Tsun Hin Navin Tsung

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Education

2017–2023 **University of California, Santa Barbara**.
Ph.D. in Physics (Astrophysics Emphasis)
Thesis title: *Hydrodynamical Study of the Impact of Cosmic Rays on Circumgalactic Gas*
Research interest: Cosmic ray magnetohydrodynamics theory and simulations, galaxy evolution, fluid instability analysis
Advisor: Dr. Siangpeng Oh

2013-2017 **University of Oxford, UK**.
Master in Mathematical and Theoretical Physics (MMathPhys)
An undergraduate degree leading to Master qualifications
Part A, B: First Class Honors (Highest classification possible)
Part C: Distinction (Highest classification possible)
Dissertation: Gyrokinetics and the Ion-Temperature-Gradient Instability in a Z-Pinch (Advisor: Dr. Felix Parra Diaz)

Employment

2023–present **Postdoctoral Research Associate**, *Joint Institute for Laboratory Astrophysics (JILA), University of Colorado, Boulder*.
- Project leader for 3+ projects, responsible for project management, research idea development, experimental design and operation. Radiative transport modeling is required for a project.
- Performed extensive multi-physics, MHD and Particle-In-Cell simulations for astrophysical modeling. Developed quantitative models to explain simulation findings.
- Project PI and Co-PI for 4 approved national supercomputing proposals (2 PI, 2 Co-PI). The approved computing resources have an equivalent value of 110,000+ USD.
- Frequent use of parallel and high-performance computing.
- Engaged in computational astrophysics research of plasma processes in AGN jets and disk.
- Research contributions include understanding plasma instabilities at jet boundaries and their effects on dissipation and nonthermal particle acceleration/ Effects of Magnetorotational Instability (MRI) on AGN disk fragmentation.
Supervisors: Dr. Dmitri Uzdensky, Dr. Mitchell Begelman
Collaborators: Dr. Phil Armitage, Dr. Yanfei Jiang, Dr. Greg Werner

2017–2023 **Graduate Research Assistant**, *Department of Physics, University of California, Santa Barbara*.
- Performed extensive multi-physics, MHD simulations for astrophysical modeling.
- Extensive experience with high-dimensional data analysis and visualization using Python programming tools and packages.
- Experience with parallel and high performance computing.
- Research contributions include modeling of the thermodynamical effects Cosmic-Rays have on galactic halos, Cosmic-Ray driven acoustic instability and shocks.
Supervisor: Dr. Siangpeng Oh
Collaborators: Dr. Yanfei Jiang, Dr. Chad Bustard

Summer 2016 **Summer Research Intern**, *Department of Physics, University of Oxford*.
- Designed and implemented analysis tools for processing images obtained from optical telescopes. Experience with image convolution.
Supervisor: Dr. Martin Bureau

Summer 2015 **Summer Research Intern**, *Department of Physics, the Chinese University of Hong Kong*.
- The ODEs governing hydrostatic balance in a self-graviting system is solved using the Runge-Kutta 4-step method.
Supervisor: Dr. Ming Chung Chu

Technical Skills

Programming: Python, C++, Fortran, Matlab, MPI computing

Supercomputing: Frontera (TACC), Stampede2 (TACC, decommissioned), Stampede3 (TACC), Anvil (Purdue RCAC)

Tools and Packages: Athena++ (C++ based fluid code), Zeltron (Fortran based relativistic Particle-In-Cell code), Numpy, Scipy, Matplotlib, Astropy

Version Control: GitHub

Typesetting: LaTeX, Microsoft Office

Publications

2023 **T.H.N Tsung**, S.P.Oh & C.Bustard, Impact of CR heating on Thermal and Hydrostatic Stability of Galactic Halos, *Monthly Notices of the Royal Astronomical Society*, 526, 3301–3334. https://doi.org/10.1093/mnras/stad2720.

2022 **T.H.N.Tsung**, S.P.Oh & Y.F.Jiang, The cosmic ray staircase: outcome of the cosmic ray acoustic instability, *Monthly Notices of the Royal Astronomical Society*, 513, 4464–4493. https://doi.org/10.1093/mnras/stac1123.

2021 **T.H.N.Tsung**, S.P.Oh & Y.F.Jiang, Fluid simulations of cosmic ray modified shocks, *Monthly Notices of the Royal Astronomical Society*, 506, 3282–3300. https://doi.org/10.1093/mnras/stab1926.

Under Review or In Preparation.

In Prep **T.H.N Tsung**, B.Tan & S.P.Oh, Cosmic ray pressure support in turbulent radiative mixing layers.

