Abstract Submitted
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Exciton condensation in 1T-$TiSe_2$ observed with meV-resolved electron energy-loss spectroscopy[1] A. KOGAR, S. VIG, M. S. RAK, A. A. HUSAIN, G. J. MACDOUGALL, T. C. CHIANG, E. FRADKIN, Univ of Illinois - Urbana, J. VAN WEZEL, University of Amsterdam, P ABBAMONTE, Univ of Illinois - Urbana — The lowest excited state of an insulator is an electron-hole bound state, i.e., an exciton. In the 1960 it was predicted that, if the exciton binding energy of a material were larger than its band gap, excitons would have negative energy and spontaneously proliferate, creating a macroscopic condensate of electron-hole pairs called an "excitonic insulator." Despite 50 years of searching, explicit evidence for condensation of excitons in a sold has never been achieved. Here, we apply a new, meV resolution, momentum resolved electron energy loss spectroscopy (M–EELS) technique to the transition metal dichalcogenide 1T-$TiSe_2$. We find that, near T_C = 190 K, this material exhibits a soft electronic collective mode that disperses to zero energy, indicating condensation of electron-hole pairs with finite center-of-mass momentum. This excitation hardens at low temperature into an amplitude mode of an condensate coupled to the crystal lattice. Our study represents the first explicit evidence for the condensation of excitons in any material.

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