Renato Mazzei

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Education

University of Virginia
PhD Astronomy, 2018 - May 2024 (expected)
M.S. Astronomy, 2017 - 2018
GPA: 4.00
B.S. Astronomy-Physics, 2013 - 2017
GPA: 3.92
Echols Scholar
College Science Scholar

PhD Research

Thesis topic:

The role of magnetic fields in star formation: From cloud to disk scales

Thesis committee:
- Prof. Zhi-Yun Li (UVA, primary advisor)
- Prof. Ilse Cleeves (UVA, co-advisor, committee chair)
- Dr. Crystal Brogan (NRAO)
- *Additonal UVA faculty member (TBD)*
- Prof. Laura Fissel (Queen's University at Kingston, frequent collaborator)

In my PhD thesis, I use 3D magnetohydrodynamic simulations and 2D synthetic polarization observations to probe the role of magnetic fields in star and planet formation processes. To derive links to real data, these theoretical efforts are accompanied by far-IR (BLAST) observations of molecular clouds and radio (ALMA) observations of protoplanetary disks and protostellar objects.

Publications
(First author papers **bolded**)

Modeling CN Zeeman effect observations of the envelopes of a low-mass protostellar disk and a massive protostar. **Mazzei, R.**, Li, Z.-Y., Chen, C.-Y., Tu, Y., Fissel, L. M., Chen, M., & Klein, R. I. (2023, MNRAS, 10.1093/mnras/stad3753).

How Informal Science Education Influences Elementary Students' Perceptions of Science and Themselves. Finn, M. K., Mazzei, R., Drechsler, B., Telkamp, Z., Rao, M., Agrawal, P, & McAlister, A. (2023, Journal of STEM Outreach, 10.15695/jstem/v6i1.10).

Relative alignment between magnetic fields and molecular gas structure in molecular clouds. **Mazzei, R.**, Li, Z.-Y., Chen, C.-Y., Fissel, L. M., Chen, M., & Park, J. (2023, MNRAS, 10.1093/mnras/stad733).

The Davis-Chandrasekhar-Fermi method revisited.
Chen, C.-Y., Li, Z.-Y., Mazzei, R.,...et al. (2022, MNRAS, 10.1093/mnras/stac1417).

Graduate Student Participation in K-12 Science Outreach: Self-Reported Impact on Identity and Confidence of STEM Graduate Students. Matthews, A., Mazzei, R., McAlister, A., Mills, B., & Song, Y. (2021, Journal of Higher Education Outreach and Engagement, paper link).

Untangling magnetic complexity in protoplanetary disks with the Zeeman effect. **Mazzei, R.**, Cleeves, L. I., & Li, Z.-Y. (2020, ApJ, 10.3847/1538-4357/abb67a).

A new method to trace three-dimensional magnetic field structure within molecular clouds using dust polarization. Chen, C.-Y., King, P. K., Li, Z.-Y., Fissel, L. M., & Mazzei, R. (2019, MNRAS, 10.1093/mnras/stz618).

Teaching

ASTR 1280 (University of Virginia)
During Summer 2020, I taught ASTR 1280 (The Origins of Almost Everything) as the instructor of record. This introductory level class aims to teach students about the nature of science through study of the origins of the Universe and the subsequent formation of galaxies, stars, planets, and life. My work included planning the course curriculum, writing tests and quizzes, and delivering in-class lectures.

Awards

2020-21	Virginia Space Grant Consortium Graduate Fellowship ($12,000)
2019	ALMA Student Observing Support Award, Cycle 7 ($26,334), PI: Ian Stephens
2019	Jefferson Foundation Scholarship Award ($1,500)
2018	ALMA Student Observing Support Award, Cycle 6 ($33,872), PI: Ilse Cleeves
2017	Limber Prize (Most distinguished 4th year astronomy undergraduate at UVA)
2016	Vyssotsky Prize (Most distinguished 3rd year astronomy undergraduate at UVA)

Proposals

2023 Atacama Large Millimeter/submillimeter Array (ALMA) Cycle 10
PI: "Ascertaining the Role of Magnetic Fields in Disk Formation via Zeeman Measurement of the Envelope of a Protostar" (Project 2023.1.00826.S, Awarded 19.1 hrs.)

2022 Atacama Large Millimeter/submillimeter Array (ALMA) Cycle 9
PI: "Ascertaining the Role of Magnetic Fields in Disk Formation via Zeeman Measurement of the Envelope of a Protostar" (Project 2022.1.00576.S, Awarded 19.1 hrs.)

Presentations

The role of magnetic fields in star formation: From cloud to disk scales. 2023 Gordon Research Conference: Origins of the Solar System (poster)

Untangling magnetic complexity in protoplanetary disks with the Zeeman effect. 2021 Virginia Space Grant Consortium Research Conference (oral presentation)

An exploration of the Zeeman Effect detectability of magnetic substructure in protoplanetary disks. 236th Meeting of the American Astronomical Society (oral presentation)

Simulating circular polarization observations as a probe of magnetic field structure in protoplanetary disks. 2020 Spring Virginia Institute for Cosmic Origins (VICO) Workshop (oral presentation)

Prospects for magnetic field detection and characterization in planet formation environments with ALMA. 2019 Gordon Research Conference: Origins of the Solar System (poster)

The role of magnetic fields in star formation: From cloud to disk scales. 2019 Bob Rood Memorial Symposium (oral presentation)

MHD simulations and synthetic polarimetry of molecular clouds. 2018 Fall Virginia Institute for Cosmic Origins (VICO) Workshop (oral presentation)

Software

- `python` (main programming language, high proficiency)
- RADMC3D / POLARIS (radiative transfer simulation software, high proficiency)
- `C` (basic proficiency)
- HTML/CSS (basic proficiency, I made my website from scratch haha)

General Skills

- Setting-up and running computer simulations
  Experience: 3D astrophysics simulations
- Cleaning and analyzing large, multi-dimensional data sets
- Visualizing quantitative data with professional plotting software
  Experience: `matplotlib`, `seaborn`
- Scientific writing and communication

Outreach

Dark Skies, Bright Kids (DSBK)
DSBK is a grad-student-run initiative intended to bolster science-education, creativity, and curiosity in children throughout the Charlottesville area. Each fall and spring semester we hold an eight-week long after school club at a local elementary school. We also organize one-off events in the community and host the annual Central Virginia Star Party. I have been an active member of DSBK since entering the PhD program and have led many activities and events. For two years I also led our internal "assessments" team. In this role I organized a research group that leveraged data obtained from students and volunteers to analyze the impact of DSBK. In my time as a member of the assessments team I was a co-author of two research papers.

Community Events
I regularly volunteer for the UVA astronomy department's public nights hosted at McCormick Observatory and Fan Mountain Observatory. At these events we teach the public about outer space and provide them with the opportunity to use our telescopes to look at and learn about interesting astronomical objects. Most recently, we observed Saturn and the globular cluster M13!