# Two-dimensional arrays of single Rydberg atoms for the quantum simulation of spin systems

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In our experiments, we generate arrays of up to 50 optical tweezers arranged in arbitrary two-dimensional geometries, each containing a single cold atom, and separated by distances of a few micrometers (Fig. 1). This is achieved by active sorting of atoms in larger arrays that are initially loaded stochastically [1]. By exciting the atoms to Rydberg states (with principal quantum numbers in the range 50–100), we can induce strong, tunable dipolar interactions between the atoms [2].

This system is an ideal platform for the quantum simulation of spin Hamiltonians. By using van der Waals interactions we can implement the quantum Ising model in a transverse field and observe the dynamics of the magnetization and of correlation functions following a quantum quench [3]. Using resonant dipole-dipole interactions, we observed the propagation of a spin excitation in a minimalistic spin chain of three atoms governed by the XY Hamiltonian [4].

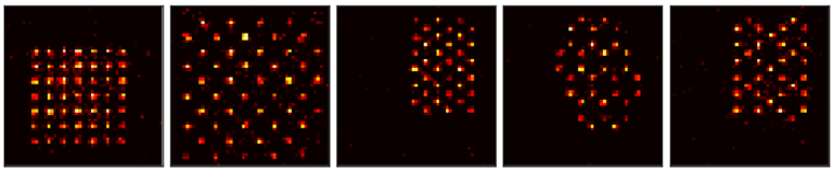

**Fig. 1:** Examples of fully loaded, two-dimensional arrays of individual atoms with various geometries that are relevant for quantum simulation of spin Hamiltonians. The typical distance between nearest-neighbour atoms is 4 $\mu$m.

## References

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