MAR11-2010-005493

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Phenomenology of electronic nematic and smectic states in STM studies of high T_c cuprates[1]

EUN-AH KIM, Cornell University

Electronic liquid crystals are phases in which electronic structure of a material breaks the spatial symmetries of its crystal lattice: electronic nematic only breaks the point group symmetry, while smectic (stripe) additionally breaks the translational symmetry. Here I define two independent order parameter fields for nematic and smectic that can be constructed from STM data. Using these order parameters we find long range intra-unit cell nematicity in the pseudogap states [1]. In contrast, we observe many topological defects that disorder the smectic fields. However, these defects reveal a remarkable coupling between smectic tendency and fluctuations in the nematic order. From these observations, we propose a Ginzburg-Landau free energy describing the quantum nematic/smectic coupling and demonstrate how it can explain the coexistence of these states and correctly predict their interplay [2]. In principle, this understanding may enable us to disentangle the complexities of the system specific cuprate phase diagrams.

[1] M. J. Lawler, K. Fujita, Jhinhwan Lee, A. R. Schmidt, Y. Kohsaka, Chung Koo Kim, H. Eisaki, S. Uchida, J. C. Davis, J. P. Sethna, Eun-Ah Kim, "Intra-unit-cell electronic nematicity of the high Tc copper-oxide pseudogap states", Nature **466**, 347 (2010).

[2] A. Mesaros, K. Fujita H. Eisaki, S. Uchida, J.C. Davis, S. Sachdev, J. Zaanen, M.J. Lawler, and Eun-Ah Kim, "How topological defects couple the smectic and nematic electronic structure of the cuprate pseudogap states", submitted (2010).

[1]This work was supported in part by NSF Grant DMR-0520404 to the Cornell Center for Materials Research and by NSF Grant DMR-0955822