Shubo Wang

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Education

2009 – 2013	The Hong Kong University of Science and Technology PhD in Nano Science and Technology (Supervisor: Prof. C. T. Chan)
2005 – 2009	Shandong University BSc in Physics

Appointments

2017 – present	Assistant Professor	Department of Physics, City University of Hong Kong
2013 – 2017	Visiting Scholar	Department of Physics and Institute for Advanced Study The Hong Kong University of Science and Technology

Grants

2021	General Research Fund	PI
2020	General Research Fund	PI
2020	NSFC Young Scientists Fund	PI
2019	Collaborative Research Fund	Co-PI
2018	Early Career Scheme	PI

Awards

2020 Faculty Service Award (Department of Physics, City University of Hong Kong)
2012 William Mong Outstanding Paper Award (The Hong Kong University of Science and Technology)

Teaching

GE1305	Everyday Physics
GE1360	Introductory Physics
PHY2191	Electricity and Magnetism
PHY3205	Electrodynamics
PHY3204	Waves and Optics
PHY8503	Mathematical Methods for Scientists and Engineers

Professional Activities & Memberships

Reviewer for: Nature, Nature Communications, Communications Physics, Science Advances, Optica, Laser & Photonics Reviews, Photonics Research, Nanophotonics, Physical Review Letters, Physical Review Research, Physical Review Applied, Physical Review A, Physical Review B, Applied Physics Letters, Optics Express, Optics Letters, ACS Photonics, Scientific Reports, Journal of the Optical Society of America A, Journal of the Optical Society of America B, Journal of Lightwave Technology, Advanced Quantum Technologies, Chinese Physics B

Session Chair for Photonics & Electromagnetics Research Symposium (PIERS) 2022

Member of American Physical Society
Member of the Optical Society (OSA)

Research Interests

Optical and acoustic angular momentum, chiral light-matter interactions, non-Hermitian optics, singular optics, photonic crystals, metamaterials, optical forces

Journal Publications

* corresponding author(s)

1. J. Peng, R. Y. Zhang, S. Jia, W. Liu, and S. Wang*, Topological near fields generated by topological structures, **Science Advances**, in press.

2. Z. Yang, Y. Cheng, N. Wang, Y. Chen, and S. Wang*, Nonreciprocal light propagation induced by a subwavelength spinning cylinder, **Optics Express** 30, 27993 (2022).

3. J. Peng, S. Jia, C. Zhang, and S. Wang*, Optical force and torque on small particles induced by polarization singularities, **Optics Express** 30, 16489 (2022).

4. S. Jia, J. Peng, Y. Cheng, and S. Wang*, Chiral discrimination by polarization singularities of a metal sphere, **Physical Review A** 105, 033513 (2022).

5. Yu. Shi, Y. Wu, L. K. Chin*, M. K. Chen, S. Wang, Y. Zhang, Z. Li, P. Y. Liu, X. Zhou, H. Cai, Y. Yu, P. H. Yap, W. Ser, B. Nguyen, J. Liao, F. Wang, C. T. Chan*, Y. Kivshar*, D. P. Tsai*, and A. Q. Liu*, Multifunctional virus manipulation with large-scale arrays of all-dielectric resonant nanocavities, **Laser & Photonics Review** 16, 2100197 (2022).

6. Q. Tong and S. Wang*, Acoustic helical dichroism in a one-dimensional lattice of chiral resonators, **Physical Review B** 105, 024111 (2022).

7. X. Xia, K. Huang, S. Wang, and X. Li*, Exact mobility edges in the non-Hermitian t_1-t_2 model: Theory and possible experimental realizations, **Physical Review B** 105, 014207 (2022).

8. N. Wang*, R. Y. Zhang*, Q. Guo, S. Wang, and C. T. Chan, Optical pulling using topologically protected one way transport surface-arc waves, **Physical Review B** 105, 014104 (2022).

9. P.-G. Chen, Z. Li, Y. Qi, T. W. Lo, S. Wang, W. Jin, K.-Y. Wong, S. Fan, A. V. Zayats, and D. Lei*, Long-range directional routing and spatial selection of high-spin-purity valley trion emission in monolayer WS_2, **ACS Nano** 15, 18163 (2021).

10. W. Wang, Y. Tan, B. Liang*, G. Ma, S. Wang, and J. Cheng, Generalized momentum conservation and Fedorov-Imbert linear shift of acoustic vortex beams at a metasurface, **Physical Review B** 104, 174301 (2021).

11. S. Wang*, G. Zhang, X. Wang, Q. Tong, J. Li, and G. Ma*, Spin-orbit interactions of transverse sound, **Nature Communications** 12, 6125 (2021). CityU News, EurekAlert!, Phys.org, Science Daily

12. H. Shi, Z. Yang, C. Zhang, Y. Cheng, Y. Chen*, and S. Wang*, Robust exceptional point of arbitrary order in coupled spinning cylinders, **Optics Express** 29, 29720 (2021).

