# S C O T T

# LUCCHIN

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I study gas dynamics and its role in galaxy formation and evolution. Using cosmological and idealized simulations I have studied the Magellanic Stream and the broader circumgalactic medium with a focus on making mock observations to compare with data.

# FDUCATION

2023 PhD in Physics

University of Wisconsin-Madison

Thesis: The Magellanic Corona and its Role in the Evolution of the Magellanic Stream

Advisor: Elena D'Onghia, Professor of Astronomy

2017 M.Sc. with Distinction in Theoretical Physics

University of Edinburgh

Thesis: The Quantum Nature of Self-Dual Yang-Mills Theory Advisor: Donal O'Connell, Professor of Physics and Astronomy

2014 B.S. in Physics and Astronomy

University of Rochester

RESEARCH AND PROFESSIONAL EXPERIENCE

**2023** - **ITC Postdoctoral Fellow** Center for Astrophysics | Harvard & Smithsonian, Cambridge, MA Advisors: Lars Hernquist, Professor of Astronomy, Charlie Conroy, Professor of Astronomy

2014-16 Software Developer

Heretto, Rochester, NY

# REFEREED PUBLICATIONS - <u>ADS</u> / ©

### **Selected Publications**

\*mentored students are underlined

- 11. The Magellanic Corona as the key to the formation of the Magellanic Stream **Lucchini, S.**, D'Onghia, E., Fox, A. J., Bustard, C., Bland-Hawthorn, J., & Zweibel, E. *Nature*, 585, 203. (2020) 10.1038/s41586-020-2663-4 arXiv:2009.04368
- 10. On the Origin of High-velocity Clouds in the Galaxy **Lucchini, S.**, Han, J., Hernquist, L., & Conroy, C. *ApJ*, 974, 105. (2024) <u>10.3847/1538-4357/ad6dde</u>
- 9. Threading the Magellanic Needle: Hypervelocity Stars Trace the Past Location of the LMC **Lucchini, S.** & Han, J. *ApJL*, submitted. (2025)

### Additional First and Second Author Publications

- 8. Invisible Accretion: Ionized Envelopes of TNG50 HVCs can Sustain Star Formation **Lucchini, S.**, Han, J., Hernquist, L., Conroy, C., & Fox, A. *ApJ*, accepted. (2025) <u>arXiv:2507.18687</u>
- 7. Following the tidal trail: a history of modeling the Magellanic Stream **Lucchini, S.** *Astrophys Space Sci*, 369, 114. (2024) 10.1007/s10509-024-04377-5 PDF
- 6. Properties of the Magellanic Corona **Lucchini, S.**, D'Onghia, E., & Fox, A. J. *ApJ*, 967, 16. (2024) <u>10.3847/1538-4357/ad3c3b</u>
- 5. The Milky Way Bar Pattern Speed using Hercules and Gaia DR3 Lucchini, S., D'Onghia, E., & Aguerri, J. A. L. MNRAS, 531, L14. (2024) 10.1093/mnrasl/slae024
- 4. Moving Groups Across Galactocentric Radius with Gaia DR3 **Lucchini, S.**, Pellett, E., D'Onghia, E., & Aguerri, J. MNRAS, 519, 1. (2023) 10.1093/mnras/stac3519
- 3. First evidence of a stripped star cluster from the Small Magellanic Cloud Piatti, A. E. & Lucchini, S. MNRAS, 515, 4005. (2022) 10.1093/mnras/stac1980
- 2. The Magellanic Stream at 20 kpc: A New Orbital History for the Magellanic Clouds **Lucchini, S.**, D'Onghia, E., & Fox, A. J. *ApJL*, 921, L36. (2021) 10.3847/2041-8213/ac3338
- 1. Using kinematic properties of pre-planetary nebulae to constrain engine paradigms Blackman, E. G. & **Lucchini, S.** *MNRAS*, 440, L16. (2014) 10.1093/mnrasl/slu001