Submitted **T.H.N Tsung**, G.R.Werner & D.A.Uzdensky & M.C.Begelman, Dissipation and particle acceleration in astrophysical jets with velocity and magnetic shear: Interaction of Kelvin-Helmholtz and Drift-Kink Instabilities, (Submitted to PRL).

In Prep **T.H.N Tsung**, M.C.Begelman & P.J.Armitage & Y.Jiang & H.Gerling-Dunsmore, Stratified, adiabatic, local shearing box simulations of disk fragmentation with net vertical flux.

Grants

2024-2025 ACCESS Maximize computing allocation PHY240194 (PI), *Nonthermal processes at multiphase boundaries in the interstellar and circumgalactic medium*, Awarded resources: 269,000.0 Node Hours on TACC Stampede3 (Equivalent value: 63,800.00 USD).

2024-2025 ACCESS Maximize computing allocation PHY140041 (Co-PI), *Particle acceleration and radiation driven by astrophysical magnetic reconnection and other plasma instabilities*, Awarded resources: 146,000.0 Node Hours on TACC Stampede3 (Equivalent value: 54,200.00 USD).

2024–2025 Leadership Resource Allocation (LRAC) AST21007 (Co-PI), *Kinetic plasma processes in relativistic jets and accretion disks around black holes*, Awarded resources: 397,650.0 Node Hours on TACC Frontera.

2024 ACCESS Explore computing allocation PHY240103 (PI), *Dynamic and thermodynamic effects of cosmic rays on boundary layers between hot and cold gas*, Awarded resources: 200,000 ACCESS credits.

2023–2024 ACCESS Discover computing allocation PHY230074 (Co-PI), *Cosmic ray Physics at the Mesoscale*, Awarded resources: 750,000 ACCESS credits.

Awards and Fellowships

2017–2018 Regent's Fellowship (32,000 USD), *UCSB*.

2015–2017 St. Edmund Hall Open Scholarship, *University of Oxford*.

2016 Oxford Physics Practicals Commendation, *University of Oxford*.

Certification

2023	NVIDIA DLI Certificate – Fundamentals of Accelerated Computing with CUDA C/C++, *Nvidia Deep Learning Institute*.
2022	Structuring Machine Learning Projects, *DeepLearning.AI/Cousera*.

Conferences and Invited Talks

Oct 2024	Dissipation and particle acceleration in astrophysical jets with velocity and magnetic shear: Interaction of Kelvin-Helmholtz and Drift-Kink Instabilities, *DPP Meeting 2024, Atlanta*.
Nov 2023	Hydrodynamical Study of the Impact of Cosmic Rays on the Stability of Circumgalactic Gas, *Center of Integrated Plasma Studies Seminar, University of Colorado, Boulder*.
Oct 2023	Hydrodynamical Study of the Impact of Cosmic Rays on the Stability of Circumgalactic Gas, *APSLS, University of Colorado, Boulder*.
Dec 2022	Simulating cosmic rays streaming at the meso-scale, *Faucher-Giguere's group meeting, Northwestern University*.
Dec 2022	Simulating cosmic rays streaming at the meso-scale, *Wisconsin astro seminar, University of Wisconsin, Madison*.
Dec 2022	Simulating cosmic rays streaming at the meso-scale, *Columbia astro lunch seminar, Columbia University*.
Nov 2022	Simulating cosmic rays streaming at the meso-scale, *Princeton astro lunch seminar, Princeton University*.
Sep 2022	Thermal instability with cosmic ray heating, *What Matter(s) Around Galaxies, Champoluc, Italy*.
Aug 2022	Thermal instability with cosmic ray heating, *6th ICM workshop, Niels Bohr Institute, Copenhagen*.
Aug 2022	Resolved simulations of cosmic rays in the circumgalactic and intracluster medium, *Department of physics seminar, the Chinese University of Hong Kong*.
Jul 2021	The cosmic ray staircase: outcome of the cosmic ray acoustic instability, *Eliot Quataert's Group, Princeton University*.
Jul 2021	The cosmic ray staircase: outcome of the cosmic ray acoustic instability, *Astro Tea, UCSB*.
May 2021	Cosmic ray hydrodynamics, *Geophysical fluid dynamics seminar, UCSC*.

Outreach

Sep–Nov 2020	**School for Scienctic Thought**. Designed a 5-week hands-on course on 'Plasma: the fourth state of matter' for under-privileged high school students in collaboration with UCSB Department of Education.

References

Siangpeng Oh.
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Mitch Begelman.
Professor of Physics
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