Dissipative Phases of a Bose-Einstein Condensate of Photons

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Bose-Einstein condensation has been observed with cold atomic gases, exciton-polaritons, and more recently also with low-dimensional photon gases e.g. in a dye solution-filled optical microcavity. I here report on experiments observing a non-Hermitian phase transition in a photon Bose-Einstein condensate realized in the dye-microcavity platform. The dissipative phase transition occurs due to an exceptional point in the condensate that is associated with the (small) system losses. While usually Bose-Einstein condensation is separated by a smooth crossover to lasing, the presence of the here observed phase transition reveals a state of the light field characterized by a bi-exponential second order coherence that is separated by a phase transition from lasing [1]. In more recent work, we have performed a critical test of the thermal nature of the photon condensate coupled to the reservoir of photo-excitable dye molecules by probing the fluctuation-dissipation theorem in this system [2].

References

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