Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

A quantum phase transition from triangular to stripe charge order in $NbSe_2$[1] ERIC HUDSON, Pennsylvania State University, ANJAN SOUMYANARAYANAN, M. M. YEE, YANG HE, Harvard University, D. J. RAHN, K. ROSSNAGEL, University of Kiel, JASPER VAN WEZEL, M.R. NORMAN, Argonne National Laboratory, JENNIFER E. HOFFMAN, Harvard University — We use scanning tunneling microscopy to reveal a previously unknown unidirectional (stripe) charge density wave (CDW) smoothly interfacing with the familiar tridirectional (triangular) CDW on the surface of the stoichiometric superconductor $NbSe_2$. Our low temperature measurements rule out thermal fluctuations, and point to local strain as the tuning parameter for this quantum phase transition. We use this discovery, in conjunction with bandstructure calculations, to resolve two longstanding debates about the anomalous spectroscopic gap and the role of Fermi surface nesting in the CDW phase of $NbSe_2$. First, the 15% wavelength difference between the two CDWs demonstrates that Fermi surface nesting plays a minor role in determining the CDW wavevectors in $NbSe_2$. Second, we disentangle a $\Delta \sim 12$ meV particle-hole asymmetric CDW gap from a spectrum dominated by collective modes, resolving a longstanding debate regarding anomalous gaps previously observed by STM and ARPES. Our results highlight the importance of local strain in governing phase transitions and competing phenomena, and suggest a new direction of inquiry for resolving similarly longstanding debates in cuprate superconductors and other strongly correlated materials.

[1]Supported by NSF DMR-0847433 (Harvard), DOE, Office of Science DE-AC02-06CH11357 (Argonne) and DFG via SFB 855 (Kiel).

Eric Hudson
Pennsylvania State University

Date submitted: 09 Nov 2012 Electronic form version 1.4