Boguliobov modes correlations in a polariton quantum fluids

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The study of collective excitations in quantum fluids is fundamental to understand nonequilibrium dynamics and many-body interactions. In this work, we report the first experimental measurement of correlations between collective excitation modes—Bogoliubov modes—in a quantum fluid of microcavity exciton-polaritons. By using a balanced detection set-up [1], we measure intensity correlation between the normal and ghost branches, probing the fluctuation dynamics of polariton fluids and extracting the spectral correlations of Bogoliubov excitations. We observe a clear enhancement of the intensity correlations when the polariton fluid operates near the turning point of the bistabilty due to the emergence of correlated phonon-like excitations. These correlations, seeded by quantum and thermal fluctuations [2], provide insights into the role of the nonlinear and phononic interactions in the collective excitations of a polariton quantum fluid.

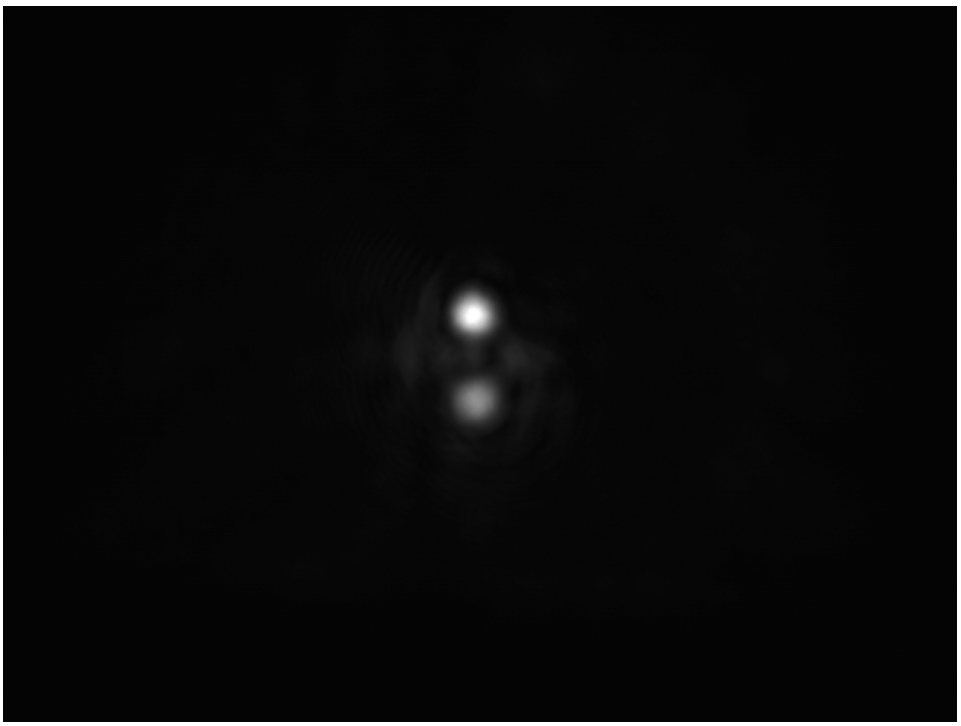

Figure 1: Momentum space picture of the probe signal and its idler after filtering out the pump signal.

References

[1] M. Romanelli et al. Four Wave Mixing Oscillation in a Semiconductor Microcavity: Generation of Two Correlated Polariton Populations Phys Review . Lett 102 106401 (2007)

[2] I . Frérot et al. , Bogoliubov Excitations Driven by Thermal Lattice Phonons in a Quantum Fluid of Light. Phys Review Letters. 13, 041058 (2023)