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Nuclear Physics at Low-Energy Storage Rings

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Storage of freshly produced secondary particles in a storage ring is a straightforward way to achieve the most efficient use of the rare species as it allows for using the same secondary ion multiple times. Employing storage rings for nuclear reaction studies is a rapidly developing field of research. Experiments at various centre-of-mass energies spanning from a few AMeV of astrophysical interest to several hundred AMeV have been meanwhile conducted at existing Experimental Storage Ring ESR of GSI in Darmstadt and the Experimental Cooler-Storage Ring CSRe of IMPCAS in Lanzhou. Since recently, the very first nuclear reactions were addressed in the only operational dedicated low-energy storage ring CRYRING installed behind the ESR. In all those experiments, thin, pure, window-less gaseous targets are utilized, where H2, D2, He, N2 are the typical gases used. Hence, rich experience has been obtained on storing and manipulating low-energy exotic beams intersecting stable targets. Thereby, sophisticated diagnostics and detection instrumentation has been developed.

The challenge today is to explore the possibility to implement into a storage ring environment a short-lived target composed of free neutrons. If successful, the discovery potential would be enormous.

In this presentation, a summary will be given of what has been achieved by now in storage-ring-based charge-particle induced nuclear reaction studies. Finally, the ideas for a low-energy storage ring combining a free-neutron target and stored short-lived species will be discussed.

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