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Departamentos de Física Teórica I y II
Universidad Complutense de Madrid

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TITULO: Physics of underdoped cuprate superconductors: Evolution of spin states from the Mott insulator

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ABSTRACT

The origin of the highly unusual behavior of a cuprate superconductor is thought to be due to its proximity to the Mott insulator. Anderson argued quite early that spin structure of the doped region is intimately connected to that of the insulator. However, attempts to construct a theory based on such a connection have run into serious difficulties. I will discuss some recent progress made in this direction. Specifically, we have derived a renormalized Hamiltonian from the parent t-J model, which is characterized by a spin gap. The model is analyzed by continuing the known spin states from the insulator, which constraints the theory. This leads to the correct phase diagram: a strange metal, a pseudogap metal and a d-wave superconductor. These results follow directly from the symmetry of the known valence-bond "vacuum" which is continued from half filling. Not much calculation is needed. Additionally, the two-dimensional nature of the metallic state emerges from the theory.