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Ultracold collisions between Rb atoms and a Sr^+ ion TOMAS SIKORSKY, ZIV MEIR, RUTI BEN-SHLOMI, YEHONATAN DALLAL, ROEE OZERI, Department of Physics of Complex Systems, Weizmann Institute of Science, Rehovot, Israel — In last decade, a novel field emerged, in which ultracold atoms and ions in overlapping traps are brought into interaction. In contrast to the short ranged atom-atom interaction which scales as r^{-6}, atom-ion potential persists for hundreds of μm's due to its lower power-law scaling - r^{-4}. Inelastic collisions between the consistuents lead to spin and charge transfer and also to molecule formation. Elastic collisions control the energy transfer between the ion and the atoms. The study of collisions at the μK range has thus far been impeded by the effect of the ion's micromotion which limited collision energy to mK scale. Unraveling this limit will allow to investigate few partial wave and even S-wave collisions. Our system is capable of trapping Sr^+ ions and Rb and Sr atoms and cooling them to their quantum ground state. Atoms and ions are trapped and cooled in separate chambers. Then, the atoms are transported using an optical conveyer belt to overlap the ions. In contrast to other experiments in this field where the atoms are used to sympathetic cool the ion, our system is also capable of ground state cooling the ion before immersing it into the atom cloud. By this method, we would be able to explore heating and cooling dynamics in the ultracold regime.

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