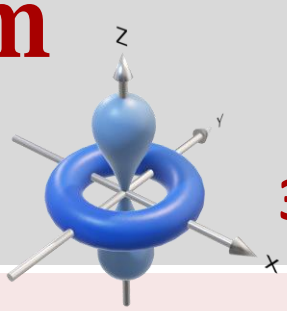
Department of Physics Colloquium

December 4, 2023 **3:00 PM**



The Left Hand of the Electron

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Sixty plus years ago parity violation by the weak force was demonstrated in experiments led by Chien-Shiung Wu on the asymmetry of electron currents emitted in the beta decay of polarized ^{60}Co. The asymmetry reflects two broken symmetries - mirror reflection and time-reversal, the latter imposed by an external magnetic field. The same year Bardeen, Cooper and Schrieffer published the celebrated BCS theory of superconductivity, and soon thereafter P. W. Anderson and P. Morel proposed that the ground-state of liquid ^{3}He (the light isotope of Helium) was possibly a BCS superfluid exhibiting spontaneously broken mirror reflection and time-reversal symmetries. Indeed, superfluid ^{3}He, discovered in 1972, is the realization of a quantum state of matter that violates both parity and time-reversal symmetry. Definitive proof of broken mirror symmetry in ^{3}He came 41 years later from the observation of asymmetry in the motion of electrons in superfluid ^{3}He [1]. I discuss these and related discoveries, as well as the physics underlying anomalous electron transport in such quantum systems with broken mirror and time-reversal symmetries [2,3].

1. H. Ikegami, Y. Tsutsumi, & K. Kono, Chiral Symmetry in Superfluid 3He-A, Science, 341,59–62, 2013.
2. O. Shevtsov & J. A. Sauls, Electrons & Weyl Fermions in Superfluid 3He-A, Phys. Rev. B, 94, 064511, 2016.
3. V. Ngampruetikorn & J. A. Sauls, Anomalous Thermal Hall Effect in Chiral Superconductors, PRL 124, 157002 (2020)
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This colloquium will be held in-person, at SERC 116 unless announced otherwise.