Shu Zhang

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https://github.com/ShuZ3274/

KEY COMPETENCIES

- Strong ambition in the research of astrophysics
- Sophisticated coding skills with Python
- Focus on fluid dynamics problems
- Advanced disciplinary training in 500 courses

EDUCATION

Master of Science Expected Graduation May 2026
McGill University, Quebec, Canada
Major in Physics, Thesis

Bachelor of Science May 2024
McGill University, Quebec, Canada
Major in Physics

Diploma of BC High School June 2020
Point Grey Secondary School, Vancouver, BC, Canada

RESEARCH PROJECTS

Penetrative convection into a stably stratified composition gradient
Independent Research 2024/06 - on going
Supervised by: Andrew Cumming
Changing the temperature of a stably stratified composition gradient solution will trigger a convective activity. The growth rate of the size of such convection zone depends on the properties of given fluids. My research is to numerically simulate the motion of fluid and potentially find out the relation.

- ✓ Fluid simulation in a 2D lattice.
- ✓ Solving PDEs with the help of Dedalus package in Python.

Magnetic Field of White Dwarf
Independent Research 2023/12 - 2024/04
Supervised by: Andrew Cumming
A study to calculate how the magnetic field profile changes over time due to ohmic diffusion, of a cooling white dwarf, how long it takes for the dynamo-generated field in the core to diffuse to the surface.

- ✓ Starting with deriving magnetic field under ohmic diffusion.
- ✓ Simulation from MESA code.
- ✓ Focusing on solving the diffusion equation numerically with high stability in the algorithm.
- ✓ Comparison with observational data on white dwarfs, from Gaia telescope.

Dark Energy and Mathematical Model
Independent Project 2023/09 - 2023/12
A study of evidence of the existence of dark energy

- ✓ Starting with deriving relativistic model of universe from scratch, then providing observational evidence to prove possibility.
- ✓ Discussion extended to the ongoing great challenge in cosmology, Hubble tension, with analysis of Planck CMB surveys and Riess observation of supernova redshift.
- ✓ End with imposition of changing dark energy density.

N-body Problem and Barne-Hut Algorithm
Group project 2023/09 - 2023/12
Team leader
In charge of most of the coding and assist composing the article

- ✓ A numerical simulation of some unique motions in solar system, including asteroid belt's triangular motion, trojan asteroid in Jupiter's orbit and the perihelion precession of Mercury.
- ✓ The method is based on object-oriented Python coding, assisted with Barne-hut algorithm to boost efficiency when encountering large N-body problem, and also using integration method like leapfrog and Rung-Kutta to reduce deviation accumulated over large time scale.

COMMUNITY INVOLVEMENT

Tutor in the class of Basic Japanese (EAST 340) 2021/09 – 2022/04
TA for PHYS 512 (computational physics w. applications) 2024/09 – 2024/12

INTEREST & SKILLS

Interest: Drawing
Skills: Python; C++
Languages: Chinese (native); English (Fluent); Japanese (Fluent)

PUBLICATIONS

Primary Contributor:

1. Matias Castro-Tapia, Shu Zhang, Andrew Cumming (2024), *Magnetic field evolution for crystallization-driven dynamos in C/O white dwarfs*, ***arXiv:***2406.01807