13. Y. Meng, Y. Hao, S. Guenneau, S. Wang, and J. Li*, Willis coupling in water waves, **New Journal of Physics** 23, 073004 (2021).

14. N. Wang, R. Y. Zhang, S. Wang, G. P. Wang*, and C. T. Chan*, Optical forces on a cylinder induced by surface waves and the conservation of the canonical momentum of light, **Optics Express** 29, 20590 (2021).

15. H. Shi, Y. Cheng, Z. Yang, Y. Chen*, and S. Wang*, Optical isolation induced by subwavelength spinning particle via spin-orbit interaction, **Physical Review B** 103, 094105 (2021).

16. J. Peng, W. Liu, and S. Wang*, Polarization singularities in light scattering by small particles, **Physical Review A** 103, 023520 (2021).

17. K. J. Wo, J. Peng, M. K. Prasad, Y. Shi, J. Li, and S. Wang*, Optical forces in coupled chiral particles, **Physical Review A** 102, 043526 (2020).

18. Y. Shi, T. Zhu, K. T. Nguyen, Y. Zhang, S. Xiong, P. H. Yap, W. Ser, S. Wang, C.-W. Qiu, C. T. Chan*, and A. Q. Liu*, Optofluidic microengine in a dynamic flow environment via self-induced back-action, **ACS Photonics** 7, 1500 (2020). Cover

19. P. Chen, T. W. Lo, Y. Fan, S. Wang, H. Huang, and D. Lei*, Chiral coupling of valley excitons and light through photonic spin-orbit interactions, **Advanced Optical Materials** 8, 1901233 (2019).

20. S. Wang*, B. Hou, and C. T. Chan*, Broadband microwave absorption by logarithmic spiral metasurface, **Scientific Reports** 9, 14078 (2019).

21. H. Shi, Z. Xiong, W. Chen, J. Xu, S. Wang*, and Y. Chen*, Gauge-field description of Sagnac frequency shift and mode hybridization in a rotating cavity, **Optics Express**, 27, 28114 (2019).

22. W. Li, D. Tan, J. Xu, S. Wang, and Y. Chen*, Finite element based Green's function integral equation for modelling light scattering, **Optics Express** 27, 16047 (2019).

23. S. Wang*, B. Hou, W. Lu, Y. Chen, Z. Q. Zhang, and C. T. Chan*, Arbitrary order exceptional point induced by photonic spin-orbit interaction in coupled resonators, **Nature Communications** 10, 832 (2019). CityU News

24. J. Chen, S. Wang, X. Li, and J. Ng*, Mechanical effect of photonic spin-orbit interaction for a metallic nanohelix, **Optics Express** 26, 27694 (2018).

25. N. Wang, S. Wang, Z.-Q. Zhang, and C. T. Chan*, Closed-form expressions for effective constitutive parameters: Electrostrictive and magnetostrictive tensors for bianisotropic metamaterials and their use in optical force density calculations, **Physical Review B** 98, 045426 (2018).

26. M. Wang, S. Wang, Q. Zhang, C. T. Chan, and H. B. Chan*, Measurement of mechanical deformations induced by enhanced electromagnetic stress on a parallel metallic-plate system, **Physical Review Letters** 121, 035502 (2018).

27. X.-L. Zhang, S. Wang, B. Hou, and C. T. Chan*, Dynamically encircling exceptional points: *In situ* control of encircling loops and the role of the starting point, **Physical Review X** 8, 021066 (2018).

28. N. Wang, S. Wang, and J. Ng*, Electromagnetic stress tensor for an amorphous metamaterial medium, **Physical Review A** 97, 033839 (2018).

29. S. Wang, G. Ma, and C. T. Chan*, Topological transport of sound mediated by spin-redirection geometric phase, **Science Advances** 4, eaaq1475 (2018). CityU News

30. X.-L. Zhang, S. Wang, W.-J. Chen, and C. T. Chan*, Exceptional points and symmetry recovery in a two-state system, **Physical Review A** 96, 022112 (2017).

31. S. T. Chui*, S. Wang, and C. T. Chan, Electromagnetic sensors from algebraic corner vortex generation in polygonal plates, **Applied Physics Letters** 110, 011107 (2017).

32. X. Cui, S. Wang, and C. T. Chan*, Superlens induced loss-insensitive optical force, **Optics Express** 24, 13992 (2016).

