ÉCOLE DE PHYSIQUE DES HOUCHES

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Trapped Ions in Rydberg-Dressed Atomic Media

Content

We report on our hybrid experiment which aims at studying trapped ions interacting with ultracold atoms that are off-resonantly coupled to Rydberg states. Since the polarisability of the Rydberg-dressed atoms can be extremely large, the interaction strength between ions and atoms increases tremendously as compared to the ground state case. Such interactions may be mediated over micrometers and could be used to entangle atoms and ions, to study spin-phonon couplings or to mediate spin-spin interactions [1]. Furthermore, we calculate how to employ Rydberg dressing on a dipole-forbidden transition to generate a repulsive atom-ion potential [2]. This prevents collision-induced heating of the ion due to its micromotion, which is found to limit attainable temperatures in atom-ion hybrids. We discuss our experimental approach for Rydberg dressing of Li atoms as well as a detailed theoretical analysis of Rydberg atom-ion interaction.

[1] T. Secker, R. Gerritsma, A. W. Glätzle, and A. Negretti, *Phys. Rev. A* **94**, 013420 (2016).

T. Secker, N. Ewald, J. Joger, H. Fürst, T. Feldker, and R. Gerritsma, *Phys. Rev. Lett.* **118**, 263201 (2017).

Summary

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