Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Studies of Charge Density Waves in Reduced Dimensions by Surface X-Ray Scattering XINYUE FANG, Department of Physics, University of Illinois at Urbana-Champaign and Advanced Photon Source, Argonne National Laboratory, HAWOONG HONG, Advanced Photon Source, Argonne National Laboratory, PENG CHEN, Department of Physics, University of Illinois at Urbana-Champaign and Advanced Light Source, Lawrence Berkeley National Laboratory, YANG LIU, Department of Physics and Center for Correlated Matter, Zhejiang University, TAI-CHANG CHIANG, Department of Physics, University of Illinois at Urbana-Champaign — $TiSe_2$, a prototypical CDW system with a 1T structure in the bulk, undergoes a simple (2x2x2) CDW transition at around 205 K in connection with the softening of a phonon mode at the zone boundary. This transition is marked by substantial changes in the transport properties. Although this material has been studied extensively, the underlying physical mechanism for the structural distortion is still under debate. Ultrathin films, including a single molecular layer, of $TiSe_2$ provide an excellent test ground for systematic tuning of the electronic interactions through dimensional control; the results will be relevant to a basic understanding of the mechanism of the CDW transition ranging from 2D to 3D. We have successfully grown, in situ, high quality single- and multi-layer films of $TiSe_2$ on a bilayer-graphene-terminated SiC surface via MBE. Surface x-ray diffraction shows that single-layer $TiSe_2$ exhibits a (2x2) CDW transition with a transition temperature of T_C =234 K, which is substantially higher than the bulk T_C =205 K. The CDW peak intensity follows closely a BCS mean-field behavior.

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Date submitted: 10 Nov 2016 Electronic form version 1.4