Doctoral INPhINIT - INCOMING Fellowship Programme 2020 Call for applications

Position: Precision in the Standard Model and beyond

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Centre description

The Galician Institute for 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 2, 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 and the Pierre Auger Observatory at present.

The experimental groups at IGFAE coordinate the Spanish participation in the LHCb Collaboration at CERN, the Spanish participation in the Pierre Auger Observatory, as well as the Spanish participation in the GSI/FAIR nuclear facility. Members of the Institute have a relevant participation in the LHCb upgrade planning, in the LHeC project development and planning, etc. In the last couple of years a new line has also been open with the building of a new facility (LaserPet) 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 holds an excellent international reputation, with participation in different international committees, invitations to plenary talks and large-impact publications.

Research project and research line description

The experiments performed at the Large Hadron Collider have provided strong evidences that the physics at the electroweak scale is correctly described by the Standard Model (SM). This feature, together with the lack of evidence for new interactions or particles, favors the

description of general effects induced by new physics in terms of an effective field theory that has the SM as a low energy limit such as the SMEFT. Limits on the coefficients of the SMEFT have been obtained from global fits on various set of data, where typically only leading order EFT effects are included. It has been showed, however, that next-to-leading EW and QCD corrections to the SMEFT effects can have large impact on the limits obtained from a global fit, and a program of calculations has begun to treat the SMEFT contributions at NLO. This task is part of a more general effort towards more precise predictions of phenomenological observables in SM and BSM theories. The aim of this project is the development of new techniques for the analytical calculation of multi-loop and multi-leg amplitudes. These methods will be applied to a vast range of processes in the SM and SMEFT.

Job description

The candidate will work on the development of new tools for the calculation of multi-leg multi-loop amplitudes. These techniques will be used for the analytical and numerical calculation of SM and SMEFT processes of interest for the LHC and future accelerators.

The candidate is expected to acquire a deep theoretical and phenomenological knowledge of the SMEFT. Analytical and numerical skills for the calculation of multi-loop amplitudes will be developed. Publications in top peer-reviewed journals and presentations in international conferences are expected to follow the development of the project.