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Topical plan for JINR research and international cooperation, Nuclear Physics (03), Theme (03-5-1130-2017/2021):

Synthesis and Properties of Nuclei at the Stability Limits.

Project: Production of radioactive ion beams and light exotic nuclei study at ACCULINNA-2 separator. Project is addressed to max 2 students.

Project description:

1. Getting familiar with principle of operation of an in-flight separator. Getting familiar with design and operation principle of the ACCULINNA and ACCULINNA-2 separator.
2. Getting familiar with detectors and detection techniques in experiments at ACCULINNA; silicon detectors (Si), scintillators (CsI(Ta), stilbene crystals. Identification of the reaction products on dE-E, dE-TOF at experimental spectra, performing simulations in the LISE++ program.
4. Getting familiar with charged particle detection technique applied in the OTPC (Optical Time Projection Chamber) and the 'mini OTPC' detector system for studies of light emission from gas mixtures used in the OTPC.
5. Analysis of data from the first experimental measurement at the ACCULINNA-2 separator.

The goal of the practice is to get basics knowledge about charged particles detection techniques used for detection of the reaction fragments at the ACCULINNA separator and neutron detection techniques. Students will learn the principle of operation of the ACCULINNA and the new ACCULINNA-2 separators as well as the methods of the radioactive ion beams production.

They will get practical experience how to work with charged particle detectors.

The main task will be analysis of the first experimental measurement at the ACCULINNA-2 – reaction $^{15}\text{N}(49\text{ MeV}/n) + ^9\text{Be}$ to get radioactive ion beams yields.

Additionally students will get basic knowledge about novel technique of charged particle detection - the setup of the OTPC spectrometer. Moreover a series of excursions to the main experimental facilities at FLNR will be organized (microtron MT-25, cyclotron IC-100 and U400M)



(Left) Main view of ACCULINNA and aACCULINNA-2 separators (center) opened reaction chamber view (right) example of energy lose – Time of Flight spectra

Requirements:

The projects is related to students and PhD students interested in nuclear physics, experimental physics and particle detection techniques. Basics knowledge in nuclear physics and C++ programming skills are nice seen.

Useful links:

<http://fls2.jinr.ru/flnr/index.html>

<http://aculina.jinr.ru/>

<http://lise.nslc.msu.edu/lise.html>

<http://indico.cern.ch/event/3062/contribution/135/material/poster/0.pdf>