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Thermo-optically induced interactions in photon Bose-Einstein Condensates[1] HADISEH ALAEIAN, Northwestern University, CLARA BARTELS, MARTIN WEITZ, University of Bonn — Bose-Einstein condensation (BEC), a new state of matter, emerges when the de Broglie wavelength of bosons becomes larger than the particle separation, leading to a macroscopic occupation of the system ground state. Followed by the first experimental demonstrations of BEC in cold atomic gases, this phase transition has been observed in other bosonic gases, as polaritons and phonons. The most recent one, photon BEC, is a promising candidate for a new generation of coherent photon sources. Due to their infancy, however, many of their properties are still unknown or only partly explored. In this talk I will present my latest results on the implications of photon interactions in photon BECs. In particular, I will investigate the effect of a thermo-optic non-linearity, leading to spatially non-local and delayed interactions. Starting from the steady state behavior, I will explore the spectrum of elementary excitations as a small perturbation. Moreover, I will discuss the resulting effective photon dispersion, manifesting various properties including possible superfluidity, as well as roton and maxon modes. The implications of physical parameters as absorption, number of photons in the condensate, and cavity trap on the dispersion will be discussed. The results of this study shed new light on the implication of interactions in photonic many-body systems.

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