Cold ion-molecule collisions in a cryogenic hybrid trap

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In recent years, collisions of cold atoms with atomic and molecular ions have been studied intensively [1]. The development of “hybrid traps” which allow for the simultaneous trapping of cold neutral atoms and ions have paved the way for gaining insights into the nature of ion-atom collisional processes at very low temperatures [2].

We are currently developing a cryogenic trap for the simultaneous confinement of cold neutral molecules and cold molecular ions. Translationally cold neutral molecules are produced by Stark deceleration and loaded into a magnetic trap [3]. The magnetic trap’s center can be mechanically displaced and superimposed with the center of an RF ion trap. The interaction of room temperature black body radiation (BBR) results in rotational excitation of the OH leading to trap loss after few seconds. To alleviate this effect, the hybrid trap is cooled down to 15 K to be shielded from room temperature BBR, which is increases the lifetime of the trapped molecules by several orders of magnitude, commensurate with the trap lifetime of the ions.

This new setup will allow for the first time studies of ion-molecule collisions in the millikelvin regime. We will present a detailed characterization of the experiment and first results.

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