PHYSICS DEPARTMENT COLLOQUIUM

“One-Dimensional Metals in Theory and Experiment”

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Theoretical analysis, dating back to Bethe's pioneering work of 1931, has show that interacting one dimensional electron systems differ in important ways from their three-dimensional counterparts. The low-temperature low-energy behavior of a conventional three-dimensional metal is described by Landau's Fermi-Liquid theory, which can be understood by treating the interaction as a weak perturbation to the non-interacting behavior. Predictions for one-dimensional metals, often described as "Luttinger Liquids", differ more radically from a non-interacting system. In recent years, experimental realizations of one-dimensional metals, including single-walled carbon nanotubes, the edges of quantized Hall systems, and "quantum wires" in GaAs heterostructures, have led to direct experimental tests of some of the predictions of Luttinger liquid theory. We shall discuss some of these results, with emphasis on electron-tunneling experiments, including recent work on tunneling between two parallel quantum wires, and evidence for the occurrence of "spin-charge" separation.

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