### **Third+ Author Publications**

- 7. Secular Attrition of Classical Bulges by Stellar Bars
  McClure, R. L., Géron, T., et al., incl **Lucchini, S.** submitted (2025) <a href="mailto:arXiv:2506.09150">arXiv:2506.09150</a>
  Contribution: Assisted with Bayesian KDE analysis and provided general feedback
- 6. Coronal Gas in Magellanic-Analog Dwarfs: Insights from the HESTIA Simulations Chisholm, R., D'Onghia, E., et al., incl **Lucchini, S.** submitted (2025) <a href="mailto:arXiv:2504.15237"><u>arXiv:2504.15237</u></a> Contribution: Comparisons with isolated LMC models and analysis techniques
- 5. The Distance to the Magellanic Stream: Constraints from Optical Absorption along Stellar Sightlines Mishra, S., Fox, A. J., et al., incl **Lucchini, S.** *ApJ*, 984, 2. (2025) <u>10.3847/1538-4357/adc68a</u>
  Contribution: Determined selection of stars and contributed models
- 4. The Gaseous Blowout of the 30 Doradus Starburst Region in the LMC Poudel, S., Horton, A., et al., incl **Lucchini, S.** *ApJ*, 984, 2. (2025) 10.3847/1538-4357/adc099 Contribution: Comparison with simulations and provided Figures 18, 19
- 3. Hypervelocity Stars Trace a Supermassive Black Hole in the Large Magellanic Cloud Han, J., El-Badry, K., **Lucchini, S.**, et al. *ApJ*, 982, 2. (2025) 10.3847/1538-4357/adb967 Contribution: Assisted with orbital histories for LMC/SMC/MW system
- 2. The Truncated Circumgalactic Medium of the Large Magellanic Cloud Mishra, S., Fox, A. J., et al., incl **Lucchini, S.** *ApJL*, 976, L28. (2024) 10.3847/2041-8213/ad8b9d Contribution: Comparison with simulations and ram pressure calculations
- 1. Observations of a Magellanic Corona Krishnarao, D., Fox, A., et al., incl **Lucchini S.** *Nature*, 609, 915. (2022) 10.1038/s41586-022-05090-5 Contribution: Provided properties of predicted Magellanic Corona from simulations

# AWARDS & GRANTS

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Research Awards				
Aug. 2024	International Astronomical Union PhD Prize			
Jun. 2022	NASA Wisconsin Space Grant Consortium Research Fellowship \$5			
Apr. 2022	AAS Division on Dynamical Astronomy 2022 Duncombe Pr			
Jul. 2021	Karl Guthe Jansky and Alice Knapp Jansky Scholarship, UW-Madison Physics Dept.			
Apr. 2021	NASA Wisconsin Space Grant Consortium Research Fellowship			
Dec. 2020	Stebbins Award, UW-Madison Astronomy Dept.			
May 2020	Karl Guthe Jansky and Alice Knapp Jansky Scholarship, UW-Madison Physics Dept. \$3k			
Apr. 2020	NASA Wisconsin Space Grant Consortium Research Fellowship \$5k			
Teaching Awards				
Apr. 2022	Joseph R. Dillinger Award for Teaching Excellence	UW-Madison Physics Dept.		
May 2020	Best TA Award (General Physics - PHY 104, F19)	UW-Madison Physics Dept.		
May 2018	Best TA Award (General Physics - PHY 207, F17)	UW-Madison Physics Dept.		
May 2013		University of Rochester Physics Dept.		
Travel Awards				
Apr. 2022	Division on Dynamical Astronomy Travel Award	\$175		
2020, 2022	UW Student Research Grants	\$1200		
Awarded Ob	servational Proposals			
	Cycle 33 Hubble Space Telescope Archival Research Pro	posal		
	Co-I: "Ionized Gas around the Small Magellanic Cloud"	P		
Jul. 2025	Cycle 33 Hubble Space Telescope GO Research Proposal	7 orbits		
	Co-I: "Where is the central black hole in the LMC?"			
Jul. 2025	Cycle 33 Hubble Space Telescope GO Research Proposal	I 30 orbits		
	Co-I: "Unveiling the Circumgalactic Medium of M33"			
Jul. 2025	Cycle 33 Hubble Space Telescope GO Research Proposal	22 orbits		
	Co-I: "The Fate of the Leading Arm of the Magellanic Stream			
Jul. 2024	· · · · · · · · · · · · · · · · · · ·			
	Co-I: "Probing the front-side of the Circumgalactic Medium			
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Feb. 2023	Period 111 Very Large Telescope Proposal	26h
	Co-I: "The Distance to the Magellanic Stream"	
Jun. 2022	Cycle 30 Hubble Space Telescope Archival Research Proposal	
	Co-I: "The Cool CGM of the Large Magellanic Cloud"	
Jun. 2021	Cycle 29 Hubble Space Telescope Archival Research Proposal	\$110k
	Co-I: "The LMC's Galactic Wind through the Eyes of ULYSSES"	
May 2020	Cycle 28 Hubble Space Telescope Archival Research Proposal	\$276k
•	Co-I: "Searching for the LMC Corona: The missing element for the formation of	the Magellanic
	Stream"	-

