PhD position in experimental nuclear astrophysics

Production of ^{18}F in novae

Gamma-rays emitted by the decay of radioactive isotopes are clues to understanding the nucleosynthesis and dynamics of stars. Classical novae, the second most frequent stellar explosions in the Galaxy, can be investigated with the annihilation line from β+ decay of 18F that should generate the most intense gamma flux. Yet, this is currently very difficult to bring accurate estimations of the production of ^{18}F. Its main destruction path, via the $^{18}F(p, \alpha)^{15}O$ reaction, is uncertain because of a lack of spectroscopic data for the compound nucleus 19Ne in the Gamow window. The goal of the present study is to reduce these uncertainties by measuring the excitation energies, spins and α partial widths of the levels in ^{19}Ne which are located near the proton threshold. To this end, the approach using elastic scatterings $\alpha(^{15}O, \alpha)^{15}O$ is proposed to probe the aimed levels. In particular, very high resolution will be achieved by the use of the very good radioactive beam emittance produced by SPIRAL1 at low energy, inverse kinematics, a gaseous target and the detection of α particles at zero degree in the laboratory. Depending on the ^{19}Ne measured properties in this experiment, the reaction rate can change the amount of ^{18}F produced during classical novae by a factor 3.5. Astrophysics simulations will be done using the MESA code.

Required skills:
Interest in experimental physics and astrophysics, computer science.

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