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EINLADUNG zum IFP-SEMINAR

Spin-Electric Coupling in Lead-Halide Perovskites

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Host: Alexey Shuvaev

Termin: Donnerstag, 24. November 2022, 15:00 Uhr

Ort: Institut für Festkörperphysik, TU Wien
Wiedner Hauptstraße 8-10, 1040 Wien
Seminar Raum DB gelb 09 (gelber Bereich, 9. OG)

Abstract:

Lead-halide perovskites enjoy a number of remarkable optoelectronic properties. To explain their origin, it is necessary to question how electromagnetic fields interact with these systems. We address this question here by studying two classical quantities: Faraday rotation and the complex refractive index in a paradigmatic perovskite $CH_3NH_3PbBr_3$ in a broad wavelength range. We find that the minimal coupling of electromagnetic fields to the $\boldsymbol{k} \cdot \boldsymbol{p}$ Hamiltonian is insufficient to describe the observed data even on the qualitative level. To amend this, we demonstrate that there exists a relevant atomic-level coupling between electromagnetic fields and the spin degree of freedom. This spin-electric coupling allows for quantitative description of the interaction of lead halide perovskite lattice with electromagnetic field, both in linear and non-linear regimes. We proceed to demonstrate, based general symmetry-based phenomenological arguments, that in the low-energy limit our effective model includes all possible couplings to the electromagnetic field in the linear order. We conclude by giving of a few examples of the novel exotic phenomena predicted by our model.