

# Tuo Liu

Research Assistant Professor

Department of Mechanical Engineering

The Hong Kong Polytechnic University

Address: FJ606, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

Tel: +852-34002557

Email: [tuoliu@polyu.edu.hk](mailto:tuoliu@polyu.edu.hk)

## RESEARCH INTERESTS

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Acoustics, Acoustic metamaterials, Non-Hermitian Acoustics

## EDUCATION

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Sept. 2018	Ph.D., Mechanical Engineering, The Hong Kong Polytechnic University
Jun. 2013	M.S., Physics, China University of Petroleum - Beijing
Jun. 2010	B.S., Acoustics, Nanjing University, China

## APPOINTMENTS & WORK EXPERIENCE

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Apr. 2020 – Present	Research Assistant Professor, Department of Mechanical Engineering, The Hong Kong Polytechnic University
May. 2019 – Apr. 2020	Postdoctoral Fellow, Department of Mechanical Engineering, The Hong Kong Polytechnic University
Oct. 2018 – May. 2019	Research Associate, Department of Mechanical Engineering, The Hong Kong Polytechnic University
Jun. 2017 – Sept. 2017	Visiting Scholar, Department of Mechanical Engineering, University of Colorado Boulder
Jul. 2013 – Sept. 2014	Acoustic Engineer, Beijing Research & Development Center, GoerTek Incorporation

## RESEARCH GRANTS

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- [1] General Research Fund (GRF), Research Grant Council of Hong Kong, No. 15219221, Study on waterborne spoof surface acoustic waves, 2021-09 to 2024-08, 762,156 HK\$, On-going, Principal investigator.
- [2] Start-up funding, The Hong Kong Polytechnic University, ZZLC, Novel Functional Devices Based on Spoof Surface Acoustic Waves, 2020-05 to 2022-05, 500,000 HK\$, On-going, Principal investigator.

## JOURNAL PUBLICATIONS

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(#contributed equally, \*corresponding authors)

- [3] S. An, **T. Liu\***, S. Liang, H. Gao, Z. Gu, and J. Zhu\*, Unidirectional invisibility of an acoustic multilayered medium with parity-time-symmetric impedance modulation, J. Appl. Phys. **129**, 175106 (2021).
- [4] S. Liang, **T. Liu\***, H. Gao, Z. Gu, S. An, and J. Zhu\*, Acoustic metasurface by layered concentric structures, Phys. Rev. Res. **2**, 043362 (2020).
- [5] H. Gao, Z. Gu, S. Liang, S. An, **T. Liu\***, and J. Zhu\*, Coding metasurface for Talbot sound amplification, Phys. Rev. Appl. **14**, 054067 (2020).
- [6] S. B. Huang#, **T. Liu#**, Z. Zhou, X. Wang\*, J. Zhu\*, and Y. Li\*, Extreme sound confinement from quasibound states in the continuum, Phys. Rev. Appl. **14**, 021001 (2020). (**Letter**)

- [7] **T. Liu**, G. C. Ma, S. J. Liang, H. Gao, Z. M. Gu, S. W. An, and J. Zhu\*, Single-sided acoustic beam splitting based on parity-time symmetry, *Phys. Rev. B* **102**, 014306 (2020).
- [8] H.Z. Chen#, **T. Liu**#, H. Y. Luan#, et al., Revealing the missing dimension at an exceptional point, *Nat. Phys.* **16**, 571 (2020).
- [9] R. Zhao, **T. Liu**\*, C. Y. Wen\*, J. Zhu\*, and L. Cheng, Impedance-near-zero acoustic metasurface for hypersonic boundary-layer flow stabilization *Phys. Rev. Appl.* **11**, 044015 (2019).
- [10] **T. Liu**, F. Chen, S. Liang, H. Gao, and J. Zhu, Subwavelength sound focusing and imaging via gradient metasurface-enabled spoof surface acoustic wave modulation. *Phys. Rev. Appl.* **11**, 034061 (2019).
- [11] **T. Liu**#, X. F. Zhu#, F. Chen, S. J. Liang, and J. Zhu, Unidirectional wave vector manipulation in two-dimensional space with an all passive acoustic parity-time-symmetric metamaterials crystal, *Phys. Rev. Lett.* **120**, 124502 (2018).
- [12] **T. Liu**, S. Liang, F. Chen, and J. Zhu, Inherent losses induced absorptive acoustic rainbow trapping with a gradient metasurface, *J. Appl. Phys.* **123**, 091702 (2018).

