Isabel Rosa Marie Medlock

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Education

Yale University — New Haven, CT
Astronomy PhD Candidate, Thesis Advisor: Prof. Daisuke Nagai — *Aug 2021 – present*

Princeton University — Princeton, NJ
B.A. in Astrophysics; Certificates in Applications of Computing and Russian Language — *Sep 2017 – Jun 2021*

Research Experience

PhD Dissertation (advised by Daisuke Nagai) — *Aug 2021 - present*

- **Probing the Physics of the CGM & Cosmological Tension with FRBs: Insights from CAMELS**: First-year theory project - exploring the potential of using fast radio bursts to constrain astrophysical feedback effects on galaxy evolution and cosmology with the CAMELS project
- **Quantifying Baryonic Feedback on Warm-Hot Circumgalactic Medium in CAMELS Simulations**: Co-mentoring (with Daisuke Nagai) Theory Project with Chloe Neufeld
- **Cold Streams: The Umbilical of High-z Galaxies (co-supervised by Frank van den Bosch)**: Developing high-resolution zoom-in simulations to study the interaction of cold streams feeding star-forming high-z galaxies with the circumgalactic medium.

Electron Acceleration in Simulations of Collisionless Shocks — *Jun 2020 - May 2021*

- **Senior Thesis with Anatoly Spitkovsky**: Studied electron acceleration in simulations of collisionless shocks. Developed methods for visualizing particle reflection and acceleration using Paraview and Python. Participated in the Princeton Astrophysics Undergraduate Summer Research Program.

Analysis of Vertical Structures of Edge-On Galaxies Using HSC-SSP — *Feb 2020 - May 2020*

- **Junior Paper with Jenny Greene**: Identified sample of edge on nearby galaxies. Using imaging techniques and model fitting, investigated the diversity of vertical structures and connection to galaxy formation and evolution.

Dispersion Measure Distributions of Fast Radio Bursts — *Oct 2019 - Jan 2020*

- **Junior Paper with Renyue Cen**: Used simulation data to calculate the dispersion measure of FRBs, considering redshift, phases of gas, and contribution of the IGM.

Presentations

33rd Texas Symposium: FRB Parallel Session in Tempe, Arizona (Invited Talk) — *Dec 11th, 2025*
Hernquist Group Meeting at Center for Astrophysics, Harvard-Smithsonian (Talk) — *Oct 10th, 2025*
ITC Luncheon at Center for Astrophysics, Harvard-Smithsonian (Invited Talk) — *Oct 9th, 2025*
Radio Lunch at Caltech (Talk) — *Oct 7th, 2025*
Monday Tea Talk at Caltech (Talk) — *Oct 6th, 2025*
Borthakur Group Meeting at Arizona State University (Invited Virtual Talk) — *Oct 3rd, 2025*
Astro Seminar at Kavli IPMU, Kashiwa, Japan (Talk) — *Sept 22nd, 2025*
2025 Santa Cruz Galaxy Workshop at University of California Santa Cruz (Talk) — *Aug 7th, 2025*
Cosmic Ecosystems at Perimeter Institute, Waterloo, Canada (Talk) — *Aug 1st, 2025*
Fast Radio Burst 2025 in Montreal, Canada (Talk) — *Jul 7th, 2025*
Cosmology at Home 2025 (Virtual Talk) — *June 17th, 2025*
FRB Journal Club at Max Planck Institute for Radio Astronomy (Invited Virtual Talk) — *April 11th, 2025*
Galaxy Evolution Coffee at European Southern Observatory - Garching, Germany (Talk) — *March 27th, 2025*
Galaxy Formation Club at Max Planck Institute for Astrophysics in Garching, Germany (Talk) — *March 26th, 2025*
CGM Meeting at European Southern Observatory - Garching, Germany (Talk) — *March 21st, 2025*
Astro Lunch at Astronomy Department, University of Washington (Invited Talk) — *Feb 25th, 2025*
Cosmology and galaxy astrophysics with simulations and machine learning at CCA (Talk) — *Dec 8th 2024*

