Experiments with stored exotic nuclei at GSI now and in future

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Experimental results on masses and lifetimes of exotic nuclei will be reported. Relativistic exotic nuclei produced via projectile fragmentation and fission were separated in flight by the fragment separator FRS and injected into the storage ring ESR for precise mass- and lifetime measurements. Direct mass measurements of electron-cooled exotic nuclei were performed using Schottky spectrometry. Fragments with half-lives shorter than the time required for electron cooling have been investigated by time-of-flight measurements with the ESR being operated in the isochronous mode. This novel experimental technique gives access to all nuclei with half-lives down to the microsecond range and has been successfully applied in first experiments.

Lifetimes of stored bare and few-electron ions have been measured with the goal to study the beta-decay under ionization conditions prevailing in stellar plasma. For the first time the direct observation of bound-state beta decay has been achieved with ^{207}Tl fragments.

The future project FAIR includes a new large-acceptance in-flight separator (Super-FRS) in combination with a new storage ring system (CR, NESR). The Super-FRS will be an ideal telescope to study the r- and rp-process nuclei.