

CURRICULUM VITAE

Feiyan Cai, Ph.D.

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1. Professional Summary

Innovative acoustics researcher with 15+ years of experience in physical acoustics, ultrasonic transducer design, and biomedical acoustics. Recognized for pioneering work in holography-based field shaping, high-performance acoustic sensors, and advanced acoustofluidics/acoustic tweezers systems. Proven leadership in directing over 30 million RMB in competitive grants, developing patented ultrasound technologies, and mentoring graduate students. Author of 70+ peer-reviewed papers with 3,300+ citations. Active in international collaborations, editorial boards, and professional societies.

2. Research Interests

- **Physical Acoustics:** Acoustic wave propagating in complex media, Field shaping, Beamforming, Acoustic radiation force
- **Acoustic Device:** Transducer, Acoustofluidics, Acoustic tweezers, Acoustic sensors
- **Biomedical Application:** Cell manipulation, Cell sonoporation, Neural Stimulation, Drug delivery, Tissue engineering, et al.

3. Education

- Wuhan University, China** Ph. D. in Condensed Matter Physics 2003-2008
- Advisor: Prof. Zhengyou Liu
 - Dissertation: Investigating the Anomalous Doppler Effect in Phononic Crystals and the Unique Properties of Phononic Crystal Slabs
- Central China Normal University, China** B. S. in Physics 1999-2003

4. Academic Experience

- Shenzhen Institutes of Advanced Technology (SIAT), Chinese Academy of Sciences (CAS)**
Paul C. Lauterbur Research Center for Biomedical Imaging 2008 -Present
- Researcher | 2017-Present
 - Associate Researcher | 2011-2016
 - Assistant Researcher | 2008-2011
- The University of Mississippi, National Center for Physical Acoustics** 2019-2020
- Visiting Scholar
- Hong Kong University of Science and Technology, Physics Department** 2010-2011
- Visiting scholar
- Institute of Computing Technology, CAS** 2009-2012
- Postdoctoral Fellow

5. Selected Research Grants

Total competitive grants exceed 30 million RMB, with grants as Principal investigator (PI) exceeding 12 million RMB.

- (1) Distinguished Young Scientist Program (Shenzhen), *Dynamical manipulation of cells and assembly of organoids by shaping field-based acoustofluidics*. No. RCJC20221008092808013, 4 million RMB, 2023.04 -2028.04, PI.
- (2) National Key Research and Development Program of China, *Metamaterials enhancing*

transmission and their application in Ultrasound transcranial imaging. No. 2021YFB3801802, 2.476 million RMB, 2021.12 -2025.11, PI.

- (3) National Natural Science Foundation of China (NSFC), General Fund, *Theory and application of shaping acoustic radiation force near layered interfaces.* No. 11974372, 0.64 million RMB, 2020.1 - 2023.12, PI.
- (4) National Key Research and Development Program of China, *Detection and modulation of ultrasound-induced blood-brain barrier opening.* No. 2018YFC0115900, 1 million RMB, 2018.8 - 2021.6, PI.
- (5) Shenzhen Key Basic Research Fund, *Ultrasound-induced enhanced separation technique for complex adhesions.* No. JCYJ20170818163258397, 2 million RMB, 2018.4 - 2021.8, PI.
- (6) NSFC General Fund, *Characteristics and applications of acoustofluidics based on slit-enhanced localized field.* No. 11674346, No. 0.7 million RMB, 2017.1 - 2020.12, PI.
- (7) Shenzhen Basic Research Fund, *High-quality fluid sensor based on slit-enhanced localized field,* No. JCYJ20150521094519482, 0.3 million, 2015.8 - 2017.8, PI.
- (8) NSFC General Fund, *Phononic crystal shaping field for Particle manipulation.* No. 11274008, 0.9 million RMB, 2013.1 - 2016.12, PI.
- (9) NSFC Young Scientist Fund, *Ultrasound-guided targeted accumulation of micro/nanoparticles in blood vessels.* No. 10904095, 0.23 million RMB, 2010.1 - 2012.12, PI.

