PhD position in nuclear instrumentation

Study and Modeling of an axisymmetric electron cyclotron resonance ion source

Because of their reliability of operation and their performance, the most commonly used ion sources are of the Electron Cyclotron Resonance (ECR) type, ion sources which very quickly replaced those based on heated filaments. The GANIL is one of the machines where the number of these equipment and their variety is the largest because the production of ions must answer to a wide requested range: high intensity (5 mA) of stable singly-charged ions; medium intensity (tens of µA) of stable ions with medium charge state; high intensity (several µAp) of highly charged stable ions (A / Q = 3); high efficiency (maximum as possible) for single-charged and moderately charged radioactive ion production. This broad dynamic explains the numerous source techniques present at GANIL.

A large part of the knowledge of this type of ion source (ECR) is based on the experience gained during its operation and many empirical laws are applied as well for the realization - development of new sources as for their operation on accelerators. Even if the routine operation is acquired, there are several areas of obscurities that prevent complete control of this instrument: plasma instabilities limiting microwave power injected; internal electrostatic confinement still poorly understood, playing an important role in the production of highly charged ions; plasma - vacuum interface for creating the extracted ion beam; experimentally measured ionic temperature having great differences with the theory etc …

The purpose of this thesis is to use hybrid and/or kinetic simulations to analyse the limits of current ion sources and to propose new ways to increase ion intensity - high charge states required for GANIL physics experiments.

Expected skills:
Basic of plasma Physics, candidate must be attracted by simulations as well as experimental work, C/C++ - Fortran coding

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