laboratoire commun CEA/DRF — spiral2 — CNRS/IN2P3

Internship in nuclear physics

Coherent implementation of the Pauli exclusion principle into INCL++

High-energy heavy-ion collisions are being described theoretically since long within the two-step scenario. In the first instants of the ion-ion reaction, a series of nucleon-nucleon collisions allows the dissipation of a large part of the kinetic energy of the participants. This process generates fast particles and light fragments, which escape the nuclear system. The remaining nucleons are described by a statistical distribution which is asymptotically uniform and forms a highly excited nuclear system, whose decay occurs via collective mechanisms such as evaporation, fission or more generally fragmentation.
The intranuclear cascade of Liège (INCL) has been developed in this framework. A recent effort was undertaken to include a C++ version of INCL into the GEANT4 package (INCL++), with emphasis on nucleon and light-ion projectiles, essentially motivated by applications such as accelerator - driven systems and proton and light-ion cancer treatment.
In the current version of INCL++, the Pauli exclusion principle at play in the sets of nucleons of both the projectile and the target nuclei are treated in a different way, essentially for calculation efficiency reasons and because, for applications, the target nucleus is the main concern of the calculations. The purpose of this internship is to implement in a same coherent way the Pauli principle in both the projectile and the target nuclei. This implementation is a necessary step towards a symmetric description of both nuclei during the collision, in the perspective of extending INCL++ to heavier projectiles.

Expected skills:
Nuclear and particle physics, C++ programming

This internship leads to a PhD thesis.

Contact: Jean-Eric Ducret
GANIL, BP 55027, 14076 Caen France
Phone: +33 (0)2 31 45 44 51
Mail: ducret_at_ganil.fr