Dimensional Reduction at a Quantum Critical Point

Competition between ground states near a quantum critical point is expected to lead to unconventional behavior in low dimensional systems. New phases of matter have been predicted, and explanations proposed for unsolved problems including non-Fermi liquid behavior and high temperature superconductivity using two-dimensional (2d) theories. In this talk, I will present a theory that describes the Bose-Einstein condensate (BEC) quantum critical point (QCP) in layered systems with a frustrated inter-layer coupling. I will demonstrate that the main effect of this geometric frustration is to reduce the dimensionality of the QCP (its critical exponents are the ones expected for a 2d system). In addition, I will present the first experimental evidence of dimensional reduction at a QCP observed in the Mott insulator BaCuSi2O6 (Han Purple).