Condensed Matter Physics Seminar Series

Strange metal transport and Ferromagnetism in the electron-doped cuprates

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I will discuss transport studies on thin films of the electron-doped cuprate system La2-xCexCuO4 that exhibit strange metal transport in the normal state down to 35 mK in the doping range where superconductivity is found at zero magnetic field. These results strongly suggest that the high-Tc superconductivity emerges from this strange metal normal state. The strange metal behavior is manifested as a linear-in-T resistivity from 35 mK to 20K and a ~T^2 resistivity from 50K to 400K both above and below a Fermi surface reconstruction at x = 0.14 [1-2]. Other indications of strange metal behavior are a low temperature linear-in-H magnetoresistance and a low temperature lnT thermopower [3-5] over the same range of doping. Surprisingly, at doping above the superconducting dome a ferromagnetic state is found below 4K [6]. I compare these results to behavior found in hole-doped cuprates [7]. At the present time these strange metal transport results have not been explained and they represent a challenge to the theory of the cuprates. A theory for the ferromagnetism has been proposed [8] but it has not been widely acknowledged.

Richard Greene is known for his many years of productive research on the physics of novel superconducting materials, at the IBM research laboratories and at the University of Maryland. He and his collaborators discovered the first known polymeric and two-dimensional organic superconductors in the 1970s. Since 1986, Dr. Greene has done extensive research on high-Tc superconductors, primarily electron-doped cuprates and iron-based materials. He has written several well-known reviews about these two superconducting systems. He was also involved in the development of the relaxation technique for specific heat measurements, a technique that is now widely used in the Quantum Design PPMS. His publications are very highly cited, with over 33,000 citations and an h-index of 96. He was the founding director of the Center for Superconductivity Research at the University of Maryland in 1989. He is a Fellow of the APS and the AAAS and the APS Dissertation Award for Experimental Condensed Matter Physics is named in his honor. In 2022, he was named a University of Maryland Distinguished University Professor.

Friday, January 10th at 10am
4-330 PAB