BEC-BCS crossover in an equilibrium exciton-polariton condensate

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Microcavity exciton-polariton systems in two-dimensions are long anticipated to exhibit a crossover from Bose-Einstein condensate (BEC) to Bardeen-Cooper-Schrieffer (BCS) superfluid, when the carrier density is tuned to reach the Mott transition density. Yet, theoretical understanding of such a BEC-BCS crossover largely relies on the mean-field framework [1, 2] and the nature of carriers at the crossover remains unclear to some extent. Here, inspired by the recent demonstration of a BCS polariton laser [3] and based on a simplified description with contact interactions to model the attraction between electrons and holes, we investigate quantum fluctuations of an exciton-polariton condensate and determine the number of electron-hole pairs, condensed photons and polaritons at the crossover beyond mean-field. We find that the exciton-polariton condense remains in the strong-coupling regime, when the carrier density is much larger than the Mott density.

References

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