6. Membership in Professional Organizations

- Board Members, Acoustofluidics Society. (2023-)
- Council Member, Chinese Society of Acoustics, Sub-committee of Biomedical Ultrasound (2018-)
- Council Member, Chinese Society of Micro-Nano Technology, Sub-committee of Micro-Nano Actuators and Microsystems
- Member, Acoustical Society of America (ASA)
- Member, Institute of Electrical and Electronics Engineers (IEEE)
- Early Career Editorial Board Member, Nanotechnology and Precision Engineering, (2023-)

7. Honors and Awards

- Outstanding Instructor, 2024 China International College Students Innovation and Entrepreneurship Competition (Shanghai Division), High-Precision Selective Acoustic Tweezers for Manipulating and Controlling Cells.
- Best Paper Award, The 9th International Multidisciplinary Conference on Optofluidics, 17 Jun 2019, Hong Kong, (Awarded to Graduated Student: Qin Lin)
- Academic Newcomer Award, 2023 Annual Second National Metamaterials Conference, 11-14 May 2023, Nanjing, (Awarded to Graduated Student: Rujun Zhang)
- First Prize Award, Shenzhen Natural Science Award, Theory and application of Acoustic tweezers, Rank 3/5, 2019.
- Second Prize Award, National Technological Invention Award, Key Techniques and Applications of Ultrasound Shear Wave Elastography, Rank 2/5, 2017.
- First Prize Award, Guangdong Province Technological Invention Award, Quantitative ultrasound elastography technology based on shear waves and its applications, Rank 2/6, 2016
- Innovation Achievement Award, China Industry-University-Research Cooperation, Ultrasound Shear Wave Elastography for Liver Cirrhosis Detection, Rank 6/7, 2014.

8. Professional Services

- Session co-organizer for the 2024 PIERS meeting on “Optical and Acoustic Manipulation: Fundamental and Application 1”
- Session co-chair for 2021 Acoustofluidics meeting on “Physical Acoustics”

- Guest editors, Nanotechnology and Precision Engineering, (2023-)
- Reviewer for 80+ journal papers
- NSFC correspondence reviewer (2013-)
- Mentored 10 MS students, 3 PhD students, and 3 Postdoctoral researchers (Co-supervisor)

9. Teaching Experience

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|----------------------|-------------------------------------|------------------------|-------------|
| • Lecturer | Frontiers in Biomedical Engineering | Nanjing University | 2024 Spring |
| • Lecturer | Frontiers in Biomedical Engineering | Sun Yat-Sen University | 2023 Summer |
| • Instructor | Physical Acoustics | SIAT, CAS | 2017 Summer |
| • Teaching Assistant | Quantum mechanics | Wuhan University | 2006 Spring |
| • Teaching Assistant | Advanced Mathematics | Wuhan University | 2006 Spring |

10. Publications (#Co-first author, *Co-Corresponding author)

Published **70+** peer-reviewed papers with over **3300** citations on Google Scholar. The complete publication list can be found on my [Google Scholar webpage](#).

Selected Publications:

• Invited Reviews

- (1) Yabin Jin*, Daniel Torrent*, Bahram Djafari Rouhani, Liangshu He, Yanxun Xiang, Fu-Zhen Xuan, Zhongming Gu, Haoran Xue, Jie Zhu, Qian Wu, Guoliang Huang, Pedro David Garcia, Guillermo Arregui, Yi Chen, Sébastien Guenneau, Martin Wegener, Muamer Kadic, Yongquan Liu, Jensen Li, Yue-Sheng Wang, Antonio Palermo, V. Romero-García, S. Kuznetsova, É Cheron, M. Lázaro Navarro, J. P. Groby, V. Pagneux, S. Félix, L. M. Garcia-Raffi, Gengkai Hu, Runcheng Cai, Timon Rabczuk, Xiaoying Zhuang, Penglin Gao, Yegao Qu, Mahmoud I. Hussein, Masahiro Nomura, Yan Pennec, **Feiyan Cai**, Xinwei Li, Wei Zhai, The 2024 phononic crystals roadmap, *Journal of Physics D: Applied Physics*, 58, 113001 (2025).
- (2) Joseph Rufo, **Feiyan Cai***, James Friend*, Martin Wiklund*, Tony Jun Huang*. Acoustofluidics for biomedical applications. *Nature Reviews Methods Primers* 2, 30 (2022).
- (3) Long Meng, **Feiyan Cai**, Fei Li, Wei Zhou, Lili Niu, Hairong Zheng*, Acoustic tweezers, *Journal of Physics D: Applied Physics*, 52, 273001 (2019).
- (4) K. Jagajjani Rao, Fei Li, Long Meng, Hairong Zheng, **Feiyan Cai***, Wei Wang*, A Force to Be Reckoned With: A Review of Synthetic Microswimmers Powered by Ultrasound, *Small*, 11, 2836-2846 (2015).
- (5) Hairong Zheng*, **Feiyan Cai**, Fei Yan, Lili Niu, Fei Li, Long Meng, Weibao Qiu, Multi-functional biomedical ultrasound: Imaging, manipulation, neuromodulation and therapy, *Chinese Science Bulletin*, 60, 1864-1873 (2015).

