

Molecular Ion Beams Stored for an Hour: First Operation and Physics Results of the Heidelberg CSR

The new cryogenic electrostatic storage ring CSR at the Max Planck Institute for Nuclear Physics can store atomic, molecular and cluster ion beams from an accelerating platform (up to 300 kV) on a closed orbit in a low-temperature environment at extremely high vacuum. Compared to conventional experiments, collisions with residual gas molecules are greatly reduced, leading to very long storage lifetimes. The low blackbody field (at ~ 10 K) avoids radiative heating of the stored particles and allows their infrared active degrees of freedom to relax to cryogenic temperatures. The stored particles – essentially unlimited in mass at a given kinetic energy, and in highly controlled internal quantum states – can then interact with merged and crossed colliding beams: lasers, electrons and neutral particles, with reaction products detected on a single-event basis. We present the physics goals, properties, and first achievements of this versatile new instrument.