The EXL experiment @ FAIR and plans with the ESR @ GSI

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The upcoming FAIR facility in Darmstadt, Germany, will produce intense high energy beams of exotic nuclei, which will be used to explore the properties of new regions of the chart of nuclides of key importance for both nuclear structure and nuclear astrophysics. Since the nucleus under study is the one which is produced in the process of in-flight fragmentation, one has to deal with inverse kinematics in which the hadronic probe, generally a light nucleus, is the target being bombarded by the heavy nucleus. The inverse kinematics will impose particular conditions on the design of detection systems. In the EXL project, heavy ion beams are first cooled in the New Experimental Storage Ring (NESR) and then used to induce reactions on windowless thin Hydrogen, deuterium and Helium gas targets in the ring. High luminosities can be achieved because the beam circulates a couple of million times in the ring. The EXL system will be ideal for high resolution reaction studies at low momentum transfers, for example the study of nuclear sizes using protons, giant resonance properties using inelastic light-ion scattering – such studies provide unique insights into the asymmetry energy in the nuclear equation of state and the properties of neutron stars. The design of the detector system considered is universal in the sense that it should allow the use of a large variety of nuclear reactions, addressing numerous physics questions. The detector system provides the capability of fully exclusive kinematical measurements, with target recoil detectors, fast ejectile forward detectors and an in-ring heavy-ion spectrometer. Technologically, the requirement that the detectors should be placed in the ultra-high vacuum of the ring is most demanding and requires non-standard solutions of the detector design.

The physics case and detector design considerations for EXL will be presented in this talk along with experimental plans with the present ESR at GSI.