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Heating dynamics in ultra-cold ion-atom system MEIRAV PINKAS, ZIV MEIR[1], TOMAS SIKORSKY, RUTI BEN-SHLOMI, NITZAN AKERMAN, ROEE OZERI, Weizmann Institute of Science — Hybrid ultra-cold atom-ion experiments are a fascinating tool for studying quantum aspects of atom-ion collisions. However, even if the atoms are initially prepared in the μK regime, the interaction energy at steady-state is limited to a few mK since the ion is heated up by the collisions. An approaching atom shifts the ion from its equilibrium position and the collision occurs at a non-vanishing rf field which, on average, couples energy into the system. In this work we study the dependency of this heating mechanism on several ion trap parameters, for a ground state cooled $^{88}Sr^{+}$ ion immersed in an ultra-cold bath of ^{87}Rb atoms. We also investigated, using molecular dynamics simulation, the heating rates, the dynamics of the ion energy distribution and their dependency on various parameters such as the trapping potentials and atom-ion mass ratios. We find that the ion energy distribution evolves from the ground-state to a hot distribution with a high-energy power-law tail which depends on the various trap parameters. The measured heating rates, for different rf confinements of the Paul trap, were compared to the molecular dynamics simulation.

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