

Bose-Einstein condensation meets Cavity QED

T. Esslinger

Department of Physics, ETH Zurich, Switzerland.

Cavity quantum electrodynamics (cavity QED) has proven to be exceedingly successful in illuminating matter-light interaction and in providing a platform to test ideas for quantum information processing. In this talk I will report on the strong coupling of a Bose-Einstein condensate to the quantized field of an ultrahigh-finesse optical cavity. The experiment brings us into a new regime of cavity QED where all atoms occupy a single mode of a matter-wave field and couple identically to the light, sharing a single excitation [1].

By coupling the field mode of the cavity to a collective density excitation of a Bose-Einstein condensate we have realized a cavity opto-mechanical system in the quantum regime and observed its strongly driven back-action dynamics. The results are surprising on a conceptual level and open a new avenue for cavity opto-mechanics and quantum gases with non-local interactions [2].

References

[1] F. Brennecke, T. Donner, S. Ritter, T. Bourdel, M. Köhl, T. Esslinger, *Cavity QED with a Bose-Einstein condensate*, Nature **450**, 268 (2007).

[2] F. Brennecke, S. Ritter, T. Donner, T. Esslinger, *Cavity Opto-Mechanics with a Bose-Einstein Condensate*, arXiv:0807.2347.