Roark S. Habegger

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EDUCATION

UNIVERSITY OF WISCONSIN – Madison, WI — Expected May 2026
Astronomy Ph.D. with Physics Minor

UNIVERSITY OF WISCONSIN – Madison, WI — Expected May 2022
Astronomy Masters

UNIVERSITY OF NORTH CAROLINA – Chapel Hill, NC — Conferred May 2020
Physics B.S. (with Highest Honors) & Mathematics B.S. & Creative Writing Minor (Highest Honors)
GPA: 3.8 (Highest Distinction)

Honors & Awards

- Completed 2 Honors Theses: Physics and Creative Writing (Poetry); Both received Highest Honors
- Two-time recipient of the NC Space Grant Undergraduate Research Scholarship (PI Dr. Dan Reichart)
- Awarded Sigma Xi Grant-In-Aid-of-Research (PI Dr. Dan Reichart)
- 6 out of 7 semesters on Dean's List
- Inducted into Phi Beta Kappa Honors Society (Spring 2019), Honors Carolina Laureate
- Recent Test Scores (2019) - General GRE: 162V, 169Q Physics GRE: 910 (85th percentile)

Global Experience

- Travelled to La Serena, Chile on two occasions to install and repair Polarimeter on the PROMPT telescope array, stationed at the Cerro-Tololo Inter American Observatory. Each trip lasted 10+ days. (Oct. 2017, Dec. 2018)

APS Group on Plasma Astrophysics (APS-GPAP) Summer School – Swarthmore, NJ — Attended June 2019
4-day crash course in Plasma Astrophysics and Space Plasma Physics funded by the American Physical Society

RESEARCH EXPERIENCE

MHD Fluid Simulations of the Parker Instability – PI Dr. Ellen Zweibel (UW) — Sep 2020 - Present
Using cosmic rays to drive magnetic field buoyancy in the interstellar medium
Research Assistant

- Objective is to recreate classic and modified Parker Instability in Athena++ using the cosmic ray transport algorithm from Jiang et al (2018). Apply to simulations of the interstellar medium to examine the effect of cosmic rays in driving a galactic wind.
- With above set up, study how localized cosmic ray injection can develop the Parker Instability in the galactic disk.

Time Dependent Grid Computational Methods – PI Dr. Fabian Heitsch (UNC) — Jan 2019 - Present
Adding time-dependent grid to Athena++ magnetohydrodynamic (MHD) code
Research Assistant

- This new method was motivated by studying binary neutron star merger ejecta and tidal tails to determine *r*-process enrichment during the resulting blast wave into the interstellar medium.
- Implemented time dependent grid in Athena++ MHD code, which will be detailed and examined in a forthcoming paper. The algorithm has been successfully applied to 1-D test cases. Currently optimizing 2- and 3-D test cases.
- Learned to connect mechanics, thermal physics, hydrodynamics, and electromagnetism. Practiced using the combination of these topics to solve problems. Spent a significant amount of time examining numerical techniques and co-moving frame (Lagrangian) hydrodynamics to understand how to implement a moving frame into Eulerian MHD equations.

Optical Polarimeter for PROMPT – PI Dr. Dan Reichart (UNC) — Jan 2017 - June 2020
Production and integration of an astronomical polarimeter on the PROMPT 8 Telescope
Research Assistant

- Redesigned and built a polarimeter to observe Gamma Ray Bursts (GRBs) within seconds of their detection to measure high linear polarization of light predicted by theoretical models.
- Created an automated, scriptable control software so the polarimeter can be controlled through the Skynet Robotic Telescopes Network.
- Learned electronics, coding, and observational astronomy. Practiced problem solving outside of classroom work, in situations with an unknown 'correct' answer. Solved unforeseen hardware problems under time constraints when installing instrument at CTIO.

COMMUNITY INVOLVEMENT

Online Introductory Python Course for Astronomers and Physicists Jun 2020 - Present

- Actively developing an introduction to coding for physics related disciplines. Some undergraduate Physics & Astronomy curricula do not require a formal coding course despite higher level courses expecting students to have the experience. This course will be freely accessible for anyone interested in Python coding and its application to physics.

Educational Research in Radio Astronomy (ERIRA) – Coordinator Dr. Dan Reichart (UNC) Aug 2019

- Guided groups of 1st and 2nd year undergraduate students through radio astronomy projects using the 40ft and 20m scopes at the Green Bank Observatory in West Virginia. This included teaching fundamental astronomy concepts, data reduction & analysis, coding, and statistics. My responsibility was teaching students how to research and discover answers to astronomy problems, as well as how to use the radio telescopes. Shared responsibility for student well-being and safety during the week-long program.

Teaching Introductory Physics (PHYS-119) – Dr. Jennifer Weinberg-Wolf (UNC) Aug 2018-May 2019

- Promoted to lead the same section described below (Spring 2019).
- Assisted in a lab and problem-solving section of UNC's second course in the introductory physics track, covering topics such as Electromagnetism, Electronics, Optics, and Quantum Mechanics (Fall 2018).

Wilderness Ranger Intern in the Superior National Forest Summer 2018

- Volunteered 800 hours working in the Boundary Waters Canoe Area Wilderness (BWCAW). This included repairing campsites, latrines, and trails as well as communicating environmental conservation laws. All of these were accomplished while living out of a canoe on 8-day trips.

ADDITIONAL INFORMATION

- Coding Languages:
    - Expert: Python, C++, Mathematica
    - Proficient: MATLAB, C#, Arduino, Visual Basic, IDL
    - Competent: MESA, HTML
- Conferences Presented at
    - APS-DPP Annual Meeting 2020 (poster on Time Dependent Grid Computational Methods)
    - NC Space Symposium 2019 (poster on Polarimeter Software)
    - SESAPS 2017 (poster on Polarimeter Hardware)

Scientific Papers

- (IN PREP) Roark Habegger and Fabian Heitsch. Time Dependent Grid for Fluid Simulations. To be submitted to *Journal of Computational Physics.* 2021.