Rahul Ramesh

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Education

ITA, Heidelberg, Germany *October 2021 – present*
PhD (Astronomy; expected April 2025)

IISER, Mohali, India *August 2016 – April 2021*
Integrated BS-MS (Physics), CPI : 9.84 (scale of 10)

Research Experience

PhD Thesis *October 2021 – present*
Title: Deciphering galaxy evolution through the baryon cycle and circumgalactic medium in cosmological simulations
Thesis Advisor: Dr. Dylan Nelson, Institut für theoretische Astrophysik, Heidelberg, Germany

MS Thesis *August 2020 – April 2021*
Title: Gravitational lensing of gravitational wave packets
Thesis Advisor: Prof. Jasjeet Singh Bagla, Indian Institute of Science Education and Research, Mohali, India

Summer Internship *April – July 2020*
Title: The stellar mass assembly of galaxies at the centers of groups and clusters
Advisor: Dr. Annalisa Pillepich, Max-Planck-Institut für Astronomie, Heidelberg, Germany

Summer Internship *May – July 2019*
Title: Measurement errors in the V_{max} approach
Advisor: Prof. Ravi K Sheth, University of Pennsylvania, Philadelphia, USA

Summer Internship *May – July 2018*
Title: Estimating cosmological parameters using bayesian inference
Advisor: Prof. Tarun Deep Saini, Indian Institute of Science, Bengaluru, India

Summer Internship *March – October 2017*
Title: Galactic rotation and Oort's constants
Advisor: Prof. Jasjeet Singh Bagla, Indian Institute of Science Education and Research, Mohali, India

Research Interests and Technical Strengths

Scientific Interests	Circumgalactic Medium, Baryon Cycle, Interaction of Multi-Phase Media
Scientific Methods	(Cosmological) Hydrodynamical Simulations, Development and Implementation of new Computational Techniques
Computer Languages	Python, C, C++ (advanced); Julia (intermediate)
Misc. Computational Skills	Arepo Code, HPC Computing, Parallel Programming

Publications

13 (9) total (first author) refereed/under-review papers. Total (first author) citations: 150 (102).

First Author Papers

9. **R. Ramesh**, D. Nelson, and P. Girichidis. "IllustrisTNG + Cosmic Rays with a Simple Transport Model: From Dwarfs to L* Galaxies". In: *A&A submitted* (Sept. 2024). DOI: 10.48550/arXiv.2409.18238. arXiv: 2409.18238 [astro-ph.GA].
8. **R. Ramesh**, D. Nelson, D. Fielding, and M. Brüggen. "Zooming in on the Circumgalactic Medium with GIBLE: Tracing the Origin and Evolution of Cold Clouds". In: *A&A submitted* (June 2024). DOI: 10.48550/arXiv.2407.00172. arXiv: 2407.00172 [astro-ph.GA].
7. **R. Ramesh**, D. Nelson, D. Fielding, and M. Brüggen. "Zooming in on the circumgalactic medium with GIBLE. The topology and draping of magnetic fields around cold clouds". In: *A&A* 684, L16 (Apr. 2024), p. L16. DOI: 10.1051/0004-6361/202348786. arXiv: 2404.01370 [astro-ph.GA].
6. **R. Ramesh** and D. Nelson. "Zooming in on the circumgalactic medium with GIBLE: Resolving small-scale gas structure in cosmological simulations". In: *MNRAS* 528.2 (Feb. 2024), pp. 3320–3339. DOI: 10.1093/mnras/stae237. arXiv: 2307.11143 [astro-ph.GA].
5. **R. Ramesh**, D. Nelson, V. Heesen, and M. Brüggen. "Azimuthal anisotropy of magnetic fields in the circumgalactic medium driven by galactic feedback processes". In: *MNRAS* 526.4 (Dec. 2023), pp. 5483–5493. DOI: 10.1093/mnras/stad3104. arXiv: 2305.11214 [astro-ph.GA].
4. **R. Ramesh**, D. Nelson, and A. Pillepich. "The circumgalactic medium of Milky Way-like galaxies in the TNG50 simulation - II. Cold, dense gas clouds and high-velocity cloud analogs". In: *MNRAS* 522.1 (June 2023), pp. 1535–1555. DOI: 10.1093/mnras/stad951. arXiv: 2303.16215 [astro-ph.GA].
3. **R. Ramesh**, D. Nelson, and A. Pillepich. "The circumgalactic medium of Milky Way-like galaxies in the TNG50 simulation - I: halo gas properties and the role of SMBH feedback". In: *MNRAS* 518.4 (Jan. 2023), pp. 5754–5777. DOI: 10.1093/mnras/stac3524. arXiv: 2211.00020 [astro-ph.GA].
2. **R. Ramesh**, A. K. Meena, and J. S. Bagla. "Wave effects in double-plane lensing". In: *Journal of Astrophysics and Astronomy* 43.2, 38 (Dec. 2022), p. 38. DOI: 10.1007/s12036-022-09821-y. arXiv: 2109.09998 [astro-ph.CO].
1. **R. Ramesh**, A. K. Meena, and J. S. Bagla. "Gravitational lensing of core-collapse supernova gravitational wave signals". In: *Journal of Astrophysics and Astronomy* 43.1, 5 (June 2022), p. 5. DOI: 10.1007/s12036-021-09787-3. arXiv: 2107.02998 [gr-qc].