• Physical Acoustics

- (6) Qin Lin, Jiaqian Wang, **Feiyan Cai***, Rujun Zhang, Degang Zhao, Xiangxiang Xia, Jinping Wang, Hairong Zheng. A deep learning approach for the fast generation of acoustic holograms. *Journal of the Acoustical Society of America* 149, 2312-2322 (2021).
- (7) Xiangxiang Xia, Yongchuan Li, **Feiyan Cai***, Hui Zhou, Teng Ma, Jinping Wang, Jiaqian Wang, Hairong Zheng*. Three-dimensional spiral motion of microparticles by a binary-phase logarithmic-spiral zone plate. *Journal of the Acoustical Society of America* 150, 2401-2408 (2021).
- (8) Yaxi Shen#, Yugui Peng#, **Feiyan Cai***, Kun Huang, DeGang Zhao, ChengWei Qiu*, Hairong Zheng* Xue-Feng Zhu*, Ultrasonic super-oscillation wave-packets with an acoustic meta-lens. *Nature Communications* 10, 3411, (2019).
- (9) **Feiyan Cai**, Fei Li, Long Meng, Junru Wu, Hairong Zheng*. Strong localization of an acoustic wave in a sub-wavelength slot between two plates. *The Journal of the Acoustical Society of America* 137, 1251-1256 (2015).

(10) **Feiyan Cai**, Long Meng, Chunxiang Jiang, Yu Pan, and Hairong Zheng*, Computation of the acoustic radiation force using the finite-difference time-domain method. *The Journal of the Acoustical Society of America*, 128,4 (2010).

• **Acoustic Devices**

(11) Rujun Zhang, Youta Huang, Weichang Wu, Weibao Qiu, Hairong Zheng*, Yanyan Yu*, Zhiqiang Zhang*, and **Feiyan Cai***, Parallel droplet ejection with artificial-structure-based holographic acoustic fields. *Physical Review Applied*, 22, 064010 (2024).

(12) Ye Yang[#], Teng Ma^{#,*}, Sinan Li[#], Qi Zhang, Jiqing Huang, Yifei Liu, Jianwei Zhuang, Yongchuan Li, Xuemin Du, Lili Niu, Yang Xiao, Congzhi Wang, **Feiyan Cai***, Hairong Zheng*. Self-Navigated 3D Acoustic Tweezers in Complex Media Based on Time Reversal. *Research* 2021, 9781394 (2021).

(13) Fei Li, **Feiyan Cai***, Likun Zhang, Zhengyou Liu, Feng Li, Long Meng, Junru Wu, Jiangyu Li, Xiaofeng Zhang, Hairong Zheng*, Phononic-Crystal-Enabled Dynamic Manipulation of Microparticles and Cells in an Acoustofluidic Channel. *Physical Review Applied* 13, 044077 (2020). (**Featured in Physics, Editors' Suggestion**)

(14) Qin Lin, **Feiyan Cai***, Fei Li, Degang Zhao, Xiangxiang Xia, Wei Zhou, Long Meng, Hairong Zheng*, The compact acoustic liquid sensor based on the circumferential modes of a cylindrical shell. *Sensors and Actuators A: Physical* 304, 111843 (2020).

(15) Chen Wang, **Feiyan Cai***, Fei Li, Long Meng, Jiangyu Li, Junru Wu, Yan Kang*, Hairong Zheng. "A highly sensitive compact liquid sensor based on slotted phononic crystal plates." *Lab on a Chip* 16, 4595-4600 (2016).

• **Biomedical Applications**

(16) Guofeng Li, Weibao Qiu, Zhiqiang Zhang, Qiuju Jiang, Min Su, Ruilin Cai, Yongchuan Li, **Feiyan Cai**, Zhiting Deng, Di Xu, Hualin Zhang, Hairong Zheng. Noninvasive Ultrasonic Neuromodulation in Freely Moving Mice. *IEEE Transactions on Biomedical Engineering* 66, 217-224 (2019).

(17) Changcan Li, Gang Xu, Yinhan Wang, Laixin Huang, **Feiyan Cai**, Long Meng, Bao Jin, Zhuoran Jiang, Hang Sun, Haitao Zhao, Xin Lu, Xingting Sang, Pengyu Huang, Fei Li*, Huayu Yang*, Yilei Mao*, Hairong Zheng*, Acoustic-holography-patterned primary hepatocytes possess liver functions, *Biomaterials*, 311, 122691, (2024).

(18) Yanni He, Fei Li, Peng Jiang, **Feiyan Cai**, Qin Lin, Meijun Zhou, Hongmei Liu*, Fei Yan*, Remote control of the recruitment and capture of endogenous stem cells by ultrasound for in situ repair of bone defects," *Bioactive Materials*, 21, 223-238, (2023).

