High Energy Ion Beam Analyses: Method Developments and Characterisation of Damage Effects.

Supervisors:

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Context

The PRISMA team of the SUBATECH laboratory works on ion beam analysis methods with the Arronax cyclotron. The high energy of the available beams (up to 70 MeV) makes it possible to probe thicker samples than with the beams of 3 to 4 MeV usually used, notably multilayers objects.

Through previous PhD theses, the team has demonstrated the interest of coupling PIXE / PIGE (Particle Induced X-ray / Gamma-ray Emission) methods, especially for the identification and quantification of heavy elements in samples of which the matrix consists of light elements. While fundamental cross-section measurements are still needed to perform absolute quantification, practical applications can already be addressed.

Goals

Development of methods for high energy ion beam analysis (PIXE, PIGE, IBIL, ...) adapted to the study of precious samples and / or high added value. What goes through:

1. The measurement of X-ray and gamma ray production cross sections for protons, deuterons and alpha particles between 17.5 and 70 MeV;

2. The characterisation of the methods developed with the Arronax cyclotron and associated damage effects;

3. Their application to the analysis and characterisation of real objects or samples: detectors subjected to irradiation, artistic works, cultural heritage objects, etc.

Required skills

✓ Understanding of the concepts of atomic physics, nuclear physics and optics;

✓ Knowledge of the analysis techniques and physicochemical characterizations;

✓ Experience in ion beam analysis and / or damage effects would be an asset;

✓ Mastery of Monte Carlo simulation tools;

✓ Able to work as a team;

✓ Autonomy and responsiveness.

Process

Interested candidates should send a CV, a letter of motivation, transcript of the master grades and one or two recommendation letters to Vincent Métivier (vincent.metivier@subatech.in2p3.fr).