Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

The Role of the Van Hove Singularity in the Quantum Criticality of the Hubbard Model SANDEEP PATHAK, K.-S. CHEN, SHUXIANG YANG, MARK JARRELL, JUANA MORENO, Louisiana State University — A quantum critical point, separating a non-Fermi liquid region from a Fermi liquid, exists in the phase diagram of the Hubbard model [Vidhyadhiraja *et. al*, Phys. Rev. Lett. **102**, 206407 (2009)]. This quantum critical point is characterized by a vanishing spectral weight and a van Hove singularity (vHS) in the dispersion that crosses the Fermi level. The real part of the critical particle-particle susceptibility exhibits a algebraic decay with temperature, which results in the imaginary part showing scaling at large frequencies. This algebraic decay leads to higher superconducting transition temperatures as compared to the BCS theory, where the pairing susceptibility decays only logarithmically. In this talk, we examine the role of the van Hove singularity in determining this critical behavior. We calculate the bare particle-particle susceptibility of a d-wave pair field for the standard two-dimensional tight binding dispersion and for a hypothetical quartic dispersion having "flatter" or "extended" singularities. We find that the standard logarithmic vHS cannot correctly describe the critical algebraic behavior and it is essential to have an extended vHS that displays an algebraic singularity. Thus, our results emphasize the possible role of the extended vHS in the unexpectedly higher T_c of cuprates.

Juana Moreno
Louisiana State University

Date submitted: 21 Nov 2010 Electronic form version 1.4