# Single atoms register in a micro-cavity for multi-particle entanglement

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Motivated by applications in quantum-enhanced metrology and quantum information processing, we are building a cold atom experimental platform devoted to multi-particle entanglement generation with a high finesse fiber optical cavity as key feature. In this cavity, $^{87}$Rb atoms resonant at 780nm, will be trapped at the antinodes of a 1560nm, i.e. twice 780nm, standing wave, forming a 1D lattice of equally and strongly coupled single atoms. In addition, a high numerical aperture lens will allow for single-site detection and addressing as shown on figure 1, and Raman transitions will be driven by tranverse beams thanks to the large optical access to the cavity.

Quantum-enhanced metrology schemes can be explored and caracterized in this setup, in particular dissipative preparation of spin squeezed atomic ensembles [1].

This system can also realise an effective Dicke model, as proposed in [2], which exhibits a quantum phase transition, already observed for large numbers of atoms [3][4]. With smaller atom number (10 to 50 atoms) we will be able to use quantum tomography techniques [5] to study the role of entanglement in the vicinity of the quantum phase transition as well as its scaling laws.

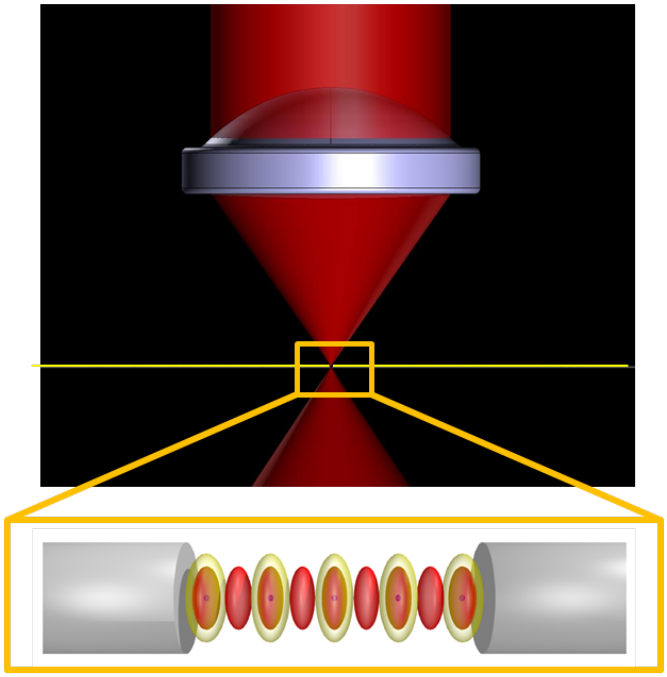

**Figure 1:** *1D lattice of $^{87}$Rb single atoms in the fibered cavity with a high numerical aperture lens*

## References

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[5] F. Haas *et al.* Science, **344**, 180 (2014)