Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

**Control of Metastable Charge Density Wave Phases in Ultrathin $1T$-$TaS_2$** ADAM TSEN, Columbia University, ROBERT HOVDEN, Cornell University, DENNIS WANG, YOUNG DUCK KIM, Columbia University, YU LIU, WENJIAN LU, YUPING SUN, Chinese Academy of Sciences, JAMES HONE, Columbia University, LENA FITTING KOURKOUTIS, Cornell University, PHILIP KIM, Harvard University, ABHAY PASUPATHY, Columbia University — Among the most intriguing aspects of reduced dimensionality in condensed matter systems is the enhancement of various correlation effects (electron-electron, electron-phonon, etc.). In quasi-2D metallic chalcogenides, they lead to electronic instabilities that give rise to a wealth of exotic ground states such as charge density waves (CDWs), spin density waves, and superconductivity. $1T$-$TaS_2$ is a unique layered material which exhibits a number of different CDW states as well as a Mott phase at low temperatures. Although its electronic structure is largely two dimensional, the CDWs are stabilized by an out-of-plane stacking. By combining low temperature transmission electron microscopy with electrical transport measurements, we investigate how the various CDW phases in $1T$-$TaS_2$ change as it approaches the physical 2D limit. We find that in well-controlled samples, the lock-in transition from a nearly commensurate CDW to a fully commensurate CDW gradually disappears with reduced thickness as both phases become increasingly metastable. I will discuss the physical reasons underlying this behavior as well as demonstrate how to manipulate this phase transition in few-layer samples by application of an in-plane electric field.

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Date submitted: 14 Nov 2014 Electronic form version 1.4