Electrodynamics in Two-Dimensional BEDT-TTF Solids

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A variety of organics with reduced dimensionality and competing interactions between charges, spins and lattice display a multiplicity of ordering phenomena and complex phase diagrams. Novel forms of the low-temperature phases, in particular those featuring ferroelectricity in the two-dimensional molecular solids, have been the focus of intense activity in recent years. Open issues concern the nature of collective charge excitations in the charge- and spin-ordered phases as well as their coupling to applied dc and ac fields. And while some of their features resemble the well-established electrodynamics of conventional charge-density waves in 1D, others appear quite different and have not been encountered until now. In the charge-ordered phase with the formation of ferroelectric-like domains below the metal-to-insulator phase transition, the charge response seems to be reasonably well understood now. Conversely, rather intriguing is the dielectric response in dimer Mott insulator phases with either canted antiferromagnetism or spin liquid. The result that neither charge disproportionation nor charge fluctuations could be detected by infrared vibrational spectroscopy leaves the proposal of ferroelectricity fully open. In order to explain the prominent dielectric relaxation we rather suggest an alternative scenario invoking collective excitations associated to domain walls or charge defects formed in an either magnetically ordered or intrinsically disordered background.