces at play in the nuclear medium. Even though the impressive progress achieved in this field, there are still some not answered key questions related to how the chemical elements were created during the evolution of the universe, how is the energy generated in the stars, what are the limits of existence of nuclei, how are complex nuclei built from their basic constituents, or even what are the fundamental properties of the interactions at play in atomic nuclei.

The nuclear physics research area of IGFAE develops an intense experimental activity, leading cutting-edge experiments in the most relevant European accelerator facilities in our field (GSI/FAIR, GANIL/SPIRAL, CERN/nToF ISOLDE, etc).

Utilizing innovative approaches, we explore different aspects of structure and dynamics of nuclear systems in a very vast domain of energies from low up to relativistic regime. Our team has a recognized trajectory with highly skilled scientists with an outstanding international impact. We highlight our strong involvement in the R3B/FAIR and ACTAR/SPIRAL international collaborations and our commitment developing new generation instrumentation (CALIFA and ACTAR) for the fore-front nuclear physics research.

Job description

The successful candidate can choose among the many topics including in our portfolio.

1. The participation in the R3B experiment (http://www.gsi.de/r3b), in the international FAIR facility (http://fair-center.eu) offers the possibility to study n-rich matter and particularly the nature of the nuclear matter as it manifest at different depths of neutron stars or the matter synthesized in neutron star merger events. The candidate could join the group activities and take part in the R3B Phase-0 experimental campaign (2020/2021) dedicated to the study of nuclear reactions induced with relativistic rare beams and covering interesting research topics as constraining the symmetry energy term of the equation of state for n-rich matter, characterize for the first time and determine the role of short rage

correlations in n-rich matter, the study of reactions with strong astrophysical interest and access to the study of the fission of n-rich nuclei and the role in the final nature and abundance of heavy chemical elements. The candidate can also be formed in technical skills as knowledge and use of advance scintillator materials, applied to the construction of the CALIFA/R3B calorimeter, and big data and machine learning for the data sorting of R3B experiment.

2. The candidate could also join other international collaborators from relevant institutes in Europe, US, Canada, and Japan working in the low energy domain. The research activities of the candidate will focus on Nuclear structure of exotic nuclei and unbound systems with transfer and resonant scattering, Fission and quasi-fission dynamics in inverse kinematics and Astor-physical reactions with neutron beams. The candidate will also have the opportunity to contribute to the development of new experimental devices, and to their optimisation and commissioning in national and international facilities such as the development of a TPC with optical readout for fission in direct kinematics and an active target for direct reactions. Optimisation of a modular, double-silicon ensemble for the detection and identification of recoils in the VAMOS spectrometer at GANIL (France).