Laboratory for Neutron Scattering and Imaging
Paul Scherrer Institut

Invitation for an LNS Seminar

Date: Friday, July 19, 2019, 10:30

Location: Paul Scherrer Institute, Area West, Bldg. **WHGA/121**

Speaker: Michael Bacak, CERN

Measuring neutron induced reaction cross-sections on the example of the 233U α-ratio and a summary and outlook on neutron imaging activities at the n_TOF facility at CERN

The first and main part of the seminar will discuss neutron induced reaction cross-section measurements at the neutron time-of-flight facility n_TOF at CERN using the example of an 233U alpha-ratio measurement.
233U is of key importance among the fissile nuclei in the Th-U fuel cycle for Generation IV nuclear energy system. It has an influence on many parts of the design of a nuclear power plant like neutronics performance, economics, nuclear safety, etc. The available data for the 233U capture cross section are scarce because the measurement is challenging due to the competing fission reaction which is on average one order of magnitude more likely compared to the capture reaction. Both reactions emit γ-rays, hence an efficient capture-fission discrimination is crucial for the accuracy in the measurement of the capture cross-section. A combined set-up of fission and γ-detectors is needed to allow tagging of the fission γ-rays to eventually subtract this source of background.
A measurement of the 233U capture α-ratio was performed in 2016. The Total Absorption Calorimeter (TAC) of n_TOF, an almost-4π array made of 40 BaF2 crystals, was employed as γ-detector. The TAC was coupled with a novel compact ionization chamber as fission detector, which was optimized for fast timing needed for alpha-fragment separation and an excellent tagging performance. A brief introduction to the experimental set-up will be given and essential parts of the analysis procedure will be discussed. Monte Carlo simulations of the full experimental set-up are compared to the experimental capture response and used to calculate the detection efficiency. Finally, (preliminary) results on the capture response and α-ratio will be presented.

In a second part, neutron imaging activities at n_TOF's EAR2 beam line will be presented.
The construction of nTOF's second beam line EAR2, with a flight path length of roughly 20 m, in 2014 allows to investigate the facility's capabilities with respect to neutron imaging due to the increased flux compared to EAR1, with 185 m flight path length. The beam line and the set-up used in the past years for neutron imaging at n_TOF will be introduced. A historical evolution of the imaging activity from feasibility measurements to a first application and the future improvements and outlook will be given.

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