#### **(Participated publications)**

- [1] Z. Gu, **T. Liu**, H. Gao, S. Liang, S. An, and J. Zhu, Acoustic coherent perfect absorber and laser modes via the non-Hermitian dopant in the zero index metamaterials, *J. Appl. Phys.* **129**, 234901 (2021).
- [2] C. Yang, **T. Liu**, J. Zhu, J. Ren, and H. Chen, Surface-Acoustic-Wave Computing of the Grover Quantum Search Algorithm with Metasurfaces, *Phys. Rev. Appl.* **15**, 044040 (2021).
- [3] H. Gao, H. Xue, Z. Gu, **T. Liu**, J. Zhu, and B. Zhang, Non-Hermitian route to higher-order topology in an acoustic crystal, *Nat. Commun.* **12**, 1888 (2021).
- [4] Z. Gu, X. Fang, **T. Liu**, H. Gao, S. Liang, Y. Li, B. Liang, J. Cheng, and J. Zhu, Tunable asymmetric acoustic transmission via binary metasurface and zero-index metamaterials, *Appl. Phys. Lett.* **118**, 113501 (2021)
- [5] Z. Gu, H. Gao, **T. Liu**, S. Liang, S. An, Y. Li, and J. Zhu, Topologically protected exceptional point with local non-Hermitian modulation in an acoustic crystal, *Phys. Rev. Appl.* **15**, 014025 (2021)
- [6] Z. Gu, H. Gao, **T. Liu**, Y. Li, and J. Zhu, Dopant-modulated sound transmission with zero index acoustic metamaterials, *J. Acoust. Soc. Am.* **148**, 1636 (2020).
- [7] Q. B. Lu, **T. Liu**, L. Ding, M. H. Lu, J. Zhu, and Y. F. Chen, Probing the spatial impulse response of ultrahigh-frequency ultrasonic transducers with photoacoustic waves, *Phys. Rev. Appl.* **14**, 034026 (2020).
- [8] H. Gao, H. Xue, Q. Wang, Z. Gu, **T. Liu**, J. Zhu, and B. Zhang, Observation of topological edge states induced solely by non-Hermiticity in an acoustic crystal, *Phys. Rev. B* **101**, 180303 (2020). **(Rapid Communication; Editor's Suggestion; Featured in Physics)**
- [9] S. Huang, Z. Zhou, D. Li, **T. Liu**, X. Wang, J. Zhu, and Y. Li, Compact broadband acoustic sink with coherently coupled weak resonances, *Sci. Bull.* **65**, 373 (2020).
- [10] H. Gao, X. Fang, Z. Gu, **T. Liu**, S. Liang, Y. Li, and J. Zhu, Conformally mapped multifunctional acoustic metamaterial lens for spectral sound guiding and Talbot effect, *Research* **2019**, 1748537 (2019).
- [11] X. Yu, Z. Lu, **T. Liu**, L. Cheng, J. Zhu, and F. Cui, Sound transmission through a periodic acoustic metamaterial grating, *J. Sound Vib.* **449**, 140-156 (2019).
- [12] S. Liang, **T. Liu**, F. Chen, and J. Zhu, Theoretical and experimental study of gradient-helicoid acoustic metamaterial, *J. Sound Vib.* **442**, 482-496 (2019).
- [13] R. Zhao, **T. Liu**, C. Y. Wen, J. Zhu, and L. Cheng, Theoretical modeling and optimization of porous coating for hypersonic-laminar-flow control, *AIAA J.* **56**, 2942 (2018).

#### **CONFERENCE PAPERS & TALKS**

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- [1] **T. Liu**, J. Zhu, Parity-time-symmetric acoustic beam splitter, in Photonics & Electromagnetics Research Symposium (PIERS2019), Xiamen, China 17-20 December 2019.
- [2] **T. Liu**, J. Zhu, Parity-time-symmetric acoustic systems, in The 1<sup>st</sup> National Metamaterial Conference, Xi'an,

China, 24-27 November 2019. **(invited talk)**

- [3] **T. Liu**, S. Liang, H. Gao, Z. Gu and J. Zhu, Passive acoustic parity-time-symmetric metamaterials crystal, in National Conference of Acoustics, Shenzhen, China, 20-23 September 2019.
- [4] **T. Liu**, R. Zhao, C. Y. Wen, L. Cheng, J. Zhu, Stabilizing hypersonic boundary-layer flow with impedance-near-zero acoustic metasurface, in The 14th International Conference On Theoretical and Computational Acoustics (ICTCA2019), Beijing, China, 28 July - 1 August 2019. **(invited talk)**
- [5] **T. Liu**, X. Zhu, and J. Zhu, Passive acoustic parity-time-symmetric metamaterials crystal, in National Conference of Acoustics, Beijing, China, 10-12 November 2018.
- [6] **T. Liu**, and J. Zhu, Acoustic metamaterials crystal for passive parity-time-symmetric modulation, in The International Congress on Artificial Materials for Novel Wave Phenomena – Metamaterials'2018, Espoo, Finland, 27 August - 1 September 2018.
- [7] **T. Liu**, and J. Zhu, Acoustic rainbow trapping through perforated structures, in The 23<sup>rd</sup> International Congress on Sound & Vibration (ICSV23), Athens, Greece, 10-14 July 2016.
- [8] **T. Liu**, W. Qiao, and X. Che, A method for liquid level detection using the amplitude of leaky-Rayleigh waves. in The 21<sup>st</sup> International Congress on Sound & Vibration (ICSV21), Beijing, China, 13-17 July 2014.

## **OTHER RESEARCH ACTIVITIES**

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Membership: The Acoustical Society of China, The Acoustical Society of America

Reviewer for:

Physical Review Letters, Physical Review B, Physical Review Applied, Physical Review Materials, Journal of the Acoustical Society of America, New Journal of Physics, Journal of Physics D: Applied Physics, Applied Physics Express, Applied Physics Letters, Journal of Applied Physics, Scientific Reports, and IEEE Access