Fast Radio Burst 2024 in Khao Lak Pang Nga, Thailand (Talk) *Nov 7th, 2024*
2024 Santa Cruz Galaxy Workshop at University of California Santa Cruz (Talk) *Aug 1st, 2024*
European Astronomical Society Annual Meeting (Virtual Poster) *July 2nd, 2024*
Baryons in the Universe 2024 at Kavli IPMU, Kashiwa, Japan (Talk) *Apr 11th, 2024*
Fast Radio Burst 2023 at IISER Bhopal, Indore, India (Remote Talk) *Nov 9th, 2023*
SACNAS National Diversity in STEM Conference in Portland, Oregon (Poster) *Oct 27th, 2023*
American Physical Society April Meeting in Minneapolis, Minnesota (Poster) *Apr 17th, 2023*
American Astronomical Society Winter Meeting 241 in Seattle, Washington (Poster) *Jan 12th, 2023*
CAMELS Workshop at the Center for Computational Astrophysics (Talk) *Nov 30th 2022*
SACNAS National Diversity in STEM Conference in San Juan, Puerto Rico (Talk) *Oct 28th, 2022*
Princeton Physics Junior Paper Symposium (Virtual Talk) *Apr 19th, 2020*

Fellowships & Awards

NSF ACCESS Computing Grant (Co-PI, Lead Author): 312.5k Stampede3 node hours ($68.5k) *2025*
NSF ACCESS Computing Grant (Co-PI, Lead Author): 300k Stampede3 node hours ($62k) *2024*
Yale Dean's Fund for Colloquia and Symposia - for Yale Cosmology Seminar ($1800) *2024,2025*
Yale Graduate Student Assembly Conference Travel Fellowship ($2400) *2023,2024,2025*
American Astronomical Society Travel Grant ($2000) *2023,2024*
APS Division of Astrophysics April Meeting Travel Grant ($300) *2023*
Dean's Emerging Scholars Research Award, Yale University ($2000) *2022*
SACNAS NDiSTEM Conference Travel Fellowship ($1000) *2022*

Activities & Outreach

First-Year Astronomy Buddy (FAB) Mentorship Program Mentor *Aug 2024 - ongoing*
Yale SACNAS Chapter (YSACNAS) Co-President, Secretary, and Treasurer *Jan 2023 - ongoing*
Yale Cosmology Seminar Co-Organizer *Sep 2023 - ongoing*
Leitner Family Observatory and Planetarium Spanish Night Creator and Organizer *Feb 2023 - ongoing*
Science in the News Presenter *Oct 2022 - May 2023*
Yale Astronomy Siblings Mentor *Sep 2022 - present*
Astronomy Climate and Diversity Committee Member *Sep 2022 - present*

Teaching Experience

Yale Pathways Workshop Instructor for Local High School Students *July 2025*
Eduexplora Yale Summer Session Instructor *July 2023*
Teaching Fellow - ASTR 120: Galaxies and the Universe, Yale *Jan - May 2023*
Teaching Fellow - ASTR 160: Frontiers and Controversies in Astrophysics, Yale *Sep - Dec 2022*
Teaching Fellow - ASTR 180: Introduction to Relativity and Black Holes, Yale *Jan - May 2022*
Teaching Fellow - ASTR 110: Planet and Stars, Yale *Sep - Dec 2021*

Skills

Technical: High Performace Computing, AREPO hydrodynamical cosmological simulations, Java, Python, Javascript, C, MATLAB, HTML, Paraview, Machine Learning
Language: Native English and Spanish speaker; Intermediate Russian

References

Daisuke Nagai (PhD Advisor): Professor of Physics and of Astronomy, Yale University
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Frank van den Bosch (Collaborator): Professor of Astronomy and Physics, Yale University
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Volker Springel (Collaborator): Director - Computational Astrophysics, Max Planck Institute for Astrophysics
Email: vspringel@mpa-garching.mpg.de, Phone: +49 89 30000 2195

Publications

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First Author

[5] **Medlock, I.**, Nagai, D., Mandelker, N., Springel, V., van den Bosch, F., Zinger, E., and Chiang, B., "Statistical Properties of Cold Streams in Massive Star Forming Halos in the IllustrisTNG-50 Simulations", submitted to ApJ (10.48550/arXiv.2511.21814)

[4] **Medlock, I.**, Nagai, D., Anglés-Alcázar, D., and Gebhardt. M., "Constraining the Effect of Baryonic Feedback on the Matter Power Spectrum with Fast Radio Bursts", 2025, *ApJ*, 983(1) 46

