

CMP Seminar
Michigan State University

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Anomalous Hall effect with massive Dirac fermions

Anomalous Hall effect arises in systems with both spin-orbit coupling and magnetization. Generally, there are three mechanisms contributing to anomalous Hall conductivity: intrinsic, side jump, and skew scattering. The standard diagrammatic approach to the anomalous Hall effect is limited to computation of ladder diagrams. We demonstrate that this approach is insufficient. An important additional contribution comes from diagrams with a single pair of intersecting disorder lines. This contribution constitutes an inherent part of skew scattering on pairs of closely located defects and essentially modifies previously obtained results for anomalous Hall conductivity. We argue that this statement is general and applies to all models of anomalous Hall effect. We illustrate it by an explicit calculation for two-dimensional massive Dirac fermions with weak disorder. In this case, inclusion of the diagrams with crossed impurity lines reverses the sign of the skew scattering term and strongly suppresses the total Hall conductivity at high electron concentrations.

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Prof. Alex Levchenko - Host