NEW FEATURES IN THE PHASE DIAGRAM OF CUPRATES

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One of the most intriguing properties of the cuprates is their generic phase diagram, where high temperature superconductivity occurs in the proximity of a metal-insulator transition. The understanding of the various phases and their connections is deemed to be the key to solving the problem of high temperature superconductivity. We have used Angle Resolved Photo Emission Spectroscopy (ARPES) to address this problem. By studying the temperature dependence of the bilayer splitting we have found evidence of a cross over between coherent and incoherent electron behavior - long anticipated by a number of theoretical models. We have also shown that a pseudogap exists on the overdoped side of the phase diagram below T_c, when the superconductivity is suppressed by application of a sufficiently high current density. However, above certain doping, the pseudogap is no longer observed under the superconducting dome. This may indicate existence of a Quantum Critical Point (QCP) at a doping level between 0.2 and 0.25 holes per Cu atom. Existence of such point could mean close relation between cuprates and in heavy fermion compounds, where QCP is usually surrounded by dome of superconductivity. These results are instrumental in choosing a viable theoretical model of high temperature superconductivity.