Experimentelle Physik 2

Seminar Festkörperphysik (CMP Seminar)

Aktuelle Probleme der Festkörperphysik für Studenten und Mitarbeiter
020236 Kolloquium/Seminar SS 25
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Optics of twisted photonic bilayers

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We discuss optical phenomena emerging in twisted photonic bilayers, the optical counterparts of twisted electronic van der Waals structures. Photonic bilayers are composed of two dielectric slabs with in-plane modulation of the dielectric permittivity. Each isolated layer exhibits an isotropic optical response. When the layers approach each other, the electromagnetic interaction occurs via the near fields giving rise to optical activity controlled by the interlayer distance and the twist angle.

Twisted photonic structures are chiral and their optical response is sensitive to both the circular polarization (spin angular momentum, SAM) and orbital angular momentum (OAM) of photons. As a results, a beam of unpolarized light passing through such a structure acquires SAM. In the reflected beam, a nonzero OAM arises, i.e., the light becomes twisted. Interestingly, both effects do not require light absorption and can be observed in transparent media. We discuss the physics and microscopic theory of these optical phenomena.

E.S. Vyatkin, A.V. Poshakinskiy, and S.A. Tarasenko, Emergent spin and orbital angular momentum of light in twisted photonic bilayer, Phys. Rev. B **111**, 125303 (2025).