[3] **Medlock, I.**, Neufeld, C., Nagai, D., Anglés-Alcázar, D., Genel, S., Oppenheimer, B., Singh, P., and Villaescusa-Navarro, F., "Quantifying Baryonic Feedback on Warm-Hot Circumgalactic Medium in CAMELS Simulations", 2025, *ApJ*, 980(1) 61

[2] **Medlock, I.**, Nagai, D., Singh, P., Oppenheimer, B., Anglés-Alcázar, D., and Villaescusa-Navarro, F., "Probing the Physics of the Circum-galactic Medium using Fast Radio Bursts: Insights from CAMELS", 2024, *ApJ*, 967(1) 32

[1] **Medlock, I.**, and Cen, R., "Dispersion Measure Distributions of Fast Radio Bursts Due to the Intergalactic Medium", 2021, *MNRAS*, 502(3), 3664-3669.

Refereed Co-Author

[6] Sims, X., Anglés-Alcázar, D., Kiat Oh, B., Nagai, D., Mercedes-Feliz, J., **Medlock, I.**, Ni, Y., Lovell, C., Villaescusa-Navarro, F., "CAMELS Environments: The Impact of Local Neighbours on Galaxy Evolution across the SIMBA, IllustrisTNG, ASTRID, and Swift-EAGLE Simulations", submitted to *MNRAS*

[5] Gebhardt, M., Anglés-Alcázar, D., Genel, S., Nagai, D., Kiat Oh, B., **Medlock, I.**, Mercedes-Feliz, J., Sutherland, S., Lee, M., Sims, X. , Lovell, C., Spergel, D., Davé, R., Schaller, M., Schaye, J., Villaescusa-Navarro, F., "Cosmological back-reaction of baryons on dark matter in the CAMELS simulations", submitted to *MNRAS*

[4] Oppenheimer, B., Voit, M., Bahé, Y., Battaglia, N., Bregman, J., Burchett, J., Eckert, D., Faerman, Y., Gibson, J., Hummels, C., **Medlock, I.**, Nagai, D., Putnam, M., Qu, Z., Sun, M., Werk, J., and Zhang, Y., "The Descriptive Parametric Model I: Gaseous Profiles for Galaxies, Groups, and Clusters", 2025, *MNRAS*, 543(3), 2649-2669

[3] Zhang, Z., Nagamine, K., Oku, Y., Lee, K.G., Fukushima, K., Tomaru, K., Zhang, B., **Medlock, I.**, and Nagai, D., "Probing the cosmic baryon distribution and the impact of AGN feedback with FRBs in CROCODILE simulation", 2025, *ApJ*, 993(2), 162

[2] Leung, C., Simha, S., **Medlock, I.**, Nagai, D., Masui, K., Kahinga, L., Lanman, A., Andrew, S., Bandura, K., Curtin, A., Gaensler, B., Gusinskaia, N., Joseph, R., Lazda, M., Mas-Ribas, L., Meyers, B., Nimmo, K., Pearlman, A., Prochaska, X., Sammons, M., Shin, K., Smith, K, Wang, H., "Stellar Mass-Dispersion Measure Correlations Constrain Baryonic Feedback in Fast Radio Burst Host Galaxies", 2025, *ApJL*, 991(1), L25

[1] Lau, E., Nagai, D., Bodgan, A., **Medlock, I.**, Oppenheimer, B., Battaglia, N., Anglés-Alcázar, D., Genel, S., Ni, Y., and Villaescusa-Navarro, F., "X-raying CAMELS: Constraining Baryonic Feedback in the Circum-Galactic Medium with the CAMEL Simulation and eRASS X-ray Observations", 2025, *ApJ*, 984(2), 190

Non-Refereed Co-Author

[2] Oppenheimer, B., Nagai, D., Lau, E., Singh, P., Butler Contreras, A., Gluck, N., Dorigo Jones, J., **Medlock, I.**, and Villaescusa-Navarro, P., "A Multi-Wavelength, Multi-Model Exploration of How Feedback Disrupts Gaseous Atmospheres", 2022, *Bulletin of the AAS, 54*(1).

[1] Singh, P., Nagai, D., Oppenheimer, B., Lau, E., Gluck, N., and **Medlock, I.**, "Galactic Gaseous Halos: Mini-Clusters Disrupted by Feedback", 2022, *Galactic Atmospheres*.