Exploring the Island of Stability: Spectroscopic Studies of Superheavy Elements and the Synthesis of New Elements Beyond Z=118"

(M2 Internship subject)

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One of the flagship subjects in current Nuclear Physics is the search for so-called superheavy elements. These elements are located at the top of the isotopic table and remain largely unknown due to the very low probability of synthesizing them. The investigation of such elements can be conducted either through the study of reaction mechanisms, their synthesis or through direct spectroscopic study (of α, β, or γ particles) of these superheavy nuclei. The DNE group is fully involved in these different scientific programs.

A decrease in the level density of single-particle states is evient in deformed nuclei around Z=100 and N=152, which reverses the trend of decreasing stability with increasing nucleus mass. The orbitals involved in this deformed region play a crucial role in predicting the positioning of the ultimate stability gain island corresponding to the region of superheavy nuclei. This has led to a resurgence of activity in spectroscopy scientific programs in this field in recent years. The advent of new types of beams and cutting-edge technology allows the exploration of nuclei that were previously poorly understood. Notably, the study of their isomeric states emerges as a potent tool for unraveling and understanding nuclear structure.

The student will start the internship by familiarizing herself/himself (by establishing a bibliography) with the theory and experimental techniques for studying the nuclear structure and synthesis of superheavy elements. The candidate will apply her/his knowledge for data analysis using a code he/she will develop in C++ and the ROOT software exploring data from spectroscopic and synthesis studies. Then, a good knowledge of the C++ language and the Root software is required. This internship will lead to a thesis subject.