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【18】A Comprehensive Experimental Approach to Multifunctional Quantum Materials & their Physical Properties: Geometry and Physics in Condensed Matter.

Wednesday 6 September 2023 12:15 (30 minutes)

This thesis ranges within the vast framework of experimental condensed matter physics, producing results on several different systems and their characteristic physical phenomena, which are collected and presented here in a structuralist perspective. In fact, we show how, in solid condensed matter, the underlying arrangement of atoms, the symmetry of their structure, and their mutual interactions, underpin the form and the nature of their collective emergent properties. Our effort in this work was focused on unveiling complex magnetic ground states in newly synthesized materials (such as the low-dimensional colossal magnetoresistance compound NaCr2O4, and the triangular lattice antiferromagnets LiCrSe2 and LiCrTe2), as well as in the clarification of unconventional symmetry breaking phenomena in highly debated systems (such as the superconductor LiTi2O4, the charge density wave system LaPt2Si2, and the topological insulator ZrTe5). In all cases, we could understand the physics of such systems only when we elucidated the details, and temperature dependent evolution, of their structures. To explore these structure-properties relationships, extensive experimental studies using large-scale research facilities were employed, with particular relevance given to neutron scattering.

Theoretical Work

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