Contribution ID: **123** Type: **Invited**

Common Fermi-liquid origin of T2 resistivity and superconductivity in n-type SrTiO3

Monday, 23 July 2012 10:45 (25 minutes)

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SrTiO3 is a semiconductor which, when doped with a low density of electrons, becomes a good conductor with relatively high mobility and strong temperature dependence of the electrical resistivity and the infrared optical conductivity. At low temperatures the material becomes superconducting with Tc below 1 K having a dome-shaped doping dependence, both in the 3D bulk material and at the 2D LaAlO3/SrTiO3 interface. The DC resistivity below 100 K has a T^2 temperature dependence. The quasiparticles are in the anti-adiabatic limit with respect to electron-phonon interaction, which renders the interaction mediated through phonons effectively non-retarded. We apply Fermi-liquid theory for the T^2 term in the resistivity, and combine this with expressions for Tc and with the Brinkman-Platzman-Rice (BPR) sum-rule to obtain Landau parameters of n-type SrTiO3. These parameters are comparable to those of liquid 3He, indicating interesting parallels between these Fermi-liquids despite the differences between the composite fermions from which they are formed. The physics of the doped semiconductor SrTiO3 stands in stark contrast with the doped cuprates where Tc's are two orders of magnitude higher and correlate with the T^1 term of the resistivity.

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Session Classification: Metal-Insulator Systems

Track Classification: Correlated Physics