Quantum simulation with laser-trapped circular Rydberg atoms

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Abstract

We have recently proposed a novel plateform to simulate arrays of interacting spins [1]. It is based on laser-trapped circular Rydberg atoms, which combine long lifetimes (few tens of ms) and strong dipole-dipole interactions.
Here, I will show how we have been able to prepare circular Rydberg states from laser-cooled Rubidium atoms in a 4K cryostat.
We demonstrate a long lifetime of 3; 7 ms for the n = 52 circular Rydberg state and characterize their decoherence [2].
I will also report on 2D laser-trapping of circular Rydberg atoms in a hollow Laguerre-Gauss laser beam [3]. We trap the atoms for up to 10 ms and fully characterize the trapping potential. Those results constitute a decisive step towards the realisation of the proposed quantum simulator.

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