Supplementary Materials for "Dual-band Flexible Large-area Ultrasonic Energy Conveying via Elastic Chiral Landau Levels"

Lei Fan[1], Zhihao Lan[2], Yafeng Chen[3#], Jie Zhu[3♮], and Zhongqing Su[1*]

[1]*Department of Mechanical Engineering, The Hong Kong Polytechnic University, Kowloon, Hong Kong SAR, China*

[2]*Department of Electronic and Electrical Engineering, University College London, London WC1E 7JE, United Kingdom*

[3]*Institute of Acoustics, School of Physics Science and Engineering, Tongji University, 200092 Shanghai, China*

1. The mechanism of dual-band topological band gaps

Split-ring resonators (SRRs) exhibit unique multimodal resonant characteristics [1-3], which can lead to multiple omnidirectional band gaps in elastic plates. To confirm this, Bloch eigenmodes at gap boundaries are displayed, as shown in Fig. S1. It is seen that the 1st topological band gap is induced by the torsional motions of SRRs, while the 2nd band gap is generated by the coupled bending resonance of SRRs and base plates. Compared with attached local resonators, SRRs have advantages of compactness and manufacturability in constructing multiband metamaterial plates.

Corresponding authors:

yachen@tongji.edu.cn

♮ jiezhu@tongji.edu.cn

* zhongqing.su@polyu.edu.hk

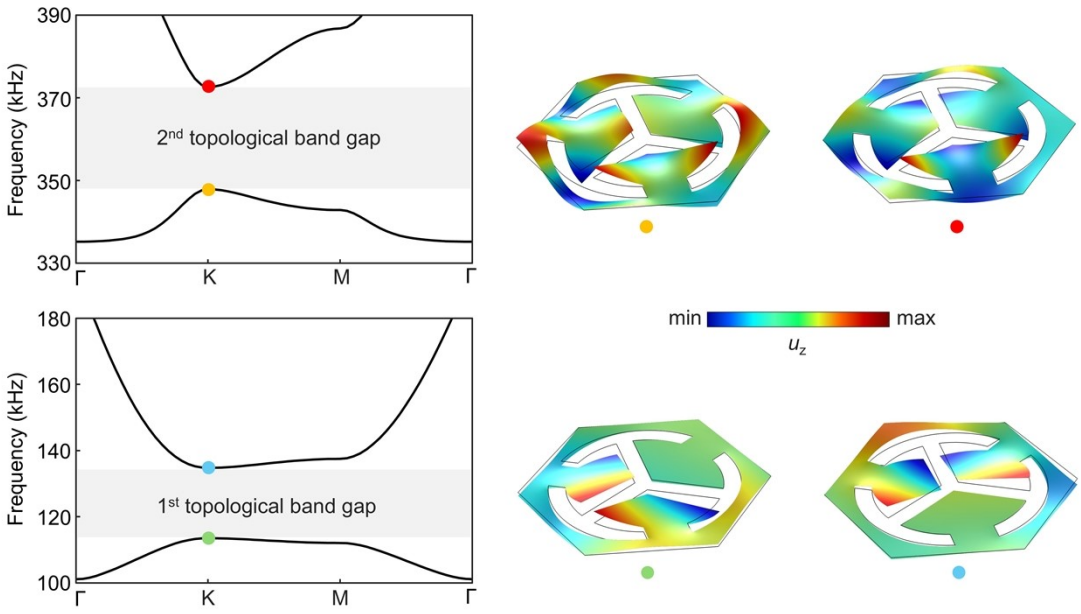

Fig S1 Dual topological band gaps (left panel) along with Bloch eigenmodes at gap boundaries (right panel)

2. The distribution of rotation angles in the energy splitter

Figure S2 illustrates the distribution of rotation angles in the upper half region of the energy splitter presented in Fig. 5 of the main text. It is noted that propagative routes of waves are consistent with the positions of unit cells with zero Dirac mass ($\theta = 0°$), as highlighted by red in Fig. S2. The variation steps $\Delta\theta$ in the horizontal and vertical directions are controllable to determine the propagation length. Here, $\Delta\theta$ is set to be 0.5° in the horizontal direction while 1° in the vertical direction.

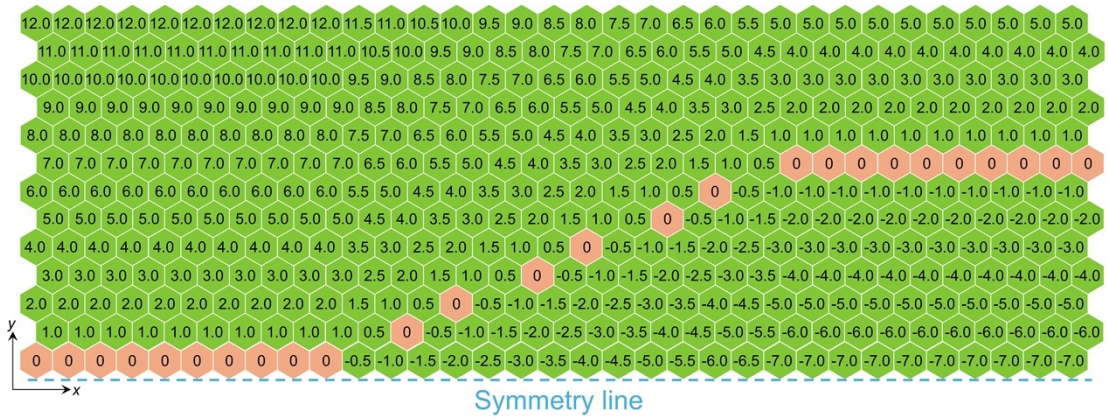

Fig S2 Distribution of rotation angles in the upper half region of the energy splitter.

References

[1] L. Fan, Y. Chen, J. Zhu, Z. Su, *J. Sound Vib.* 2025, **595**, 118795.

[2] Z. Huang, J. Wu, C. Wang, S. Yang, F. Ma, *Phys. Rev. B* 2021, **104**, 094110.

[3] Z. Huang, J.H. Wu, Y. Lei, C. Liu, F. Ma, *Mater. Today Phys.* 2022, **27**, 100793.