BOSE-EINSTEIN CONDENSATION AND STIMULATED THERMALIZATION IN PLASMONIC LATTICES

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Bose-Einstein condensation has been realized for various particles or quasi-particles, such as atoms, molecules, photons, magnons and semiconductor exciton polaritons. We have recently experimentally realized a new type of condensate: a BEC of hybrids of surface plasmons and light in a nanoparticle array [1]. The condensate forms at room temperature and shows ultrafast dynamics. We utilized a special measurement technique, based on formation of the condensate under propagation of the plasmonic excitations, to monitor the sub-picosecond thermalization dynamics of the system. Recently, we have achieved such Bose-Einstein condensation also at the strong coupling regime, and shown by varying the lattice size that the thermalization in these systems is a simulated process that occurs in 100 femtosecond scale [2]. This new platform is ideal for studies of differences and connections between BEC and lasing [3,4,5]. While usually lasing in nanoparticle arrays occurs at the centre of the Brillouin zone, we have now demonstrated lasing also at the K-point [6]. The lasing mode can be identified with the help of group theory. Clear lasing is observed despite a narrow band gap at the K-point, which is promising considering future studies of topological photonics. Nanoparticle arrays are well suited for studies of topological phenomena due to the easy tunability of the array geometry and the system symmetries.

References

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