Zhengzhan Shang

Depatment of Astro- and Geophysics, Institute of Physics, University of Graz | Nationality: Chinese

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Research Interest

My research interests lie in astrophysical fluid dynamics, solar and stellar plasma physics, solar dynamos and magnetohydrodynamic simulations. Keywords: Sun: oscillation, Sun: interiors, Sun: magnetic field.

Education

Ph.D Physics — **University of Graz**, Graz, Austria — July. 2025 – July. 2028

- Planned title of Doctoral thesis : "Rossby Waves in Dynamo Layers of Sun-Like Stars" (Research Group: Prof. Dr. Astrid Veronig; Co-supervisor: Dr. Teimuraz Zaqarashvili)
- Funding: Austrian Science Fund (FWF) - project number: A28165300050

German Intensive Course Certificate B1-C1 — **Institut für Interkulturelle Kommunikation** (IIK), Göttingen, Germany — Sept. 2024 - Apr. 2025

M.Sc. Physics — **University of Göttingen**, Göttingen, Germany — Oct. 2020 – Sept. 2024

- Final Grade: 2,0/1,0 (good)
- Master's Thesis: "Numerical Evaluation of Kolmogorov's Theory of Turbulence in Rotating Ellipsoid" (Research Group: Prof. Dr. Andreas Tilgner)

B.Sc. Mathematics & Physics — **University of Wisconsin-Stevens Point** (UWSP), Stevens Point, WI, USA — Sept. 2016 – May 2020

- Minor: Astronomy
- GPA: 3.16/4.0 (good)

Employments and Relevant Experience

Student Internship — Research Group: Prof. Dr. Laurent Gizon, Co-supervisor: Dr. Damien Fournier, **Max Planck Institute for Solar System Research**, Göttingen, Germany — Sept. 2022 - Jun. 2023

- Reproduction of the paper by Tang (1979), "Comparison of Spectral Methods for Flows on Spheres"
- Investigation of two-dimensional flow on a spherical surface using the full-spectral method
- Implementation of a full-spectral method in Python

Research Assistant — Research Group: Prof. Dr. Mick Veum, **Department of Physics and Astronomy**, UWSP, WI, USA — Sept. 2017 - Feb. 2020

- Data acquisition and analysis using Microsoft Office for the following experiments:
  - measuring the temperature variation of film tension in freestanding liquid-crystal films
  - measuring the contact angle of water droplets on hydrophobic soils
- Designing and implementing improvements to the experimental apparatus and data acquisition techniques

Research Assistant in Astrophysics — Research Group: Prof. Dr. Sebastian Zamfir, **Department of Physics and Astronomy**, UWSP, WI, USA — Sept. 2017 - Jun. 2018

- Data collection from the SDSS SkyServer and categorization using Python

- Determination of mutual suppression in the winds and jets of extragalactic quasars

Awards and Scholarships

***Math Club Leadership Award* (2020)** **Department of Mathematical Sciences**, UWSP, WI, USA

***Department Leadership Award* (2020)** **Department of Mathematical Sciences**, UWSP, WI, USA

***Distinguished Achievement Award* (2020)** **College of Letters and Science**, UWSP, WI, USA

***Arthur J. Pejsa Aerospace Scholarship* (2019)** **University of Wisconsin-Stevens Point**, WI, USA

Current and Past Projects

Linear MHD Solar Rossby Waves with Differential Rotation 2025-present

- Magnetohydrodynamics 1D linear simulation of Rossby waves in the Sun and Sun-like stars in the rotating frame
- Tools Used: Python, Dedalus, LaTeX, Mathematica

Non-linear MHD Shallow Water Solar Rossby Waves 2025-present

- Magnetohydrodynamics 2D non-linear simulation of Rossby waves in the Sun and Sun-like stars with shallow water approximation in the rectangular geometry
- Tools Used: Python, Dedalus, LaTeX, Mathematica

Tidal Dissipation in Rotating Ellipsoids github.com/zhengzhanshang/ell_rot_2024, 2024

- Computational fluid dynamics (CFD) simulations of elliptical instability in rotating ellipsoids using Dedalus in a high-performance computing (HPC) environment
- Tools Used: Python, Dedalus, SageMath, LaTeX, WolframAlpha

Full Spectral Method in Spherical Geometry github.com/zhengzhanshang/mps_internship_2023, 2023

- Coded the full spectral method to solve for the velocity field using finite difference method in spherical geometry
- Tools Used: Python

Advanced Linear Algebra 2020

- Investigating the properties of matrices through their eigenvalues and eigenvectors, and extending these concepts to operators in infinite-dimensional spaces

Participation of Scientific Meetings and Workshops

1 oral presentation

- Oral Presentation at Austrian Early Career Conference, Salznurg, Austria, 2026. Title: "Why solar surface Rossby wave power depends on cycle phase?"

2 poster presentations

- Poster Presentation at Undergraduate Research Symposium, Stevens Point, USA 2019. Title: "The relation between the tension of a freestanding liquid-crystal film and its bulk temperature"
- Poster Presentation at UW System Symposium for Undergraduate Research, Green Bay, USA 2018. Title: "Winds and Jets Mutual Suppression in Quasars?"

Other Additional Experience

***Tutor* (2018-2020):** Taught a course at UWSP on mathematics for non-mathematicians, as well as introductory-level physics and mathematics courses for students from diverse backgrounds

***Planetarium Presenter* (2019-2020):** Presenter at UWSP's Allen F. Blocher Planetarium. Delivered engaging astronomy shows and demonstrated skill in educating and entertaining diverse audiences

***Observatory Operator* (2019-2020):** Operated telescopes and managed observational sessions at UWSP's Arthur J. Pejsa Observatory. Conducted astronomical observations and provided informative guidance to visitors

Skills

- Python | Dedalus | LaTeX | SageMath | WolframAlpha | Mathematica | ParaView | HPC (High-performance Computing) | MobaXterm | Microsoft Office
- Unix - [Linux, OSX, Windows]
- English - Professional Proficiency | German - C1 | Mandarin Chinese - Native

References

Prof. Dr. Teimuraz Zaqarashvili (PhD supervisor):<teimuraz.zaqarashvili@uni-graz.at>

Univ.-Prof. Mag. Dr.rer.nat. Astrid Veronig (PhD supervisor):<astrid.veronig@uni-graz.at>

Prof. Dr. Andreas Tilgner (master's thesis supervisor):<andreas.tilgner@phys.uni-goettingen.de>

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