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Magnetism and quantum transport in the kagome lattices of semi-metallic Mn3X[1]

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Lamellar insulating materials with magnetic ions on the kagome lattice of corner-sharing triangles have attracted much attention over the years because of the geometrical frustration and the consequent lack of magnetic ordering at low temperatures. Now it turns out that the non-collinear antiferromagnetic ordering induced by the longer range and inter-kagome-layer interactions of a semi-metal can have interesting effects on quantum transport. Specifically, the AB stacked kagome layers of Mn3X form an anti-chiral co-planar magnetic order that gives rise to strong anomalous Hall and Nernst effects at room temperature linked to Weyl points in the electronic band structure[1]. I shall describe an experimental study of the magnetic order and excitations in Mn3Ge[2]. While a phenomenological spin Hamiltonian including exchange interactions, Dzyaloshinskii-Moriya interactions, and single-ion crystal field terms can describe aspects of the Mn-based magnetism, spin-wave damping, and the extended range of magnetic interactions indicate the strong interactions with conduction electrons that underly its quantum transport anomalies. The talk will illustrate the constructive interplay between the pursuit of a fundamental understanding of electrons in solids and the discovery of materials with novel properties for technological applications. [1] "Large anomalous Hall effect in a non-collinear antiferromagnet at room temperature," S. Nakatsuji, N. Kiyohara and T. Higo, Nature **527** (2016) 212-215. [2] "Antichiral spin order its Goldstone modes and their hybridization with phonons in the topological semimetal Mn_3Ge," Y. Chen, J. Gaudet, S. Dasgupta, G. G. Marcus, J. Lin, T. Chen, T. Tomita, M. Ikhlas, Y. Zhao, W. C. Chen, M. B. Stone, O. Tchernyshyov, S. Nakatsuji, C. Broholm, Phys. Rev. B **102**, 054403, (2020).

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