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The stacked-ring ion guide and the MR-TOF MS developed for the NEXT experiment

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The NEXT experiment [1] is currently being built at the AGOR facility in Groningen. NEXT aims to study Neutron-rich EXotic, heavy nuclei around $N=126$ and in the transfermium region which are produced in multi-nucleon Transfer reactions. Precision mass spectrometry and decay spectroscopy will be used to characterize these nuclei.

The target-like transfer products are pre-separated from the primary beam and lighter projectile-like products within the magnetic field of a superconducting solenoid magnet. They are slowed down by use of a gas catcher. A continuous and divergent beam of low energy ions is extracted from the gas catcher which has to be transformed to well-focused bunches of ions with keV energy suitable for time-of-flight mass measurements. For this purpose, a new ion guide consisting of a stack of ring electrodes has been developed where deviation in a radio-frequency duty cycle is introduced to transport the ions along the ion guide and produce ion bunches [2]. A recently designed multi-reflection time-of-flight analyzer [3] will be used for isobaric separation and mass measurements.

At the moment, the custom-made ion guide and MR-TOF mass spectrometer (MR-TOF MS) are being commissioned and its performance has been studied using an alkali ion source. In this contribution, the first tests of the setup will be presented and discussed.

[1] J. Even, X. Chen, A. Soylu, P. Fischer, A. Karpov, V. Saiko, J. Saren, M. Schlaich, T. Schlathöler, L. Schweikhard, J. Uusitalo, and F. Wienholtz, The NEXT Project: Towards Production and Investigation of Neutron-Rich Heavy Nuclides, *Atoms* 10, 59 (2022).

[2] X. Chen, J. Even, P. Fischer, M. Schlaich, T. Schlathöler, L. Schweikhard, and A. Soylu, Stacked-Ring Ion Guide for Cooling and Bunching Rare Isotopes, *Int. J. Mass Spectrom.* 477, 116856 (2022).

[3] M. Schlaich, Development and Characterization of a Multi-Reflection Time-of-Flight Mass Spectrometer for the Offline Ion Source of PUMA, Master's thesis, Technische Universität Darmstadt(2021).

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