Jozef Stefan Institute, Department of Theoretical Physics

Solid State Group Seminars

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Mott quantum criticality and bad metal behavior

Quantum critical scaling is an ubiquitous phenomenon accompanying zero-temperature phase transitions, but its prominence in the context of finite temperature (first-order) transitions and connection with bad metal behavior have not been clarified until recently. We solve the Hubbard model by means of single-site dynamical mean-field theory (DMFT) to show that even though the Mott metal-insulator transition here is of the first order, at sufficiently high temperatures a typical quantum critical behavior is recovered. Our results display striking agreement with measurements on Kappa-organic materials, where the system can be tuned through a finite temperature Mott transition by varying pressure. We also consider the doping driven Mott transition and find that the associated quantum critical region matches perfectly the region of bad metallic behavior, where resistivity is around (and above) the Mott-Ioffe-Regel limit and is linear in temperature. In this regime, the linearity and slope of the temperature dependence of resistivity can be simply explained by the presence of quantum critical scaling, and the full DMFT result is quantitatively reproduced by a simple semi-phenomenological formula. The results are found to be in agreement with the high temperature (200-1000K) behavior in cuprate films, which we believe can be traced back to the presence of a hidden Mott transition at zero temperature.

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