# PRESENTATIONS

#### **Selected Invited Talks**

Feb. 2025	CfA ITC Luncheon Seminar [Recording Link]	Cambridge, MA
Oct. 2024	Decade of Discovery: Celebrating 10 Years of the Illustris Project	Gargonza, Italy
Aug. 2024	IAU GA – Division J PhD Prize Seminar [Recording Link]	Cape Town, South Africa
Apr. 2024	Via Science Meeting	Cambridge, MA
Nov. 2023	Univ. Vienna Institute for Astrophysics Colloquium	Virtual
Sept. 2023	CfA ITC Luncheon Seminar [Recording Link]	Cambridge, MA
Apr. 2023	CU Boulder Astrophysical & Planetary Sciences Friday Lunch Seminar	Boulder, CO
Mar. 2023	Univ. Maryland Center for Theory and Computation Seminar	College Park, MD
Oct. 2022	CCA Galaxy Evolution Group Meeting Seminar	New York, NY
Oct. 2022	Columbia University Seminar	New York, NY
Oct. 2022	Space Telescope Science Institute Low Density Universe Seminar	Baltimore, MD
Jul. 2022	Madison Astronomical Society Public Talk [Recording Link]	Madison, WI
Jun. 2022	GBO HVCs Workshop Invited Talk	Green Bank, WV
Mar. 2022	Space Telescope/Johns Hopkins Galaxies and AGN Seminar	Virtual

### **Selected Contributed Talks**

July 2025	Cosmic Ecosystems	Waterloo, ON
May 2025	XMC II: Clouds Over Yellowstone [Recording Link]	Bozeman, MT
Jan. 2025	245 <sup>th</sup> American Astronomical Society Meeting	National Harbor, MD
Aug. 2024	Multiphase Madness CGM Conference [Recording Link]	Cambridge, MA
Jun. 2024	244 <sup>th</sup> American Astronomical Society Meeting	Madison, WI
Feb. 2024	XMC Workshop: Milky Clouds Over Manhattan	New York, NY
Apr. 2022	53 <sup>rd</sup> Division on Dynamical Astronomy of the AAS Annual Meeting	New York, NY
Sept. 2019	A synoptic view of the Magellanic Clouds: VMC, Gaia and beyond	Garching, Germany

# TEACHING & ADVISING EXPERIENCE

# Co-Instructor – UW Madison

Taught five lectures over the eight-week session including active learning components (clicker questions) and live demonstrations. Rewrote two lectures including pre-lecture and bridge material and wrote new problems for exams and discussion worksheets.

General Physics – algebra-based mechanics (PHY 103), Su22

50 students

# Teaching Assistant - UW Madison

Created worksheets and quizzes each week. Led discussion sections and labs where group work and interactive learning was encouraged. Graded problem sets and exams.

