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Peer Review File

Spin-polarized and possible pseudospin-polarized scanning tunneling microscopy in kagome metal FeSn

Reviewers' comments:

Reviewer #1 (Remarks to the Author):

The authors have softened the claim of pSPSTM. Since the idea of the pSPSTM is interesting and the current level of the claim is mostly reasonable, I assess that the manuscript can be published in Communications Physics if the authors consider the following comments.

1. I am not convinced by the authors' reply regarding the tip-shape effect. If the pattern change shown in Fig. 3(h) is initiated by the change in the tip condition, the exact shape of the tip should also change. As for the tip-to-sample distance dependence, I do not find a reason why the set-point current from 100 pA to 3000 pA is enough to exclude the possible tip-shape effect. I recommend the authors remove Fig. 3(h) and related discussion.

2. The pSPSTM concept is interesting but remains speculation at present. Therefore, it is too early to state that the experiment advances our understanding of pseudospin-dependent tunneling and is useful for future applications. I recommend the authors remove the last sentences of the abstract and the main text. Rather, the authors may need to explain possible improvements that would make the pSPSTM more convincing.

We appreciate the reviewer's comments to improve our manuscript. We revised the manuscript according to the reviewer's suggestions. Responses to the reviewer's comments are copied and our response follows in bold. The modifications are also marked by red color in the revised manuscript–marked up.

Reviewer #1 (Remarks to the Author):

The authors have softened the claim of pSPSTM. Since the idea of the pSPSTM is interesting and the current level of the claim is mostly reasonable, I assess that the manuscript can be published in Communications Physics if the authors consider the following comments.

Author Reply: We appreciate the reviewer's potential support for publication of our manuscript. We modified the manuscript according to the the reviewer's specific comments.

1. I am not convinced by the authors' reply regarding the tip-shape effect. If the pattern change shown in Fig. 3(h) is initiated by the change in the tip condition, the exact shape of the tip should also change. As for the tip-to-sample distance dependence, I do not find a reason why the set-point current from 100 pA to 3000 pA is enough to exclude the possible tip-shape effect. I recommend the authors remove Fig. 3(h) and related discussion.

Author Reply: We removed Fig. 3(h) and related discussion. We also removed the sentence that described the set-point effect.

- **We removed the following paragraph. (Page 8) "~~If the symmetry breaking is indeed caused by the quantum tunneling associated with the tip, the triangular pattern in Fig. 3a can be flipped by the tip condition. Figure 3h shows how the pattern changes with respect to the tip. Imaging was performed from top to bottom, and the horizontal arrow indicates the moment at which the tip is changed. Interestingly, the downward-oriented triangle turns upward as the tip changes. Moreover, this orientation reversal is accomplished by a sudden phase slip indicated by the green dashed line in Fig. 3h. The pseudospin-polarized signal does not diminish by the tip-to-sample distance, supporting that the observed pseudospin-polarization is not caused by a trivial tip-shape effect (Supplementary Information).~~"**
- **Accordingly, we removed Fig. 3(h) from the main text and Fig. S10 from the Supplementary Information.**

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- **In the abstract, we made a modification to the last sentence. "Based on a simple tight-binding calculation, we further simulated the pseudospin texture of KL, confirming the geometric origin of pseudospin. This work potentially deepens our understanding of the lattice symmetry-preserving tunneling process in Dirac materials."**
- **In the main text, we rewrote the last sentence. "Our experiments suggest possible lattice symmetry-preserving tunneling in Dirac materials. If the angle between the tip and sample KLs can be controlled, one could study the pseudospin-dependent tunneling in a more systematic way. The *in-situ* rotation of the sample would be one of such ways, but requires further instrumental development in STM."**

The authors thank the reviewer #1 again for his time and effort in reviewing our manuscript.

REVIEWERS' COMMENTS:

Reviewer #1 (Remarks to the Author):

The authors adequately revised the manuscript. I am happy to recommend the publication of the revised manuscript in Communications Physics.