



复旦大学物理系 物质科学报告

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Diverse Manifestations of Electron Correlation in Organic Conductors

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Coulomb interactions among electrons have huge impacts on their behavior through competitions of charge localization/delocalization and spin order/disorder. Layered BEDT-TTF compounds host flexible lattice geometries and appreciable Coulomb interactions, both of which are varied by pressure or chemical substitution to display diverse emergent phenomena like a showcase of correlation physics. In case of a half-filled band, the Mott metal-insulator transition shows universal quantum criticality at high temperatures but exhibits lattice-specific behaviour at low temperatures; in particular, a Mott insulator with a triangular lattice carries a spin liquid, which can be doped and superconduct. When a band is quarter-filled, electrons on a triangular lattice, which imposes frustration against Wigner crystallization, exhibit an exotic glass, which crystallizes in a long time, or a frustration-induced anomalous metal. Alternatively, electrons are partially ordered, leading to the emergence of massless Dirac fermions, which show Dirac-cone reshaping, anomalous spin correlation and incipient mass-generation instability due to unscreened long-range Coulomb repulsion. It seems as if organic materials seek for connection to soft-matter physics or particle physics beyond the conventional discipline of solid state physics. In this colloquium, I present our recent works on the above subjects.



Kazushi Kanoda graduated with his Ph.D. in nuclear engineering from Kyoto University in 1987 and worked as a research associate in the Department of Physics, Gakushuin University (1987–1991), an associate professor at the Institute for Molecular Science (1991–1997), and an associate professor in the Department of Applied Physics, the University of Tokyo (1997–1999). He has been a professor of applied physics at the University of Tokyo since 1999. His group has studied electronic properties of molecular materials, including strongly correlated electron systems, massless Dirac fermions, charge-order/glass systems, neutral-ionic transition systems, and π - d interacting systems. He received (i) IBM Japan Prize, 1998, (ii) Japanese Physical Society Award for Academic Papers on Physics, 2006, and (iii) Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Japan, 2019.