

# Towards Bose-Einstein condensation of exciton polaritons at room temperature: tunable liquid crystal microcavities

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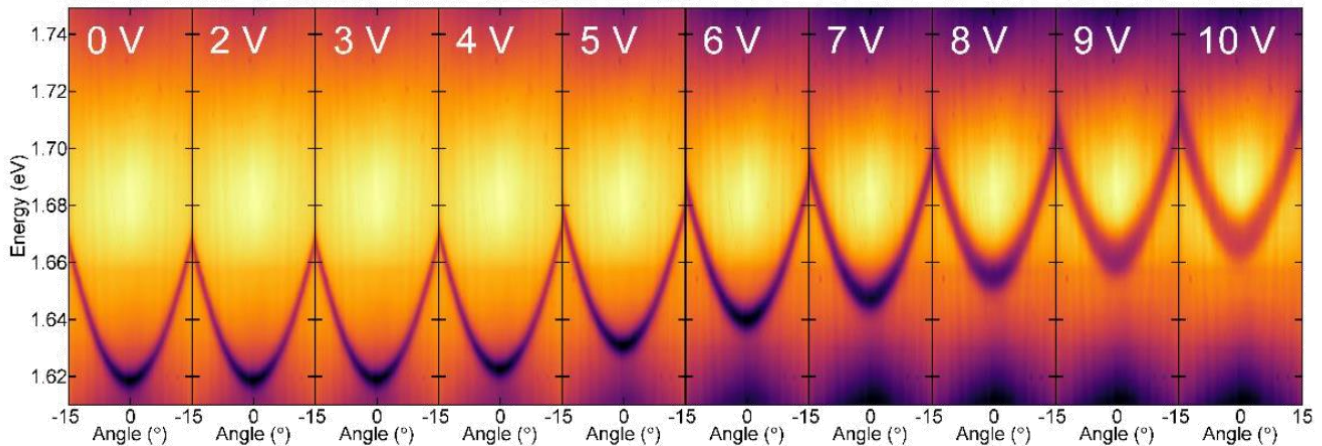
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The possibility to observe the exciton polaritons - quasiparticles arising from a strong coupling of cavity photons and excitons in local emitters (e.g. dye molecules, transition metal dichalcogenides (TMDs) monolayers) - relies heavily on the tuning of energy difference between excitonic and photonic mode. Exciton polaritons are bosons with a small effective mass, for which nonlinear phenomena such as superfluidity, polariton lasing or Bose-Einstein condensation can be observed at room temperature.

In this communication we present a novel kind of a tunable microcavity consisting of a nematic liquid crystalline (LC) birefringent optical medium enclosed in a typical Fabry-Perot resonator. The long-range order of elongated liquid crystals molecules results in a strong anisotropy in particular in optical properties. The liquid nature of these materials, and most of all the large freedom of molecular reorientation, allow for convenient control of these properties by relatively weak external electric fields. Significant changes in the optical properties of LC can be obtained after applying merely several volts. With the ability to manipulate the permittivity tensor and, therefore, effective refractive indices for different polarizations of light it is possible to tune the energy splitting between cavity modes for transverse electric (TE) and magnetic (TM) fields (Fig. 1). This results in a change of the energy of the photon mode transmitted through the cavity observed in reciprocal space. Our novel device allows for the integration of Bose-Einstein condensates into the room-temperature operating devices.



**Fig. 1.** Dispersion relation of microcavity photonic mode under applied voltage. The incident light for transmission experiment was horizontally polarized.

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