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Keynote - The Multiverse of f-electron Quantum Materials

Thursday, 16 March 2023 08:30 (1 hour)

New materials will define tomorrow's technologies. They are part of a materials multiverse where every crystal provides a unique framework to define a new state of matter –some more exotic than others. Notions of topology have provided a new paradigm for understanding some of these new phases of matter and have exciting physical consequences, such as protected surface states and magnetic fields in momentum space. By adding electronic correlations, additional states of matter can emerge with novel types of excitations such as composite fermions and non-abelian anyons. f-electron-based materials possess both strong electronic correlations and strong spin-orbit coupling. This combination suggests that f-electron materials are ideal for discovering new topologically non-trivial phases, which arise as a consequence of strong electronic correlations. In this talk, I will introduce how various fascinating physical phenomena, including heavy fermions, unconventional superconductors, spin liquids, topological Kondo insulators, Weyl semimetals, and Majorana fermions, emerge in f-electron materials and the quantum information science technologies - ranging from quantum computing to dark matter detection - that we aim to enable with them.

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