

## Tao CAI

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### Employment

Associate Professor /Assistant Professor, State Key Laboratory of Lunar and Planetary Sciences, Macau University of Science and Technology, Jan 2018-present  
Lecturer, School of Mathematics, Sun Yat-sen University, July 2013 - Mar 2018.  
Visiting Fellow, Department of Mathematics, City University of Hong Kong, Jan-May 2013.

### Education

Ph.D. Mathematics, Hong Kong University of Science and Technology, Hong Kong, 2011.  
M.Sc. Astrophysics, Chinese Academy of Science, P.R.China, 2006.  
B.Sc. Information and Computational Science, Central South University, P.R.China, 2003.

### Research Interests

Planetary atmospheres, Stellar structure and evolution, Computational fluid dynamics

### Publications

1. Sethulakshmy Edathara Sreenivasan, **Tao Cai\***, Penetrative convection in rotating tilted f-plane with multiple radiative and convective layers, 2025, *The Astrophysical Journal*, 988, 81.
2. **Tao Cai\***, Examination of vorticity and divergence on a rotating turbulent convection model of Jupiter's polar vortices, 2024, *Journal of Geophysical Research: Planets*, 129, e2023JE008281.
3. Fan Xu, **Tao Cai\***, Penetrative magneto-convection of a rotating Boussinesq flow in f-planes, 2024, *Physics of Fluids*, 36, 026609.
4. Xinyi Zhang\*, **Tao Cai\***, Yan Li, Tao Wu, Determining the Age and the Convective Core Overshooting for Two Red Giants KIC 9145955 and KIC 9970396 by the Gravity-Dominated Mixed Modes, 2022, *The Astrophysical Journal*, 931,64.
5. **Tao Cai\***, Kwing L. Chan, Kim-Chiu Chow, Spontaneous Generated Convective Anticyclones in Low Latitude --- A Model for the Great Red Spot, 2022, *The Astrophysical Journal*, 925, 94.
6. **Tao Cai\***, Large-scale Vortices in Rapidly Rotating Rayleigh-Bénard Convection at Small Prandtl Number, 2021, *The Astrophysical Journal*, 923, 138.
7. **Tao Cai\***, Cong Yu\*, Xing Wei, Convectively Coupled Equatorial Trapped Waves in Stars and Planets, 2021, *The Astrophysical Journal*, 914, 11.
8. **Tao Cai**, Kwing L. Chan\*, Hans G. Mayr, Deep Closely Packed Long-Lived Cyclones on Jupiter's Poles, 2021, *The Planetary Science Journal*, 2, 81.
9. **Tao Cai\***, Cong Yu\*, Xing Wei, Inertial and Gravity Wave Transmissions near Radiative-Convective Boundaries, 2021, *Journal of Fluid Mechanics*, 916, A48.

10. **Tao Cai\***, Cong Yu\*, Xing Wei, Enhancement of Wave Transmission in Multiple Radiative and Convective Zones, 2021, *Journal of Fluid Mechanics*, 915, A125.
11. **Tao Cai\***, Penetrative Convection for Rotating Boussinesq Flow in Tilted F-planes. 2020, *The Astrophysical Journal*, 898, 22.
12. **Tao Cai\***, Upward Overshooting in Turbulent Compressible Convection. III. Calibrate Parameters for one-dimensional Reynolds Stress Model. 2020, *The Astrophysical Journal*, 891, 77.
13. **Tao Cai\***, Upward Overshooting in Turbulent Compressible Convection. II. Simulations at Large Relative Stability Parameters. 2020, *The Astrophysical Journal*, 891, 49.
14. **Tao Cai\***, Upward Overshooting in Turbulent Compressible Convection. I. Effects of the Relative Stability Parameter, the Prandtl number, and the Péclet number. 2020, *The Astrophysical Journal*, 888, 46.
15. **Tao Cai\***, Numerical Analysis of Nonlocal Convection—Comparison with Three-dimensional Numerical Simulations of Efficient Turbulent Convection. 2018, *The Astrophysical Journal*, 868, 12.
16. **Tao Cai**, Bharat Hazari, Jennifer Te Lai\* and Vijay Mohan, Kaldorian Disaggregation, Temporary Migration and Welfare: Theory and Calibration. 2018, *Pacific Economic Review*, 23(2), 193.
17. **Tao Cai**, Vinh Dang, Jennifer Te Lai\*, China's Capital and 'Hot' Money Flows: An Empirical Investigation. 2016, *Pacific Economic Review*, 21(2), 276.
18. **Tao Cai\***, A Semi-implicit Spectral Method for Compressible Convection of Rotating and Density-stratified Flows in Cartesian Geometry, 2016, *Journal of Computational Physics*, 310, 342.
19. **Tao Cai\***, Numerical Analysis of Nonlocal Convection, 2014, *Monthly Notices of the Royal Astronomical Society*, 443, 3703.
20. **Tao Cai\***, Kwing L. Chan, 3D Numerical Simulation of Convection in Giant Planets: Effects of the Solid Core Size, 2012, *Planetary and Space Science*, 71(1), 125.
21. **Tao Cai\***, Kwing L. Chan, Licai Deng, Numerical Simulation of Core Convection by a Multi-layer Semi-implicit Spherical Spectral Method, 2011, *Journal of Computational Physics*, 230(24), 8698.
22. **Tao Cai\***, Supersonic Convection in Stellar Interiors, 2006, *Chinese Astronomy and Astrophysics*, 30, 284.

## Grants

FDCT, No. 0147/2023/RIA3, On the study of rotating magnetoconvection in gas giants. (PI)