# Experiments with subradiant atomic ensembles in a high-finesse optical cavity

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We report on our recent experiments performed with cold atoms strongly coupled to a single mode of a high-finesse optical cavity. We demonstrate an optical bistability between two hyperfine ground states of the atoms [1]. While the atomic saturation is kept low, the source of nonlinearity is a cavity-assisted pumping between ground states of the atoms [2] and the stability depends on the intensity of two driving lasers. We interpret the phenomenon in terms of the recent paradigm of driven-dissipative phase transitions [3], where the transmitted and driving fields are understood as the order and control parameters, respectively. Furthermore, we explore the radiation properties of light scattered by atoms into the cavity when they are in a subradiant configuration.

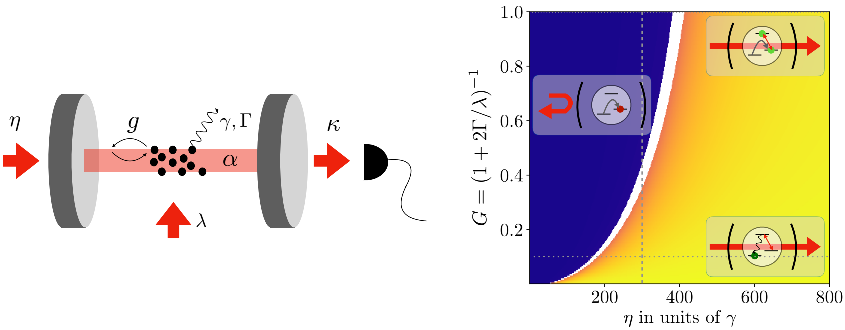


**Fig. 1:** (Left) Cavity QED scheme with competing optical pumping processes driven by the cavity field and the transverse illumination $\lambda$. (Right) Phase diagram as a function of the drive strengths $\eta$ and $\lambda$. Colour coding indicates the intracavity intensity relative to an empty resonantly driven cavity. The white domain separating the dark blue ('transmission blockade') and the yellow ('bright') phases corresponds to quantum bistability, i.e., the coexistence of both phases.

## References

[1] B. Gábor, et al, Phys. Rev. A **107** 023713 (2023)
[2] T. W. Clark, A. Dombi, et al, Phys. Rev. A **105** 063712 (2022)
[3] A. Vukics, A. Dombi, J. M. Fink, and P. Domokos, Quantum **3**, 150 (2019)

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