Exciton polaritons in perovskite lattices at room temperature

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Microcavity exciton polaritons are part-light, part-matter quasiparticles emerging from the quantum hybridization of excitons and microcavity photons. As strong-interacting bosons, they have been exhibited rich quantum dynamics in the past decades. With the development of microfabrication techniques, polariton condensates can be precisely trapped in periodical potentials to form artificial lattices, which have led to a wide range of important applications, such as ultrafast simulators of the X-Y Hamiltonian[1], topological Chern insulators[2] and topological lasers[3]. However, such realizations have been limited in GaAs system, which can only work at liquid helium temperatures. Here, we demonstrate our latest results on perovskite microcavities, which serve as a promising system to realize artificial polariton lattices operating at room temperature. Specifically, we demonstrate the observation of exciton polariton condensation in a one-dimensional strong lead halide perovskite lattice at room temperature. Modulated by deep periodic potentials, the strong lead halide perovskite lattice exhibits a large forbidden bandgap opening up to 13.3 meV and a lattice band up to 8.5 meV wide (Fig.1), which are at least 10 times larger than previous systems. Above a critical density, we observe exciton polariton condensation into p_y orbital states with long-range spatial coherence at room temperature. In addition, we also demonstrate the realization of a perovskite zigzag lattice with topological protected edge states Our results pave the way to implement artificial polariton lattices for quantum simulation and topology at room temperature.

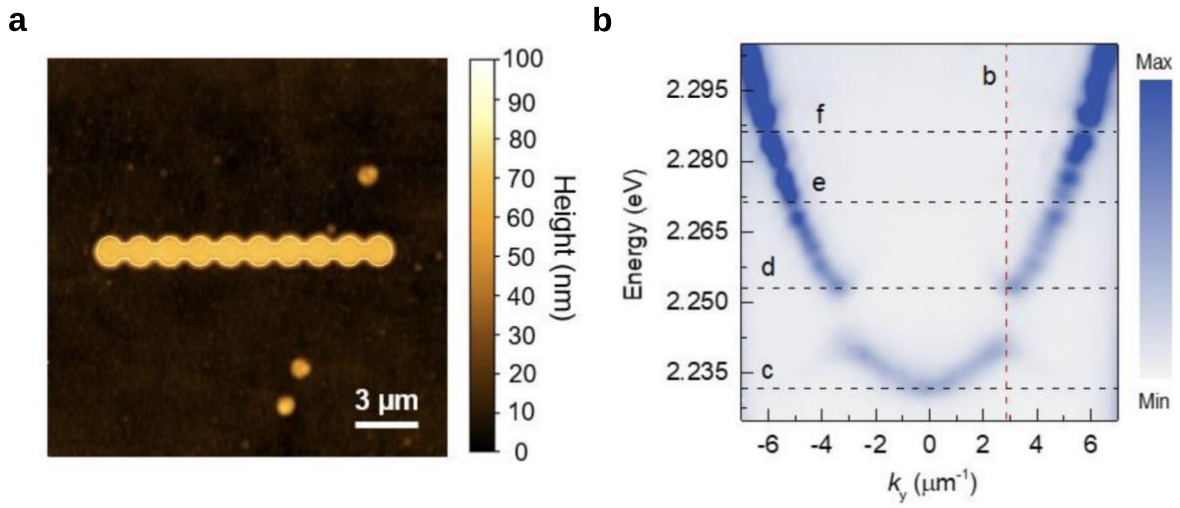

Fig.1. **a**, Atomic microscopy image of the perovskite lattice. **b**, Energy-resolved dispersion of the perovskite lattice.

References

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