Interacting laser-trapped circular Rydberg atoms

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Circular Rydberg atoms, namely Rydberg atoms with maximal orbital momentum, have long natural lifetimes, typically 100 times longer than their low-momentum counterparts. This makes them well suited to the quantum simulation of the dynamics of interacting quantum systems. Our experimental setup allows us to laser trap individual circular Rydberg atoms in an array of hollow optical tweezers, or bottle optical beams [1].

In this talk, I will report on our recent experimental activities that demonstrate the dipole-dipole interaction between two circular Rydberg atoms [2]. We characterize this interaction through microwave spectroscopy and observe the coupling between spin and motional degrees of freedom that it can induce. I will also show how we use the dipole-dipole interaction to locally detect and manipulate circular Rydberg atoms in the array.

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[1] B. Ravon et al, Phys. Rev. Lett. 131, 093401 (2023)

[2] P. Méhaignerie et al, in preparation