Shunshun Cao

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RESEARCH INTERESTS

Pulsars, Coherent Emission Mechanisms, Collisionless Shocks, Astrophysical Plasmas

I have been working on interpreting radio pulsar observation signal since undergraduate period, in Prof. Renxin Xu's group. During the first two years of my PhD project, my main focus is to connect the propagation effects in pulsar magnetospheres with observation data. Since October 2025, I have been working on theoretical modeling of collisionless shock in relativistic plasmas, with Particle-in-Cell simulations, in Prof. Zheng Gong's group.

EDUCATION

Peking University, Beijing, China — Sept. 2023 —
Doctor of Philosophy: Astrophysics (School of Physics)

Peking University, Beijing, China — Sept. 2019 — Jul. 2023
Bachelor of Science: Astronomy (honours degree, School of Physics)

PUBLICATIONS

Journal paper

Leading Author Publications

1. **Cao, S.**, Guo, Y., Jiang, J. et al. (2026), Pulsar electrodynamics inferred from frequency-dependent circular polarization diversity, *A&A*, 710, A282.
2. **Cao, S.**, Jiang, J., Dyks, J. et al. (2025), Rapid Rotation of Polarization Orientations in PSR B1919+21's Single Pulses: Implications on Pulsar's Magnetospheric Dynamics, *ApJ*, 983, 43.
3. **Cao, S.**, Jiang, J., Dyks, J. et al. (2024), PSR B0943+10: Mode Switch, Polar Cap Geometry, and Orthogonally Polarized Radiation, *ApJ*, 973, 56.

Contributing Author Publications

1. Long, H., Lu, R., Wang W. et al. (2026), Pulsar anti-glitches: starquakes driven by magnetism? arxiv.2607.12285.
2. Zhao, T., **Cao, S.**, & Xu, R. (2026), Constraining Pulsar Radiative Geometry via Multi-wavelength Modeling, arxiv.2607.04083.
3. Oswald, L., Basu, A., Chakraborty, M. et al. (2026), Understanding Pulsar Magnetospheres with the SKAO, arxiv.2607.05432.
4. Wang, W., **Cao, S.**, Huang, Z. et al. (2026), To Understand the Radiative Processes of Pulsars and Fast Radio Bursts with the FAST, *Chinese Phys. Lett.*, 43, 051103.
5. Xu, Z., Wang, W., **Cao, S.**, Xu, R. (2026), Pulsar Sparking: What if Mountains are on the Surface? *Res. Astron. Astrophys.* 26, 035014.
6. Zhao, S., Wu, X., Luo, R. et al. (2026), Magnetic dipolar geometry unveiled from a long-period radio pulsar, preprint (10.21203/rs.3.rs-8477576/v1).
7. Wang, Z., Lu, J., Wang, W. et al. (2025), The radiative subpulse modulation and spectral features of PSR B1929+10 with the whole pulse phase emission, *A&A*, 700, A255.
8. Jiang, J., **Cao, S.**, Lee, K. et al. (2025), HI Absorption Line and Anomalous Dispersion in the Radio Pulses of PSR B1937+21, *ApJ*, 988, 277.
9. Ding, R., Pan, Z., Eatough, R. et al. (2025), Discovery of a Periodic Radio Signal from the Formerly Radio-quiet γ-Ray Pulsar J0359+5414 with FAST, *ApJ*, 987, 128.
10. Wang, J., **Cao, S.**, Jiang, J. et al. (2025), First Constraint on Axion-Photon Coupling g_γ from Neutron Star Observations, arXiv.2506.07546.
11. Wang, Z., **Cao, S.**, Lu, J. et al. (2024), An Extreme Radio Fluctuation of Pulsar B1929+10, *ApJL*, 976, L22.
12. Jiang, J., Xu, J., Niu, J. et al. (2024), Ninety percent circular polarization detected in a repeating fast radio burst, *National Science Review*, 12, 2.
13. Wang, Z., Lu, J., Jiang, J. et al. (2024), Radio Pulsar B0950+08: Radiation in the Magnetosphere and Sparks above the Surface, *ApJ*, 963, 65.
14. Wang, Z., Lu, J., Jiang, J. et al. (2024), Non-symmetrical sparking may hint "zits" on a pulsar surface, *Astronomische Nachrichten*, 345, e240010.

