Master thesis proposal

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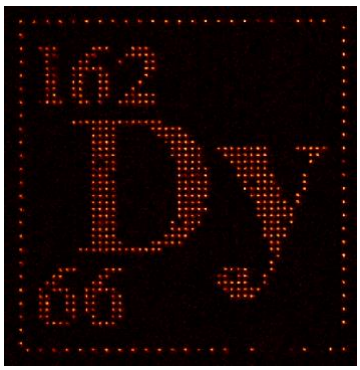
Collective spontaneous emission in arrays of single Dy atoms

Keywords: Atomic physics, light matter interaction, quantum simulation



This project takes place on an experimental platform producing **arrays of single dysprosium atoms** [1-4]. The goal of the internship and following PhD project is to study collective light scattering and light emission in ensembles of single atoms in a fully quantum regime, in particular to explore superradiance and subradiance.

In ordered arrays, the effects are spectacular when the interparticle distance is a fraction of the wavelength of the light. In order to achieve this, we have **recently combined tweezer arrays and an accordion lattice** loaded from the tweezer array. This allows to reach interatomic distances down to 330 nm smaller than the wavelength of the narrow atomic transition at 741 nm. This lattice is magic for the transition to trap ground and atomic states, a prerequisite for the studies. During the internship, which is experimental, we will prepare chains of single atoms with short interatomic spacing and perform ground state cooling on a narrow transition to obtain full control over the atoms' quantum states. This will then allow us to study super and subradinace in a fully controlled setting. Following these studies, we will design methods to measure the individual spin state in the J=8 ground state manifold of Dy in order to open for the possibility of spin systems with large J and single atom resolution, a feature unique to Dy and hardly studied so far.

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References

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