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Title: Cavity solid-state materials engineering from quantum electrodynamical density functional theory

Abstract: Embedding solids in optical cavities enables equilibrium control of materials properties without external driving, opening routes to enhance ferromagnetism, modify topological protection, and tune metal-insulator transitions, and so on. While conventional density functional theory underpins first-principles studies of extended materials, strongly photon-coupled systems require ab initio frameworks that treat electrons - and, when relevant, nuclei - together with quantized electromagnetic modes. This talk introduces quantum electrodynamical density functional theory (QEDFT) for periodic solids, outlining its core formalism, practical implementations, and surveying recent predictions for cavity-modified phases and properties of solid-state materials. I will show how vacuum fluctuations and collective light-matter coupling renormalize electronic bands, phonon dispersions, dielectric responses, etc. I will conclude with open challenges and opportunities for QEDFT for solid-state materials.