

Friday, October 22, 2020
4:10 – 5:00 PM
Barnard Hall 103

The Left Hand of the Electron in a Chiral Vacuum

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Abstract:

Parity violation by the weak force was demonstrated in an experiment led by C. S. Wu in 1957 on the asymmetry of electron currents emitted in the beta decay of polarized ^{60}Co . The asymmetry reflects two broken symmetries - mirror reflections and time-reversal, the latter imposed by an external magnetic field. That same year Bardeen, Cooper and Schrieffer published the celebrated BCS theory of superconductivity, and soon thereafter Anderson and Morel proposed that the ground-state of liquid ^3He was likely a BCS condensate of chiral p-wave Cooper pairs, exhibiting spontaneously broken mirror reflection and time-reversal symmetries. Indeed, the high-pressure phase, superfluid $^3\text{He-A}$, discovered in 1971, is the realization of the Anderson-Morel state. However, proof that $^3\text{He-A}$ spontaneously breaks mirror and timereversal symmetry came 41 years later with the observation an anomalous Hall effect for electrons moving in superfluid $^3\text{He-A}$. I discuss this discovery and the underlying theory, and specifically how broken symmetry and topology of the superfluid vacuum conspire to endow quasiparticles with “handedness”. The search for electronic analogs of the chiral phase of ^3He is actively pursued by many laboratories. I conclude with new results for a bulk signature of broken timereversal and mirror symmetry in proposed chiral superconductors. Research supported by NSF grant DMR-1508730.

Host:

Anton Vorontsov

** Refreshments served in the Barnard second floor atrium at 3:45 **