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Abstract for an Invited Paper
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Theory of the nematic quantum critical point in a nodal superconductor¹

EUN-AH KIM, Stanford University

In the last several years, experimental evidence has accumulated in a variety of highly correlated electronic systems of new quantum phases which (for purely electronic reasons) spontaneously break the rotational (point group) symmetry of the underlying crystal. Such electron “nematic” phases have been seen in quantum Hall systems[1], in the metamagnetic metal $\text{Sr}_3\text{Ru}_2\text{O}_7$ [2], and more recently in magnetic neutron scattering studies of the high temperature superconductor, YBCO[3]. In the case of a high T_c superconductor, the quantum dynamics of nematic order parameter naturally couples strongly to quasiparticle (qp) excitations. In this talk, I will discuss our recent results on the effects of the coupling between quantum critical nematic fluctuations and the nodal qp’s of a d-wave superconductor in the vicinity of a putative quantum critical point inside the superconducting phase. We solve a model system with N flavors of quasiparticles in the large N limit[4]. To leading order in $1/N$, quantum fluctuations enhance the dispersion anisotropy of the nodal excitations, and cause strong scattering which critically broadens the quasiparticle peaks in the spectral function, except in the vicinity of “the tips of the banana,” where the qp’s remain sharp. We will discuss the possible implications of our results to ARPES and STM experiments.

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¹Stanford Institute for Theoretical Physics