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Commensurate Fluctuations in the Pseudogap and Incommensurate Spin-Peierls Phases of TiOCl J.P. CLANCY, B.D. GAULIN, K.C. RULE, J.P. CASTELLAN, Department of Physics and Astronomy, McMaster University, F.C. CHOU, Center for Condensed Matter Sciences, National Taiwan University — We have performed x-ray scattering measurements on the unconventional spin-Peierls system TiOCl and the closely related doped compound $Ti_{(1-x)}Sc_xOCl$ (x = 0.01, 0.03). In pure TiOCl these measurements reveal the presence of commensurate dimerization peaks within both the incommensurate spin-Peierls phase ($T_{c1} < T < T_{c2}$) and the so-called pseudogap phase ($T_{c2} < T < T^*$). This commensurate scattering is slightly shifted in Q-space relative to the commensurate long-range ordered state below T_{c1}, and has a fairly narrow width in Q, suggesting correlation lengths greater than 100 angstroms. Below $T^* \sim 130$K, the integrated intensity of the scattering over the commensurate and incommensurate positions grows continuously as a function of decreasing temperature. In addition, measurements performed on the doped compound show that the substitution of non-magnetic Sc^{3+} ions (S = 0) onto Ti^{3+} (S = 1/2) sites appears to suppress commensurate fluctuations and prevent the development of a commensurate long-range ordered state.

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