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The TRIUMF Storage Ring (TRISR) Project

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Heavy-ion storage rings connected to radioactive beam facilities offer a unique environment for nuclear physics experiments. So far, storage rings have been only coupled to in-flight fragmentation facilities, for example the ESR and the CRYRING at GSI Darmstadt, Germany, the CSRe at HIRF in Lanzhou, China, and the Rare RI Ring at RIKEN Nishina Center in Japan.

Neutron capture reactions play a crucial role for the understanding of the synthesis of elements heavier than iron in stars and stellar explosions via the slow (s), intermediate (i), and rapid (r) neutron capture processes. While the majority of the s-process neutron captures occur on stable or long-lived nuclei and have already been experimentally constrained, measuring the direct neutron capture cross section of short-lived nuclides (half-life $\ll 1$ year) has so far been out of reach and led to large uncertainties in Hauser-Feshbach predictions of very neutron-rich nuclei. To partially circumvent this problem, indirect measurements via (d,p) reactions in inverse kinematics are carried out, and the neutron capture cross section extracted with the help of theoretical models.

Recently, a new method to couple a neutron-producing “facility” to a RIB storage ring was proposed [1]. While their initial proposal involved a storage ring running through a high flux reactor, later ideas involved the use of a spallation neutron source. This direction is presently investigated at Los Alamos National Laboratory.

The TRIUMF storage ring project proposes to instead use a compact neutron generator. The whole facility would fit into the existing ISAC experimental hall and could be operational within a decade. Here, the TRISR project is introduced and some measurements are outlined that would become possible, especially with the upcoming availability of clean, intense radioisotope beams from the new ARIEL facility.

[1] R. Reifarth and Yu. A. Litvinov, Phys. Rev. ST Accel. Beams **17**, 014701 (2014)

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Keyword-2

Storage Rings

Keyword-3

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