

# Quantum Optics Seminar

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„Dissipative dynamics and many-body dark states in cavity-BEC systems“

## Abstract

Cavity-atom systems provide a platform for simulating a large variety of quantum phenomena. Recently, the driven-dissipative nature of the system is known to introduce new phases of matter unseen in closed systems. In this talk, we investigate a dissipative cavity coupled to an ensemble of V-shaped three-level atoms with underlying  $SU(3)$  structure. We discuss how the dissipation, together with the atomic level structure, universally stabilises a continuous family of dark and nearly dark excited many-body states with inverted atomic populations as the steady states. The dynamics towards these multistable states is accompanied by a superradiant photon burst, and characterised by a significant dependence on the chosen ramping path and rate of the system parameters. Lastly, our results on the  $SU(3)$  system capture the essence of an experimentally-observed cascade of directional, photon-assisted tunnelling processes on a lattice in momentum space, which is realised by a spinor Bose-Einstein condensate driven by two Raman lasers and coupled to a dissipative cavity.

**Tuesday | 11.10.2022 | 15:00 | Schrödinger lecture hall | IQOQI**