Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Strong Periodic Lattice Distortion in Transition Metal Dichalcogenides JIXIA DAI, EDUARDO CALLEJA, YUE CAO, DANIEL DESSAU, KYLE MCELROY, Department of Physics, University of Colorado at Boulder, Boulder, Colorado 80309, USA, HELMUTH BERGER, Department de Physique, EPF Lausanne, CH-1015 Lausanne, Switzerland, XIANGDE ZHU, LIJUN LI, YUPING SUN, Key Laboratory of Materials Physics, Institute of Solid State Physics, CAS, Hefei 230031, China, T. WOLF, Karlsruher Institut für Technologie, Institut für Festkörperphysik, P.O.B. 3640, D-76021 Karlsruhe, Germany — The charge density wave (CDW) instability was initially proposed to be the result of the Peierls mechanism in which a divergence in electronic response function results in a periodic charge redistribution; i.e. the electron gas itself is unstable with respect to the formation of a periodically varying electron charge density. However, the mechanism of CDW in many 2D Transition Metal Dichalcogenide (TMD) is still under debate. Fermi surface nesting was originally believed to act as the driving mechanism of CDW transitions in these materials; however, recent reports from both theoretical and experimental studies are not quite within this simple model. We use Spectroscopic Imaging Scanning Tunneling Microscope (SI-STM) to study the surfaces of 2H-$TaSe_2$, 2H-TaS_2, and 2H-$NbSe_2$ at various temperatures from 6K to above 100K. Topographic images and differential conductance data were recorded and analyzed in order to help understanding the underlying physics of CDW phases. Our results shows that Periodic Lattice Distortion (PLD) likely plays a more important role than the charge modulation in 2D TMD.

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Date submitted: 08 Dec 2011 Electronic form version 1.4