33. S. Wang, J. Ng, M. Xiao, and C. T. Chan*, Electromagnetic stress at the boundary: Photon pressure or tension?, **Science Advances** 2, e1501485 (2016). Nature Photonics *News and Views*

34. S. T. Chui*, S. Wang, and C. T. Chan, Scattering of electromagnetic waves from surfaces with conformal mapping: An example of a triangular plate, **Physical Review E** 93, 033302 (2016).

35. S. Wang and C. T. Chan*, Strong optical force acting on a dipolar particle over a multilayer substrate, **Optics Express** 24, 2235 (2016).

36. X.-L. Zhang, S. Wang, Z. F. Lin, H. B. Sun, and C. T. Chan*, Optical force on toroidal nanostructures: toroidal dipole versus renormalized electric dipole, **Physical Review A** 92, 043804 (2015).

37. W. J. Sun, S. Wang, J. Ng, L. Zhou, and C. T. Chan*, Analytic derivation of electrostrictive tensors and their application to optical force density calculations, **Physical Review B** 91, 235439 (2015). Editors' Suggestion

38. S. Wang and C. T. Chan*, Lateral optical force on chiral particles near a surface, **Nature Communications** 5, 3307 (2014). ESI Highly Cited Paper

39. Z. Marcet, Z. H. Hang, S. Wang, C. T. Chan, and H. B. Chan*, Measurement of enhanced radiation force on a parallel metallic-plate system in the microwave regime, **Physical Review Letters** 112, 045504 (2014).

40. S. Wang and C. T. Chan*, Microwave-induced elastic deformation of a metallic thin film, **Journal of Physics D: Applied Physics** 46, 395104 (2013).

41. S. Wang*, H. H. Zheng, J. J. Xiao, Z. F. Lin, and C. T. Chan, Fast multipole boundary element method for three dimensional electromagnetic scattering problem, **International Journal of Computational Materials Science and Engineering** 01, 1250038 (2012).

42. C. P. Huang*, S. Wang, X. G. Yin, Y. Zhang, H. Liu, Y. Y. Zhu, and C. T. Chan*, Enhanced electromagnetic pressure in a sandwiched reflection grating, **Physical Review B** 86, 085446 (2012).

43. C. P. Huang*, X. G. Yin, Y. Zhang, S. Wang, Y. Y. Zhu, H. Liu, and C. T. Chan*, Deep subwavelength Fabry-Perot-like resonances in a sandwiched reflection grating, **Physical Review B** 85, 235410 (2012).

44. S. Wang*, J. Ng, H. Liu, H. H. Zheng, Z. H. Hang, and C. T. Chan*, Sizable electromagnetic forces in parallel-plate metallic cavity, **Physical Review B** 84, 075114 (2011).

45. H. Liu*, J. Ng, S. Wang, Z. H. Hang, C. T. Chan, and S. N. Zhu, Strong plasmon coupling between two gold nanospheres on a gold slab, **New Journal of Physics** 13, 073040 (2011).

46. H. Liu*, J. Ng, S. Wang, Z. F. Lin, Z. H. Hang, C. T. Chan*, and S. N. Zhu, Strong light-induced negative optical pressure arising from kinetic energy of conduction electrons in plasmon-type cavities, **Physical Review Letters** 106, 087401 (2011).

Conference Presentations

Keynote Talks

1. *Photon momentum effects in artificial microstructures*, International Symposium on Photonics and Optoelectronics (**SOPO**), Xi'an, China, August 17-19, 2019.

2. *Acoustic spin-redirection geometric phase*, Joint Annual Conference of Physical Societies in Guangdong-Hong Kong-Macao Greater Bay Area (**YGA**), Macau, China, July 26-29, 2018.

Invited Talks

1. *Topological optical fields generated by topological structures*, The International Conference on Metamaterials, Photonic Crystals and Plasmonics (**META**), Torremolinos, Spain, July 19-22, 2022.

2. *Manipulating optical and acoustic angular momentum by using chiral structures*, International Conference on Frontier Materials (**ICFM**), Zhuhai, China, May 27-31, 2022.

3. *Topological Properties of Polarization Singularities in Scattering Systems*, Photonics & Electromagnetics Research Symposium (**PIERS**), Hangzhou, China, April 25-28, 2022.

4. *Nonreciprocity and non-Hermiticity in spinning resonators*, Photonics & Electromagnetics Research Symposium (**PIERS**), Hangzhou, China, April 25-28, 2022.

5. *Spin-orbit interactions of transverse sound*, Greater Bay Area Symposium for Wave Functional Materials, Hong Kong, China, October 16-17, 2021.

6. *Arbitrary order exceptional point induced by photonic spin-orbit interaction*, The International Conference on Metamaterials, Photonic Crystals and Plasmonics (**META**), Warsaw, Poland, July 20-23, 2021.

