Dr. Shang-Min Tsai

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Research Interests

Chemistry and dynamics of exoplanet atmospheres | biosignatures and habitability

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Employment

11.2023 - present Project scientist, University of California, Riverside

11.2022 - 10.2023 Postdoctoral Scholar, University of California, Riverside

12.2018 - 10.2022 Postdoctoral Researcher (ERC funded), University of Oxford

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Education

10.2014 - 9.2018 Ph.D., Astrophysics, University of Bern

11.2012 - 6.2014 Research Assistant, Academia Sinica Institute of Astronomy and Astrophysics

11.2011 - 10.2012 Military Service in the Air Force (conscription)

9.2008 - 6.2011 M.Sc, Astrophysics, National Taiwan University (NTU)

9.2004 - 6.2008 B.Sc., Physics, National Taiwan University

Awards

2023 Second place at UCREarly Career Scientist Symposium Oral presentations

2019 Philosophy and science Faculty Award at University of Bern

2018 Heinrich Greinacher award for the doctoral thesis "Chemical Kinetics on Exoplanet Atmospheres"

2018 SSAA MERAC Funding and Travel Award

Projects

PI in International Space Science Institute (ISSI) International Team (2023) : *3-D Chemical Kinetics Model Benchmark for Hot Jupiter Atmospheres*

Model lead in JWST Early Release Science for the exoplanet WASP-39 b

co-I in JWST 3171: *Red Dwarfs and the Seven Giants: First Insights into the Atmospheres of Giant Exoplanets around M-dwarf Stars* (PI: Dr. Shubham Kanodia)

co-I in JWST 4082: *Putting it all Together: Dynamics and Chemistry Probed Through Transmission Spectroscopy of a Cloud-Free Exoplanet* (PI: Michael Radica)

co-I in JWST DDT 2784: *MIRI LRS follow up on SO_2 detection in WASP-39b* (PI: Dr. Diana Powell, Dr. Elspeth Lee)

Foreign collaborator [1] NASA Habitable Worlds proposal 22-HW22_2-0031: *How To Identify Exoplanet Surfaces Using Atmospheric Trace Species in Super-Earth Atmospheres* (PI: Prof. Xinting Yu)

co-I in JWST GO 2784: *Unveiling the Nature of the Impossible Planets* (PI: Dr. Peter Gao)

co-PI in ISSI International Team (2018) (PI: Dr. Benjamin Drummond) : *An intercomparison of 1D chemical kinetics codes for exoplanet atmospheres*

PRESENTATIONS

- Invited Talks

ASIAA Colloquium: *Exoplanet atmospheres – from photochemistry to habitability*, 11 October 2023, Taipei, Taiwan

Planetary Science Lunch Seminar: *The atmosphere of gas giants near and far*, 29 March 2023, Caltech, US

ESP (Exoclimes Simulation Platform) Summer School, Guarda Val, Switzerland – 12-14 June 2019

Astrophysics seminar at University of Exeter, 14 March 2019

- Selected Contributed Talks

Revealing Atmospheric Chemistry of Exoplanets with JWST, Exeter, UK, 27 June 2023

Direct Evidence of Photochemistry in an Exoplanet Atmosphere, AAS 241 meeting, Seattle, US, 9 Jan 2023

The evolution and stability of CO_2-CH_4-H_2O atmospheres, Rocky Worlds II, Oxford, UK, 4–8 July 2022

Compositional Variations of the Highly Eccentric Planet HD 80606b, Europlanet Science Congress, online, 13 – 24 September 2021

Toward 3D photochemical modelling of exoplanet atmospheres, Exoplanets II, Cambridge, UK – 5 June 2018

TEACHING/SUPERVISING/PUBLIC OUTREACH

Co-supervising Ziyu Huang (2022 – Present)   University of Southern California

Co-supervising Hamish Innes (2020 – 2021)   University of Oxford
– Innes, **Tsai**, *Pierrehumbert (2023) The Runaway Greenhouse Effect on Hycean Worlds, ApJ, 953, 168*

Co-supervising Amy Louca (2020 – 2021)   Leiden University

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[1] not affiliated with a US institute at the time of application

– *Louca, Miguel, Tsai, et al. (2023), The impact of time-dependent stellar activity on exoplanet atmospheres, MNRAS, 521, 3*

Co-supervising Mantas Zilinskas (2020 – 2021)   Leiden University
– *Zilinskas, Miguel,* **Tsai***, et al. (2023), Atmospheric compositions and observability of nitrogen-dominated ultra-short-period super-Earths, MNRAS, 494, 1*

Co-supervising Thomas Drant (2021)   IPSL, University of Paris Saclay, France

Supervising Ailsa Campbell (summer student, 2022)   University of Oxford

Tutor MPhys C5 Physics of Atmospheres and Oceans   Spring 2019
- *teaching problem sets*

Astrobites Author   2017 – 2018

Teaching Assistant University of Bern   Fall 2017
Fluid Dynamics by Kevin Heng
- *devising and delivering teaching sessions on problem sets*

Community service

Referee for AAS, MNRAS, A&A etc. journals

Non-panelist reviewer for NASAXRP23 proposals

Code Development

VULCAN: Open-Source, photochemical kinetics model for planetary and exoplanetary atmospheres
(widely used by the community including several JWST Cycle 1 & 2 programs)
`https://github.com/exoclime/VULCAN`

HELIOS: GPU-accelerated, radiative transfer model
(contributed to the convection and chemistry modules)
`https://github.com/exoclime/HELIOS`

THOR: GPU-accelerated, 3-D general circulation model
(contributed to the radiative-transfer and disequilibrium chemistry modules)
`https://github.com/exoclime/HELIOS`