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Isomeric beams, LIfetimes and MAsses: The ILIMA project at FAIR

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Nuclear physics experiments in heavy-ion storage rings have proven a high potential over the last decades [1,2]. The ILIMA collaboration (Isomeric beams, LIfetimes and MAsses), based on experiences with the GSI Experimental Storage Ring (ESR) and IMP cooler-storage ring (CSRe) aims at accurate measurement of masses, lifetimes and decay modes of nuclear isomers and ground states at the new FAIR facility, where the new superconducting high-acceptance fragment separator Super-FRS will provide access to the most exotic nuclear species. These nuclides will be separated in flight and stored in dedicated storage rings, where their properties will be studied.

Two complementary techniques of isochronous mass spectrometry (IMS) and Schottky mass spectrometry (SMS) have been developed. The former one enables mass measurements with a relative mass accuracy of about 1*10^{-6} for nuclides with lifetimes below 0.1 ms. Whereas the latter one, applied to electron-cooled ions (cooling time requires about 1 s), allows reaching mass uncertainties of a few 10 keV only.

Both techniques require just a few particles for a successful measurement, and therefore give access to the nuclides with extremely small production yields. This has for instance been demonstrated by the accurate mass measurement of 208Hg [3], which has been achieved on a single stored hydrogen-like ion. The decay mode of a single ion can be characterised through accurate mass determination before and after the decay event [4].

The ILIMA collaboration is developing the next generation of experiments which inevitably demands new generation detection and analysis methods. In this contribution the present status of the project will be given. Also the planned future developments will be outlined.

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Primary authors: Prof. ILIMA, Collaboration (http://www.gsi.de/forschung/fair_experiments/NUSTAR/ilima_e.html); Dr LITVINOV, Yuri (GSI Helmholtzzentrum für Schwerionenforschung)

Presenter: Dr LITVINOV, Yuri (GSI Helmholtzzentrum für Schwerionenforschung)

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