SYNTHETIC OPTICAL SPIN-ORBIT INTERACTION IN TUNABLE LIQUID CRYSTAL MICROCAVITIES

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By enclosing a nematic liquid crystalline (LC) birefringent medium inside a microcavity (MC), in which LC anisotropy can be controlled with external electric field, we are able to spectrally tune and couple subsequent cavity modes. [1] Recently, we've demonstrated a Rashba-Dresselhaus-like spin orbit coupling (SOC) in such structure, when modes of different parity were brought into a resonance. [2]

In this work, we investigate polarization-resolved dispersion of spin-orbit coupled modes in a microcavity, that operates in weak coupling regime, with organic dye incorporated within LC layer. We are allowed to trace cavity modes by detecting photons emitted from the nonresonantly excited sample. We performed angle-resolved tomography of the emission to fully map dispersion relation of the cavity modes for all directions of in-plane wave vector of the cavity photons. Polarisation-resolved energy-momentum tomographies for all major regimes in LC MC were included in research: resonance of the modes with opposite parity, when they are coupled by Rashba-Dresselhaus spin-orbit coupling term (Fig. 1) and resonance of the modes of the same parity.

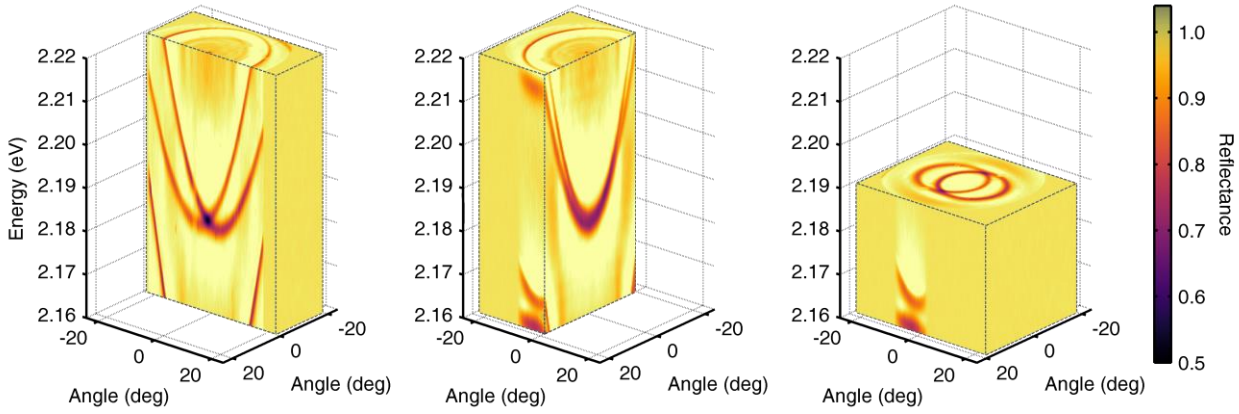

Fig. 1. Dispersion relation tomography, measured in reflectance, illustrating regime of resonance of the modes with different parities (voltage applied to the sample).

[1] K. Lekenta et al., Tunable optical spin Hall effect in a liquid crystal microcavity. Light Sci. Appl. **7**, 74 (2018).
[2] K. Rechcińska et al., Engineering spin-orbit synthetic Hamiltonians in liquid-crystal optical cavities. Science **366**, 727 (2019)