Others

1. Contributed to *The Scientific Reports of FAST Core Array*[1] (Chapter 5, Section 3.2—"Using FAST core array to study pulsar wind nebulae and other extended structures")

SEMINARS & CONFERENCE TALKS

1. My slides for paper-reading seminars at Peking University could be found at https://discoegg.github.io//talks/seminar_series.
2. "Diagnostics of Pulsar Magnetospheric Plasmas", 2026.7, FAST/Future Pulsar Symposium 15, Guiyang, China.
3. "The Diversity of Pulsar Circular Polarization and Its Mechanism", 2026.2, GPPS Symposium, Yancheng, China.
4. "New Results on Analysis of the Wave Summation in the Radio Emission of B1919+21", 2025.7, FAST/Future Pulsar Symposium 14, Qingdao, China.
5. "Analysis and modeling of the rapid polarization rotations in single pulses of B1919+21", 2025.5, The Era When Pulsars Meet FRBs, Qiannan, China.
6. "Attempts on Studying Pulsar Magnetospheres with FAST single pulse observations", 2025.5, NAOC lunch talk, Beijing, China.
7. "Evidence for wave-plasma interaction by single pulses", 2024.12, International Pulsar Symposium 2024, Guiyang, China.
8. "PSR B0943+10: Mode Switch, Polar Cap Geometry,and Orthogonally Polarized Radiation", 2024.10, "Space-time Probe" Pulsar Science Symposium, Huangshan, China.
9. "Study of PSR B0943+10 using FAST: the modes, geometry and OPMs", 2023.7, FAST/Future Pulsar Symposium 12, Nanyang, China.

POSTERS

1. "Diversity of circular polarization spectra from magnetospheric limiting polarization effects", 2026.7, FRB 2026, Guiyang, China.
2. "Insights into Pulsar Magnetospheres Using FAST Single Pulses", 2025.9, AAPPS-DPP, Fukuoka, Japan.

AWARDS

"Crab prize" at FAST/Future Pulsar Symposium 15
https://psr.pku.edu.cn/conference/fps/FPS15/Prizes.html July, 2026

Excellent Teaching Assistant at School of Physics, Peking University
Electrodynamics (taught by Prof. Lijing Shao) June, 2026

Third Prize at Zhong Shengbiao Education Fund Graduate Academic Forum, School of Physics, Peking University
https://mp.weixin.qq.com/s/PQ2xDyLHahm15BPNBKvstA May, 2026

"Vela prize" at FAST/Future Pulsar Symposium 15
https://psr.pku.edu.cn/conference/fps/FPS14/Prizes.html July, 2025

Participation Award at Zhong Shengbiao Education Fund Graduate Academic Forum, School of Physics, Peking University
https://mp.weixin.qq.com/s/1QaNsAz1pJf_FEcF1-i5yg May, 2025

OTHER EXPERIENCES

Teaching assistant of Electrodynamics (2025 fall) and Astrophysics (2025 spring) in Peking University

Part-time tutor for undergraduate students (2023 spring to 2025 summer) in Peking University

SKILLS

- Programming with PYTHON
- Particle-in-Cell simulation with EPOCH
- Radio pulsar data reduction
- Analytical modeling in plasma physics

[1] https://www.ecsponline.com/goods.php?id=233517

- Linux, Latex, ...

REFERENCES

Prof. Renxin Xu (PhD. supervisor)
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Prof. Zheng Gong
Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing, China
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Prof. Yanjun Guo (Co-supervisor)
National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China
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