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Collective modes in Cu_xTiSe_2 measured with meV-resolution EELS[1] MELINDA RAK, SEAN VIG, ALI HUSAIN, MATTEO MITRANO, SAMANTHA RUBECK, Univ of Illinois - Urbana, ANSHUL KOGAR, Massachusetts Institute of Technology, GORAN KARAPETROV, Drexel University, EMILIA MOROSAN, Rice University, PETER ABBAMONTE, Univ of Illinois - Urbana — The charge density wave (CDW) in $1T$-$TiSe_2$ has been widely thought to be the result of an excitonic insulator transition. We recently observed a soft electronic mode in $TiSe_2$ using a new, momentum-resolved electron energy loss spectroscopy (M-EELS) technique, demonstrating a condensation of electron-hole pairs in this material. As $TiSe_2$ is doped with Cu to produce Cu_xTiSe_2, a superconducting dome emerges above $x \sim 0.04$. In this talk, I describe how the electronic collective mode evolves with Cu doping. We find that the temperature dependence of the electronic mode reverses as Cu is introduced and that the mode is much broader at low temperature as compared to the undoped material. Additionally, the electronic mode no longer has a positive dispersion at 300 K as described by the Lindhard function, but has a slightly negative dispersion for small momentum transfers. We will discuss the implications of these results for the excitonic insulator transition in $TiSe_2$.

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