General Physics – algebra-based mechanics (PHY 103), S20	75 students (~400 total)
General Physics – algebra-based E&M (PHY 104), F19	75 students (~400 total)
General Physics – calculus-based E&M (PHY 202), F18, Su18, S19, Su19	50 students (~500 total)
General Physics – calculus-based mechanics (PHY 207), F17, S18	50 students (~300 total)
Electromagnetic Fields (PHY 323), S21	20 students
Theoretical Physics – Dynamics (PHY 711), F21	30 graduate students

#### Guest Lecturer – UW Madison

Our Exploration of the Solar System (AST 104), S22 General Physics – algebra-based mechanics (PHY 103), review lecture S20

## Teaching Intern – University of Rochester

Led labs and workshop sessions and graded coursework and exams for a variety of courses.

### Advising Experience

Two UW-Madison undergraduate students from 2020–2023 developing and using the MGWave open-source python wavelet transformation code. Resulted in publication of Moving Groups through Galactocentric Radius with Gaia DR3.

Two Caltech undergraduate students during Summer 2024 and Summer 2025 SURF programs. Population analysis of cold gas in the circumgalactic medium and study of impact of numerical resolution.

## 0 R G A N I 7 A T I 0 N S

Chair of organizing committee for Multiphase Madness CGM conference

Aug. 2024 since 2023

ITC Luncheon talk series coordinator

UW Physics Outreach, Museum, Web Content & Events committee member

2022-2023

Member - American Astronomical Society, GASKAP

Reviewer - AAS Journals, MNRAS

# AND PRESS

### Hypervelocity Stars Trace a Supermassive Black Hole in the Large Magellanic Cloud

Han, J., El-Badry, K., Lucchini, S., et al. ApJ, accepted. (2025)

- CfA: "Runaway Stars Reveal Hidden Black Hole In Milky Way's Nearest Neighbor"
- NPR: "That galaxy next door? It's home to a monster black hole"
- Forbes: "Supermassive Black Hole Lurks In Nearby Large Magellanic Cloud"
- Smithsonian: "Astronomers Discover Evidence of a Stealthy Supermassive Black Hole..."
- Reuters: "Fast-moving stars reveal supermassive black hole inside nearby galaxy"
- Phys.org, New Scientist, Discover Magazine, Space.com, Sci News

## The Truncated Circumgalactic Medium of the Large Magellanic Cloud

Mishra, S., et al., incl. Lucchini, S. ApJL, 976, L28. (2024)

- NASA: "NASA's Hubble Sees Aftermath of Galaxy's Scrape with Milky Way"
- Universe Today, SciTechDaily

#### Observations of a Magellanic Corona

Krishnarao, D., et al., incl. Lucchini, S. Nature, 609, 915. (2022)

- NASA: "Using Quasars to Map the Magellanic Corona"
- UW-Madison: "Decades of work at UW-Madison underpin discovery of corona..."
- Hubblesite: "Hubble Detects Protective Shield Defending a Pair of Dwarf Galaxies"
- Space.com, Sci News, CNET, Universe Magazine

#### The Magellanic Stream at 20 kpc: A New Orbital History for the Magellanic Clouds

Lucchini, S., et al. ApJL, 921, L36. (2021)

- UW-Madison: "Magellanic Stream arcing over Milky Way may be five times closer than previously thought"
- Phys.org, Science Alert, Live Science

### The Magellanic Corona as the key to the formation of the Magellanic Stream

Lucchini, S., et al. Nature, 585, 203. (2020)

- <u>UW-Madison</u>: "Huge Halo of Warm Gas around Magellanic Clouds is Key to Formation of Magellanic Stream"
- Univ. Sydney: "How the Milky Way stole an enormous gas halo from our dwarf neighbours"
- Nature: "Galactic coronae"
- Phys.org, Universe Today, CNET, VICE, Cosmos Magazine, Sci News, Science Daily, Science Alert