Roark Habegger – Curriculum Vitae

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A significant amount of the interstellar medium's energy budget is in the form of high energy particles, or cosmic rays. They are coupled to the rest of the interstellar medium through the magnetic field. When cosmic rays scatter off waves in the magnetic field, they impart momentum and energy into the waves, which then heat and push the thermal plasma. How do those effects impact the dynamical evolution of the interstellar medium, on a large scale (10kpc>L>1pc)? I use magnetohydrodynamic simulations in concert with theoretical analysis to better understand the impact of cosmic rays on the structure and evolution of the interstellar medium.

Education

In Progress	**University of Wisconsin – Madison**:
	Astronomy Ph.D. (Expected 2025)
2020-2022	**University of Wisconsin – Madison**:
	Physics M.A.
	Astronomy M.S.
	GPA: 3.96
2016-2020	**University of North Carolina at Chapel Hill**:
	Physics B.S. with Highest Honors (`Thesis Link`)
	Mathematics B.S.
	Creative Writing (Poetry) Minor with Highest Honors (`Thesis Link`)
	GPA: 3.80 (Highest Distinction, Honors Carolina Laureate, Phi Beta Kappa)

Publications

2024	**R. Habegger**, E. Zweibel. *Cosmic Ray Feedback from Supernovae in a Stratified ISM*. In Prep.
	K.W. Ho, **R. Habegger**, K.H. Yuen. *Supernova driven ISM Turbulence and Divergence Cleaning by Cosmic Rays*. In Prep.
	F. Heitsch, **R. Habegger**. *A Coscaling Grid for Athena++ II: Magnetohydrodynamics*. In Prep
	R. Habegger, K.W. Ho, K.H. Yuen, E. Zweibel. *Cosmic Ray Feedback on Bi-stable ISM Turbulence*. Submitted to ApJ. `arXiv Link`.
2023	**R. Habegger**, E. Zweibel, S. Wong. *The Impact of Cosmic Ray Injection on Magnetic Flux Tubes in a Galactic Disk*. 2023 ApJ 951 99. `Link`.
2021	**R. Habegger**, F. Heitsch. *A Coscaling Grid for Athena++*. 2021 ApJS 256 42. `Link`.

Research Interests

Plasma Astrophysics	Cosmic rays, magnetohydrodynamic instabilities, supernovae, neutron stars, accretion disks
Computational Methods	Magnetohydrodynamic simulations, data visualization, genetic algorithms, particle-in-cell methods (C++, Python)

Teaching Interests

Computational Methods	Python, dynamical systems, numerical integration & interpolation, data visualization.
Physics	Astrophysical fluid dynamics, electrodynamics, plasma physics, quantum mechanics

Research Presentations

2024	American Astronomical Society 244th Annual meeting: **talk** on Cosmic Ray Feedback from Supernovae in a Stratified ISM, **invited talk** on Cosmic Ray Feedback on Bi-stable ISM Turbulence.
2023	American Physical Society (APS) Division of Plasma Physics (DPP) Annual meeting: **poster** on The Large-Scale Impact of Localized Cosmic Ray Injection, **talk** on Magnetized Turbulence with Cosmic Rays and Radiative Cooling.
	Talk on Cosmic Ray Injection at Modelling of Multiphase Astrophysical Media conference in Kochel, Germany
	Invited colloquium on Cosmic Ray Injection in a Realistic Galactic Disk at Ruhr University in Bochum.
	Poster on Cosmic Ray Injection in a Realistic Galactic Disk at Les Houches School of Physics Doctoral Training on Plasmas in Extreme Environments
2022	APS-DPP Annual Meeting: **poster** on Cosmic Ray Injection in a Realistic Galactic Disk
2021	APS-DPP Annual Meeting: **poster** on Cosmic Ray Loaded Magnetic Flux Tubes
2020	APS-DPP Annual Meeting: **poster** on Coscaling Grid
2019	NC Space Symposium: **poster** on Polarimeter Software development
2017	SESAPS (Southeastern Section of the APS): **poster** on Polarimeter Hardware

Accepted Funding & Grants

2022-2025	NASA Future Investigators in NASA Earth and Space Science and Technology (FINESST): *The Impact of Localized Cosmic Ray Injections on Galactic Evolution*
	Total amount: $146,703
2022	APS Topical Group on Plasma Astrophysics Student Travel Grant
	Total Amount: $2,000

2019	Sigma Xi Grant-In-Aid-of-Research
	Total Amount: $5,000
Summer 2018	North Carolina Space Grant Undergraduate Research Scholarship
	Total amount: $5,000
Summer 2017	North Carolina Space Grant Undergraduate Research Scholarship
	Total amount: $5,000

Teaching & Mentorship

2023-2024	Provided free tutoring for Astronomy majors in physics (quantum mechanics), math (multivariable calculus, complex analysis), and astronomy classes
2023	Mentor for Madison Metropolitan School District Summer Research Internship (`About Page`)
2020-2023	Mentor for the Undergraduate Research Scholar (URS) program
2019	Educational Research In Radio Astronomy (ERIRA) Project Coordinator & Mentor
2018-2019	Introductory Physics Teaching Assistant (Phys-119: Introductory Calculus based Electromagnetism and Quanta)

Outreach

2024	Astronomy On Tap (AoT) talk: Untangling & Understanding Magnetic Fields. `Presentation Slides Link`.
2023	Astronomy Graduate Lecture for Undergraduates (AstroGLU) on Synchrotron Radiation
2022	Research presentation to UW Astronomy Dept. Board of Visitors
	AstroGLU on Plasma Astrophysics
	Wisconsin Science Festival – Computational Astrophysics Booth
2021-2022	Contributor to Radio Astronomy podcast on local Madison radio station WORT 89.9

Department Service & Involvement

2023-2024	Graduate Student Bench
	Started Mathematical and Computational Methods Coffee hour (MCMCoffee)
2022-2023	Representative on the Graduate Admissions Committee
2021-2022	Department Website Content Manager