Reply to: 'Comment on: "The chiral phase transition in charge ordered 1T-TiSe₂" '

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We offer a reply to the recently posted comment on our earlier work concerning the chiral phase transition in charge ordered 1T-TiSe₂.

A comment on our description [1] of the chiral phase transition in charge ordered 1T-TiSe₂ was recently posted on the arxiv [2]. The comment offers an alternative interpretation that addresses part of the x-ray data in our original work, but is incompatible both with the behavior of other physical observables that we presented [1], and with recent direct observations of the broken inversion symmetry in 1T-TiSe₂ [3].

It is a well-known fact of scientific life that isolated experimental observations are open to interpretation. It is therefore not surprising there may exist multiple ways of interpreting the one figure reproduced by the authors of this comment. The fact that alternative interpretations of a partial data set exist, is not in and of itself an indication that the original interpretation is flawed.

In this regard, the authors of the comment ignore the fact that the figure they reproduce represents only part of the data presented in Ref. 1. The alternative interpretation they give for the one isolated figure is in fact inconsistent with the rest of the data presented in the original article [1]. That is, assuming the alternative interpretation that there is only a single transition in 1T-TiSe₂, it is not possible to explain the two kinks in the specific heat, nor the two anomalies in the resistance, both measured on the same sample as that used for the x-ray experiment, and both occurring at the same second tran-

sition temperature 7 K below the main CDW transition temperature T_{CDW} .

Our original interpretation [1] was based on three sets of different physical properties (x-ray data, specific heat, electrical resistance), providing a consistent explanation for that entire set of observations. In contrast, the alternative interpretation presented in the comment [2] does not give a consistent explanation of the entire data set.

Finally, we would like to point out that direct evidence for the breakdown of inversion symmetry in 1T-TiSe₂, consistent with the presence of a chiral charge density wave, was recently reported on the basis of circularly polarised photogalvanic effect measurements [3].

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- [2] M.-K. Lin, J. A. Hlevyack, P. Chen, R.-Y. Liu, and T.-C. Chiang, arXiv:1903.11120 (2019).
- [3] A. M. M. Valdivia, "Spontaneous chiral ordering in titanium diselenide," (2018), supervised by P. D. Jarillo-Herrero.