Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Criticality in correlated quantum matter[1] ANGELA KOPP, SUDIP CHAKRAVARTY, UCLA — At quantum critical points (QCPs) quantum fluctuations occur on all length scales, from microscopic to macroscopic, which, remarkably, can be observed at finite temperatures, the regime to which all experiments are necessarily confined. But how high in temperature can the effects of quantum criticality persist? That is, can physical observables be described in terms of universal scaling functions originating from the QCPs? We answer these questions by examining exact solutions of models of systems with strong electronic correlations and find that QCPs can influence physical properties at surprisingly high temperatures. As a powerful illustration of quantum criticality, we predict that the zero temperature superfluid density, $\rho_s(0)$, and the transition temperature, T_c, of the copper-oxide superconductors are related by $T_c \propto \rho_s(0)^y$, where the exponent y is different at the two edges of the superconducting dome, signifying the presence of the respective QCPs. This relationship can be tested in high quality crystals.

[1]supported by the NSF under grant DMR-0411931

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Date submitted: 29 Nov 2005 Electronic form version 1.4