Shan-Chang Lin

Summary

My work focuses on computational physics, high-performance computing (HPC), and parallel computing. I have experience in magnetohydrodynamics (MHD) simulations, 3-dimensional particle-in-cell (PIC) simulations, and modeling plasma physics, including magnetic reconnection and plasma instabilities. I also have experience in solving nonlinear ordinary differential equations (ODEs) using the finite difference method. I am aiming to apply computational physics skills in advancing technology.

Skills

- plasma physics, MHD simulations, PIC simulations, computational physics, finite difference, machine learning, C++, Python (numpy, pandas, matplotlib, scikit-learn, tensorflow), high-performance computing (HPC), parallel computing

Experience

PhD student researcher in plasma physics

- Derive and numerically solve an ordinary differential equation (ODE) to estimate magnetic reconnection onset time based on first-principles theory
- Design and conduct 3-dimensional particle-in-cell (PIC) simulations on a high-performance supercomputer. Analyze the simulation results using Python. Conduct and publish the first study to discover how drift-kink instability affects X-line spreading, and the first study to discover finite X-line could form spontaneously.
- Design and conduct 2-dimensional magnetohydrodynamics (MHD) simulations, which includes Maxwell's equations and fluid equations, on a high-performance supercomputer. Analyze the simulation results using Python. Discover a new method to generate fast reconnection in MHD simulations. Publish the results in a peer-reviewed journal.

Research Assistant at Institute of Astronomy and Astrophysics, Academia Sinica

- Conduct N-body simulations and analyze observable features for different dark matter models.

Short-term scholar at The University of Texas at Austin

- Develop a Python script to solve the Schrödinger-Poisson equations in a one-dimensional system.

Master student researcher in cosmology

- Numerically solve an ODE using the finite difference method, C++, and parallel computing. Analyze the results using Python. Discover a new way to solve a spherical symmetric steady-state solution of the Schrödinger-Poisson equations, which are nonlinear partial differential equations (PDEs). Publish the results in a peer-reviewed journal.

Side Projects

Machine Learning and Statistical Data Analysis

- Develop a classifier in Python to predict whether the averaged rating exceeds a certain value based on the reviews. Utilized techniques such as bag-of-words, TFIDF, and Word2Vec to implement the classifier.

2D lattice simulations on self-organizing hierarchies

- Develop a Python script to simulate the encounters of particles in a 2D lattice.

Education

- **Ph.D. in Physics**, Dartmouth College. Hanover, NH, USA. Jan. 2019–present.
- **Master of Science in Physics**, National Taiwan University. Taipei, Taiwan.
- **Bachelor of Science in Physics**, National Taiwan University. Taipei, Taiwan.

Publications

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- **Shan-Chang Lin**, Yi-Hsin Liu, Xiaocan Li. The spreading of magnetic reconnection X-line in particle-in-cell simulations– mechanism and the effect of drift-kink instability. Journal of Geophysical Research: Space Physics, 130, e2024JA033494 (2025).
- Liu, Yi-Hsin, Paul Cassak, Xiaocan Li, Michael Hesse, **Shan-Chang Lin**, and Kevin Genestreti. "First-principles theory of the rate of magnetic reconnection in magnetospheric and solar plasmas." Communications Physics 5, no. 1 (2022): 1-9.
- **Shan-Chang Lin**, Yi-Hsin Liu, Xiaocan Li. "Fast magnetic reconnection induced by resistivity gradients in 2D magnetohydrodynamics." Physics of Plasmas 28 (7), 072109 (2021).
- Liu, Yi-Hsin, **Shan-Chang Lin**, Michael Hesse, Fan Guo, Xiaocan Li, Haocheng Zhang, and Sarah Peery. "The critical role of collisionless plasma energization on the structure of relativistic magnetic reconnection." The Astrophysical Journal Letters 892, no. 1 (2020): L13.
- **Shan-Chang Lin**, Hsi-Yu Schive, Shing-Kwong Wong, Tzihong Chiueh. "Self-consistent construction of virialized wave dark matter halos." Phys. Rev. D 97, 103523 (2018).

References

- Prof. Yi-Hsin Liu,
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- Dr. Xiaocan Li,
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