

“Spin waves in Fermi Liquids: New ‘Tricks’ from an ‘Old Dog’”

Kevin S. Bedell

John H. Rourke Professor of Physics
Boston College

Lev Davidovich Landau first proposed the theory of the interacting Fermi liquid in 1956. This year 2011 marks the 55'th anniversary of the Landau Fermi Liquid Theory; it is this theory I affectionately refer to as the “Old Dog.” This theory has provided a general framework to study thermodynamic, transport and collective properties of strongly correlated Fermi liquids and gases. One of the early predictions of the Fermi Liquid Theory (what some might call “Old Tricks”) was the existence of transverse spin waves, or for short, spin waves. For example: i) In a paramagnetic Fermi Liquid in a magnetic field, Silin in 1958 predicted the existence of spin waves. ii) In that same year Abrikosov and Dzyaloshinskii derived the Ferromagnetic Fermi Liquid Theory and predicted that there would be a spin wave in this system in the absence of a magnetic field, the so called “goldstone mode” of the ordered ferromagnet. There have been many discoveries and predictions of Fermi Liquid Theory from the last half of the last century but there are some “New Tricks” the “Old Dog” has learned at the beginning of this new century. These include a new spin-current mode in a weak ferromagnetic metal and a new “ferromagnetic like” spin wave mode in a non-equilibrium paramagnetic Fermi liquid in the absence of a magnetic field. In this colloquium I will describe these modes and the techniques that could be used to detect them.