

# Emergent Phenomena with Ultra-Cold Atoms in a Traveling-Wave Optical Cavity

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The cold rubidium atoms are trapped in the optical potential realised by injecting a 4 mirrors traveling-wave cavity with a laser at telecom wavelength. To enhance the atom loading, a protocol based on gray molasse [1] is used. A BEC was already achieved in the cavity by evaporative cooling [2], and now the new challenge is trying to condense the atoms using an all-optical scheme.

With the BEC we plan to study self-ordering phenomena in the ring cavity. The traveling-wave cavity eliminates the fixed boundary conditions at the mirrors imposed by conventional standing-wave cavities, enabling nearly uniform atom–light coupling across the ensemble. Thus, during crystallisation, a free phase is induced in the optical lattice and, consequently, in the emerging atomic lattice, providing a continuous parameter.

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[1] D. S. Naik *et al.*, *Phys. Rev. Res.* **2**, 013212 (2020).

[2] D. S. Naik *et al.*, *Quantum Sci. Technol* **3**, 045009 (2018).