7. *Photonic and acoustic momentum effects*, Greater Bay Area Symposium for Wave Functional Materials, Guangzhou, China, July 18-20, 2019.

8. *Asymmetric coupling induced by photonic spin-orbit interactions*, Photonics & Electromagnetics Research Symposium (**PIERS**), Rome, Italy, June 17-20, 2019.

9. *Microwave absorption by logarithmic spiral metasurface*, Progress in Electromagnetics Research Symposium (**PIERS**), Toyama, Japan, August 1-4, 2018.

10. *Learning from nature: bio-inspired metasurface microwave absorber*, The International Conference on Metamaterials, Photonic Crystals and Plasmonics (**META**), Marseille, France, June 24- July 1, 2018.

11. *Bio-inspired broadband microwave metasurface absorber*, Progress in Electromagnetics Research Symposium (**PIERS**), Singapore, November 19-22, 2017.

12. *Topological transport of sound vortices*, The International Conference on Metamaterials, Photonic Crystals and Plasmonics (**META**), Incheon, Korea, July 25-28, 2017.

13. *Do photons push or pull a boundary?*, Conference on Lasers and Electro-Optics/Europe and the European Quantum Electronics Conference (**CLEO/Europe-EQEC**), Munich, Germany, June 25-29, 2017.

14. *Boundary stress induced by electromagnetic wave & Effective medium theory of boundary optical stress*, Progress in Electromagnetics Research Symposium (**PIERS**), Shanghai, China, August 8-11, 2016.

15. *Boundary optical stress in metamaterial and effective-medium systems*, The Advanced Electromagnetics Symposium (**AES**), Malaga, Spain, July 26-28, 2016.

16. *Boundary optical stress: pressure or tension?*, The International Conference on Metamaterials, Photonic Crystals and Plasmonics (**META**), Malaga, Spain, July 25-28, 2016.

17. *Electromagnetic stress on metamaterial boundaries*, The International Union of Materials Research Societies-International Conference on Electronic Materials (**IUMRS-ICEM**), Singapore, July 4-8, 2016.

18. *Chirality enables unusual optical force*, Society of Photo-optical Instrumentation Engineers (**SPIE**), San Diego, California, USA, August 17-21, 2014.

Contributed Talks

1. *Spin-orbit interactions of transverse sound*, The International Conference on Metamaterials, Photonic Crystals and Plasmonics (**META**), Torremolinos, Spain, July 19-22, 2022.

2. *Acoustic spin-orbit interactions*, Photonics & Electromagnetics Research Symposium (PIERS), Hangzhou, China, April 25-28, 2022.

3. *Spin-redirection geometric phase of acoustic vortices*, Photonics & Electromagnetics Research Symposium (**PIERS**), Rome, Italy, June 17-20, 2019.

4. *Electromagnetic wave induced force and stress on metallic thin films*, Progress in Electromagnetics Research Symposium (**PIERS**), Stockholm, Sweden, August 12-15, 2013.

5. *Lateral optical force induced by spin angular momentum of electromagnetic wave*, The 16th Conference of The Physical Society of Hong Kong (**PSHK**), Hong Kong, June, 2013.

6. *Electromagnetic forces in metallic cavity*, Progress in Electromagnetics Research Symposium (**PIERS**), Kuala Lumpur, Malaysia, March 27-30, 2012.

7. *Resonance enhanced electromagnetic forces in parallel-plate metallic cavity*, The 14th Conference of The Physical Society of Hong Kong (**PSHK**), Hong Kong, June, 2011.

Developed Algorithms

FMBEM: Fast multipole boundary element method for simulating 3D electromagnetic waves. It consumes less memory and is much faster than COMSOL.

DLG: Semi-analytical Green's function method for simulating electromagnetic wave propagation inside a 2D lattice of small cylinders.

MieSphLay: Multiple scattering method for simulating electromagnetic wave scattering by a Mie sphere sitting on a semi-infinite multi-layer substrate.

DSphLay: Green's function method for simulating electromagnetic wave scattering by a dipolar particle sitting on a semi-infinite multi-layer substrate.

Research Highlights

EurekAlert: *CityU physicists discovered special transverse sound wave*

Phys.org: *Physicists discover special transverse sound wave*

Science Daily: *Physicists discovered special transverse sound wave*

CityU Research Stories: *CityU physicists discovered special transverse sound wave*

Liangjiang Technology Review: *Acoustic spin-orbit interactions*

CityU Research Stories: *Exceptional point achieved with photonic resonators paves way for development of ultrasensitive optical sensors*

Liangjiang Technology Review: *Arbitrary order exceptional point realized in optical structures*

CityU Research Stories: *Spin-redirection phase of sound demonstrated for the first time*

Nature Photonics News & Views: *Momentum in metamaterials*