ROOM TEMPERATURE ORGANIC EXCITON-POLARITON CONDENSATES IN TAILORED LANDSCAPES

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Interacting Bosonic condensates, loaded in periodic potentials have emerged as a prime system for on-chip quantum simulation, exploration of exotic quantum phases, and topological photonics. However, such experiments, which rely on a well-defined shaping of the potential landscape of the condensates, have been restricted to ultra-cold temperatures in atomic systems in laser traps, or cryogenic temperatures for exciton-polaritons in the mature GaAs platform. In our work, we present first experiments conducted on a condensate of exciton-polaritons in a lattice at ambient conditions. We utilize fluorescent proteins as an excitonic gain material, providing ultra-stable Frenkel excitons, and directly take advantage of their soft nature by mechanically shaping them in the photonic lattice environment.
I will discuss the following observations:

- The high quality of our device allows us to generate a close-to ideal bandstructure of the lattice, arranged by tightly bound polaritonic traps [1].
- The high structural quality of our material allows us to enter the regime of bosonic condensation at ambient condition in this lattice [1,2].
- Microscopic modelling allows us to establish the fundamental understanding about polaritonic non-linearities based on Frenkel-Excitons [2]
- By shaping the pump spot, we can load the condensate into distinct lattice modes and symmetries at will. This capability is a powerful tool for any sort of advanced experiments relying on collective transitions of coherent bosonic states.

References

[1] Dusel, Marco, et al. "Room temperature Organic Exciton-Polariton Condensate in a Lattice." *arXiv preprint arXiv:1907.05065* (2019).

[2] Betzold, Simon, et al. "Coherence and Interaction in confined room-temperature polariton condensates with Frenkel excitons." *arXiv preprint arXiv:1906.02509* (2019).