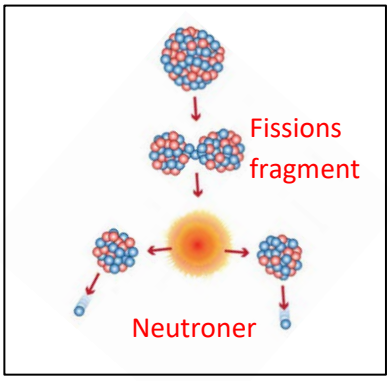
Master project in Applied Nuclear Physics

Simulations of detector response in nuclear fission experiments

Engineering Programme / Master in Physics - Degree Project (Exjobb) 30 credits (20 weeks)

Fission is a fascinating topic in nuclear physics, where the interplay between the fundamental forces give rise to exciting quantum phenomena. Fission fragment masses, neutron evaporation and γ-ray emission may help to understand how nuclei are formed and how their internal structures are. In order to study the properties of fragments, one needs accurate and well-characterized detectors. In this work, you will gain knowledge about fission physics and nuclear de-excitation by using dedicated fission codes. You will also learn about solid-state silicon detectors.



In the framework of a granted VR project (Swedish Research Council), Uppsala University is part of a research program to develop a large silicon detector array at the Joint Research Centre of the European Commission in Belgium. The state-of-the-art nuclear instrument, VERDI, stands for "VElocity foR Direct particle Identification". When a fission event occurs, both fission fragments escape back-to-back and are detected in each Time-Of-Flight (TOF) arm. By measuring the velocities and energies of both particles, one can reconstruct the masses of the particles using the kinematics of the reaction. In order to obtain precise mass measurements, a complete understanding of the detector response is imperative.

The aim of the project is to model and improve the experimental design by performing various simulations linked to the signal formation. More specifically the tasks are to:

1. study and simulate the so-called Pulse-Height Defect (PHD) in Si detectors.
2. study and simulate the so-called Plasma decay- and delay times (PTD) in Si detectors.
3. investigate how the PHD and PDT affects the measured fission data.
4. investigate how the detector resolution parameters (time and energy) affect the data.
5. study how energy losses affect the resolution.

The needed simulation tools will be provided. The fission code GEF will be used to simulate different fission processes and kinematics effects and the SRIM code will be used to calculate energy losses. This project grants you a good opportunity to acquire theoretical and experimental knowledge in nuclear physics. We welcome your applications through the below stated links. Programming skills are required.

Start date: As soon as possible, upon agreement.

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