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Dimensional effects on the charge density waves in ultrathin films of $TiSe_2$ PENG CHEN, University of Illinois at Urbana-Champaign, YANG-H CHAN, Academia Sinica, MAN-H WONG, XIN-Y FANG, University of Illinois at Urbana-Champaign, MEI-Y CHOU, Academia Sinica, SUNG-K MO, ZAHID HUSSAIN, ALEXEI-V FEDOROV, Lawrence Berkeley National Laboratory, TAI-C CHIANG, University of Illinois at Urbana-Champaign — Charge density wave (CDW) formation in solids is a critical phenomenon involving the collective reorganization of the electrons and atoms in the system into a wave structure, and it is expected to be sensitive to the geometric constraint of the system at the nanoscale. Here, we study the CDW transition in $TiSe_2$, a quasi-two-dimensional layered material, to determine the effects of quantum confinement and changing dimensions in films ranging from a single layer to multilayers. Of key interest is the characteristic length scale for the transformation from a two-dimensional case to the three-dimensional limit. Angle-resolved photoemission spectroscopy (ARPES) measurements of films with thicknesses up to six layers reveal substantial variations in the energy structure of discrete quantum well states; however, the temperature-dependent band gap renormalization converges at just three layers. The results indicate a layer-dependent mixture of two transition temperatures and a very-short-range CDW interaction within a three-dimensional framework.

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