Ray Wang

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Education

Michigan State University, East Lansing, MI, U.S.A. Aug. 2023 - Present
Ph.D. Student in Astronomy & Astrophysics

University of Michigan, Ann Arbor, MI, U.S.A. Apr. 2023
B.S. in Astronomy & Astrophysics (with honors)
B.S. in Interdisciplinary Physics

Undergraduate Honors Thesis: "Sunyaev–Zel'dovich Scaling Relations of low-z SDSS Galaxy Groups and Clusters." *Supervised by Prof. Christopher J. Miller*

Research Interests

Extragalactic Astronomy — X-ray and the thermal Sunyaev-Zel'dovich (tSZ) effect observations of galaxy clusters and their intracluster medium (ICM) — Planck, ACT, Chandra, and XMM-Newton.

Research Experience

Graduate Research Assistant Aug. 2023 - present
Michigan State University, Department of Physics and Astronomy
Advisor: Prof. Megan E. Donahue

- Using the tSZ effect to trace hot baryonic gas properties in galaxy clusters selected from the Local Volume Complete Cluster Survey (LoVoCCS). LoVoCCS is the largest clusters sample that is mass-complete at z$\sim$ 0.1, with individual weak-lensing masses from DECam and Subaru/HSC. Our goal is to build benchmark SZ scaling relations to lensing masses and X-ray properties.
- Modeling the non-thermal pressure support of the LoVoCCS clusters by using the CLUster Multi-Probes in Three Dimensions (CLUMP-3D) framework to jointly fit Planck and ACT SZ data, XMM X-ray data, and DECam and Subaru/HSC lensing maps.
- Using archival data to measure the velocity dispersion and dynamical mass of the LoVoCCS clusters. The velocity dispersion is an important observable that can be used to build benchmark scaling relations, and the dynamical mass can serve as an additional mass probe for the LoVoCCS project.
- Building an X-ray data analysis pipeline using archival Chandra data. This pipeline will provide Chandra X-ray analysis for the the second catalog of the Archive of Chandra Cluster Entropy Profile Tables (ACCEPT2.0).

Undergraduate Research Assistant Sept. 2020 - present
University of Michigan, Department of Astronomy & Astrophysics
Advisor: Prof. Christopher J. Miller

- Stacking the Planck tSZ data of the SDSS C4 clusters sample and measuring the tSZ-driven hydrostatic masses and the generalized pressure profile parameters. Studying the ICM thermodynamic properties and the hydrostatic bias between the tSZ-driven hydrostatic, the caustic, and the weak-lensing masses.

Telescope Time

Blanco CT-4m/DECam	7.5 nights as Co-I (2025A)
SOAR Goodman	2.5 nights through MSU (2024A/2025A/2025B)
SOAR SAMOS	1.5 night through MSU (2025B)

Publications

[1] D. J. Turner, J. E. Pilling, M. Donahue, P. A. Giles, K. Romer, A. Gupta, T. Wallage, **R. Wang**. "DAXA: Traversing the X-ray desert by Democratising Archival X-ray Astronomy" Submitted to *the Journal of Open Source Software (JOSS)*.

Talks and Posters

[1] Poster and flash talk, *Cosmic Ecosystem* Aug. 2025, Waterloo, Canada

[2] Contributed talk, *Galaxy Groups in the era of eROSITA and Euclid* Jul. 2024, Sesto, Italy

Teaching Experience

Graduate Teaching Assistant Aug. 2023 - present

Michigan State University, *ISP 205L: Visions of the Universe* ($\sim$ 100 students)

- This is a lab designed for undergraduates who are not majoring in natural science subjects. I serve as both primary and secondary instructor for one section each. As a primary instructor, I prepare and deliver a short lecture at the beginning of each session, organize demonstrations, answer questions during and outside the labs, hold office hours, and grade labs every week. As a secondary instructor, I support the primary instructor during the lab session. I also help design a new Doppler shift lab that helps students to better understand galaxy motions.

Honors and Awards

[1] Harlo Mork Graduate TA Excellence in Teaching Award Nov. 2024

Students Advised

[1] Griffin Siersma (MSU undergrad; presented a poster at the MidSURE Symposium) Spring 2025

Outreach and Service

- **MSU Extragalactic Journal Club** Aug. 2024 - present
  Founder and organizer of a weekly meeting featuring invited speaker talks or paper discussions; co-hosted the journal club with the Clusters Seminar at the University of Michigan.
- **MSU Astronomy Seminar Committe** May. 2024 - present
  Serving as a graduate student representative on the committee. Formulating the seminar speaker list for every upcoming school year and coordinating their schedule with the department.
- **MSU Graduate Faculty Search Committe** Dec. 2023 - Apr. 2024
  Participating in the search for a new Astronomy tenure-track assistant professor at MSU. Acting as a representative for graduate students, interviewing six faculty candidates, and forming feedback.
- **MSU Public Observing Night** Aug. 2023 - present
  Organizing/participating in weekly public observing nights at the MSU campus observatory as a volunteer (5 nights) or as a public night leader (3 nights). Utilizing the 6-inch telescope for outreach, and running the information table for questions.

Skills and Languages

Programming Languages	Python, Mathematica, C/C++
Software & Tools	Astropy, emcee, COLOSSUS, AstroML, Numba, Matplotlib, NumPy, SciPy, DS9, LaTeX, CMB and X-ray: HEALPix, Ciao, Xspec, Sherpa, XGA, DAXA
Languages	Mandarin: Native; English: Proficient; Japanese: Familiar

Personal References

Prof. Megan E. Donahue, University Distinguished Professor and Professor of Physics & Astronomy
Graduate Research Advisor at Michigan State University
Biomedical Physical Sciences, 567 Wilson R.d. East Lansing, MI 48824, U.S.A.
donahu42@msu.edu, +1(517)-884-5618

Prof. Christopher J. Miller, Professor of Astronomy & Astrophysics and Professor of Physics
Undergraduate Research Advisor at University of Michigan
West Hall, 1085 S. University, Ann Arbor, MI 48109, U.S.A.
christoq@umich.edu, +1(734)-764-3433