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Dimer-type Organic Salt as Electronic Ferroelectric Material

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In some low-dimensional organic compounds, two molecules form a dimer in a crystal lattice. Two-dimensional molecular conductors, such as κ-(BEDT-TTF)$_2$Cu$_2$(CN)$_3$ are one of the examples, and are termed the dimer-Mott (DM) insulating system. Recently, dielectric anomalies are observed in this class of materials. It is believed that a charge imbalance inside of dimers is responsible for the observed dielectric anomalies. These are recognized as an electronic ferroelectricity [1]. We have examined theoretically electronic states, optical property, and superconductivity in organic salts with the molecular dimer degree of freedom. (1) The electronic structure in a DM system is examined. By analyzing the theoretical model, we clarify that the polar-charge ordered phase attributed to the charge imbalance inside of dimers competes to the non-polar insulating phase [2]. We further examine roles of randomness. (2) The collective charge excitation due to the dimer dipole is found to be realized [3]. The recently found peak structure in the THz spectroscopy is interpreted to be the collective mode [4]. (3) The superconductivity induced by the polar charge fluctuation is examined by the Hubbard-type model. Role of frustration and competition to the spin fluctuation are focused on [5].

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