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Charge density wave fluctuations and possible heavy fermion behavior without magnetism in $ThCr_2Si_2$-type KNi_2S_2 and KNi_2Se_2 JAMES NEILSON, Johns Hopkins University, ANNA LLOBET, Los Alamos National Laboratory, JIAJIA WEN, Johns Hopkins University, MATTHEW SUCHOMEL, Advanced Photon Source, Argonne National Laboratory, TYREL MCQUEEN, Johns Hopkins University — Materials with the $ThCr_2Si_2$-type structure host myriad examples of many-body physics, including high-temperature superconductivity and heavy fermion behavior. In these compounds, the emergence of the collective state frequently occurs near a magnetic instability, suggesting that magnetic fluctuations underlie the electronic phenomena. I will provide evidence for similar many-body physics in the structurally related, but non-magnetic compounds, KNi_2S_2 and KNi_2Se_2. From the analysis of synchrotron X-ray diffraction and neutron total scattering data, we observe spatially incoherent charge density wave fluctuations that disappear on cooling. Along with the implied and unusual increase in local symmetry, we find that there is negative thermal expansion and enhancement of the electronic band mass below $T \sim 15$ K, with superconductivity emerging below 1 K. These findings demonstrate that collective electronic phenomena occurs in $ThCr_2Si_2$-type materials without direct proximity to localized magnetism. Furthermore, these results highlight the importance in understanding charge fluctuations and their hybridization in driving the emergence of coherent or many-body electronic states, akin to localized magnetism associated with heavy fermion behavior.

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