(19) Tiantian Chen, Jie Chen, Zhenyu Yi, Congqin Zheng, Linming Zhou, Yongjun Wu*, **Feiyan Cai**, Jiale Qin, Zijian Hong, Yuhui Huang*, Enhanced Ultrasound Transmission through Skull Using Flexible Matching Layer with Gradual Acoustic Impedance, *Acs Appl Mater Inter*, 15 (2023) 55510-55517.

(20) Jieqiong Wang, Liting Xie, Yu Shi, LiJuan Ao, **Feiyan Cai**, Fei Yan*. Early Detection and Reversal of Cell Apoptosis Induced by Focused Ultrasound-Mediated Blood-Brain Barrier Opening. *ACS Nano*, 15, 9, 14509-14521 (2021).

11. Selected Authorized Patents

(1) Xiangxiang Xia, **Feiyan Cai**, Manzhu Ke, Hui Zhou, Fei Li, XU Di, Yongchuan Li, Planar lens and manufacturing method for planar lens. Hairong Zheng, US Patent, US16/902225.

(2) Hairong Zheng, Fei Li, **Feiyan Cai**, Long Meng, Chen Wang, Chengxiang Zhang, Weibao Qiu, Yongchuan Li, Fei Yan, Lili Niu, Liufeng Geng, Chaowei Xu, Microfluidic system and method of controlling particles based on artificially structured acoustic field. US Patent, US15/742491.

- (3) Hairong Zheng, **Feiyan Cai**, Fei Li, Long Meng, Chen Wang, System and method for controlling and sorting particles based on artificially structured acoustic field. China Patent. CN201310080968.5. [Utilized by Shenzhen Sonolepu Medical Technology Co., Ltd]
- (4) Hairong Zheng, Long Meng, **Feiyan Cai**, Lili Niu, Fei Li, Yang Xiao. Microfluidic system and method of sorting specific cells. China Patent. CN201410382668.7. [Utilized by Guangzhou Consun Pharmaceutical Co., Ltd]

12. Selected Invited Presentations

- (1) The 18th Symposium on Piezoelectricity, Acoustic Waves, and Device Applications (SPAWDA), 8-11 Nov 2024, Dongguan, China, Lamb wave-based Acoustofluidics.
- (2) 25th Annual Conference of the Chinese Society of Micro-nano Technology, 20-23 Oct 2023, Shenzhen, China, *Lamb wave-based acoustic tweezers*.
- (3) The 2nd China Metamaterials Conference, 11-14 May 2023, Nanjing, China, *Shaping field based-Acoustic tweezers*.
- (4) 2023 International Congress on Ultrasonics (ICU), 18-21 September 2023 Beijing China, *Deep learning for precise and rapid acoustic hologram generation*.
- (5) Acoustofluidics 2019, 25-28 August 2019, Enschede, Netherlands, *Phononic crystals induced reversible acoustic radiation forces for 3D manipulation of microparticles*.
- (6) 176th Meeting Acoustical Society of America, 5-9 November 2018, Victoria Conference Centre Victoria, BC, Canada, *Acoustic radiation force manipulation of tissue, cell, and interactions with neurons*.
- (7) 8th International Multidisciplinary Conference on Optofluidics, 5th-8th August 2018, Shanghai, China, *Dexterous manipulating massive microparticles via artificially engineered acoustic field*.
- (8) 163th meeting of the Acoustical Society of America, 13-18 May, 2012, Hong Kong. *Acoustic trapping of particles by a periodically structured stiff plate*.

13. Skills

- **Simulation & Programming:** Fortran, C, C++, MATLAB, Mathematics, COMSOL, Multiple Scattering (MS), T-Matrix, Finite Different Time Domain (FDTD), Plane Wave Explain (PWE), Finite Element Analysis (FEM), MPI (Message Passing Interface), Field II, K-wave, M-sound, Deep Learning
- **Experimental:** Transducer Fabrication, Micro/Nanofabrication, Acoustic Measurement, Cell Culture
- **Languages:** English (fluent), Chinese (native)

14. References

- Professor Bruce Drinkwater, Email: B.Drinkwater@bristol.ac.uk
School of Electrical, Electronic and Mechanical Engineering, University of Bristol, UK
- Professor James Friend, Email: jfriend@ucsd.edu
Department of Mechanical and Aerospace Engineering, Jacobs School of Engineering and the Department of Surgery, School of Medicine, University of California, San Diego
- Professor Hairong Zheng, Email: hr.zheng@siat.ac.cn
Nanjing University, China/Shenzhen Institutes of Advanced Technology (SIAT), Chinese Academy of Sciences (CAS)