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Experiments with stored highly-charged ions at ISOLDE: TSR@HIE-ISOLDE proposal

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Stored in heavy-ion storage rings, secondary beams enable a wide range of nuclear physics experiments. Such experiments profit, e.g., from high resolving power and excellent quality of cooled beams, from high revolution frequencies, which allows to “recycle” exotic nuclei, from ultra-high vacuum conditions, which allows to preserve high atomic charge states, from low background conditions, etc. These are some of the reasons, that a variety of novel ideas has been proposed in the recent years in addition to the well-established scientific programs on in-ring mass and half-life measurements [1,2].

However, many suggested experiments require stored, highly-charged exotic nuclei at relatively low energies of a few MeV/u. Therefore, it is of interest to explore the possibility of installing a storage ring at an ISOL facility, which naturally delivers low-emittance low-energy beams. To be more specific, we propose to store HIE-ISOLDE beams in a storage ring, where we would like to perform precision experiments. For this purpose we suggest to employ the Test Storage Ring (TSR) presently in operation in Heidelberg [3]. The running of the TSR will be stopped soon and it will be possible to move and install the TSR at HIE-ISOLDE facility. The physics cases include nuclear- and atomic physics experiments. A few examples of proposed studies are listed below:

- beta decay of highly-charged ions;
- astrophysical reactions;
- one- and two-nucleon transfer reactions;
- search for long-lived isomeric states;
- dielectronic recombination on exotic nuclei;
- clean isomeric beams;
- feasibility studies for beta-beam project.

In this contribution we will present the proposal, outline the physics cases and give the present status of the project.

[1] B. Franzke, H. Geissel & G. Münzenberg, *Mass Spectrom. Rev.* 27 (2008) 428

[2] X.L. Tu et al., *Phys. Rev. Lett.* 106 (2011) 112501.

[3] Ion Storage Ring TSR, <http://www.mpi-hd.mpg.de/blaum/storage-rings/tsr/index.en.html>

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