Co-Author Papers

4. O. Wittig, **R. Ramesh**, and D. Nelson. "Tracing the cosmological origin of gas that fuels in-situ star formation in TNG50 galaxies". In: *A&A submitted* (Oct. 2024). [Dropbox Link].
3. A. Pillepich, D. Sotillo-Ramos, **R. Ramesh**, D. Nelson, C. Engler, V. Rodriguez-Gomez, M. Fournier, M. Donnari, V. Springel, and L. Hernquist. "Milky Way and Andromeda analogs from the TNG50 simulation". In: *MNRAS* (Sept. 2024), stae2165. ISSN: 0035-8711. DOI: 10.1093/mnras/stae2165. URL: https://doi.org/10.1093/mnras/stae2165.
2. S. Weng, C. Péroux, **R. Ramesh**, D. Nelson, E. M. Sadler, M. Zwaan, V. Bollo, and B. Casavecchia. "The physical origins of gas in the circumgalactic medium using observationally motivated TNG50 mocks". In: *MNRAS* 527.2 (Jan. 2024), pp. 3494–3516. DOI: 10.1093/mnras/stad3426. arXiv: 2310.18310 [astro-ph.GA].

1. A. Boecker, N. Neumayer, A. Pillepich, N. Frankel, **R. Ramesh**, R. Leaman, and L. Hernquist. "The origin of stars in the inner 500 parsecs in TNG50 galaxies". In: *MNRAS* 519.4 (Mar. 2023), pp. 5202–5235. DOI: 10.1093/mnras/stac3759. arXiv: 2301.11942 [astro-ph.GA].

Conferences, Meetings and Seminars

12. Zooming In, Zooming Out: Exploring Galaxy Formation through Simulations, EAS Meeting, Padua, Italy (July 2024)
11. The hot phase of the circumgalactic medium, EAS Meeting, Padua, Italy (July 2024)
10. Gas accretion onto galaxies: new insights from observations and simulations, EAS Meeting, Padua, Italy (July 2024)
9. ISSI CGM Meeting, Bern, Switzerland (March 2024)
8. Galaxy Lunch Meeting, Lund, Sweden (December 2023)
7. MIST2023: Cosmic turbulence and Magnetic fields, Cargese, France (September 2023)
6. Evolution of Gas in and around Galaxies, Stanley, USA (August 2023)
5. New views on the Baryon Cycle in Galaxies, Healesville, Australia (July 2023)
4. MPIA Galaxy Coffee, Heidelberg, Germany (July 2023)
3. Modelling of Multiphase Astrophysical Media, Kochel, Germany (May 2023)
2. ISSI CGM Meeting, Bern, Switzerland (October 2022)
1. The Build-up of Monsters Through Cosmic History, EAS Meeting, Virtual (June 2021)

Academic Achievements and Fellowships

7. Academic Excellence Certificate (Physics) – IISER, Mohali, Batch of 2021
6. DAAD-WISE 2020 Scholarship (was later cancelled due to the COVID-19 pandemic)
5. 2019 SWAN Radio Imaging Challenge – Member of winning team
4. SN Bose 2019 Scholarship
3. Academic Excellence Certificate in Semesters 3, 4, 6 and 8 – IISER, Mohali
2. CNR Rao Award in Semesters 1 and 2 – IISER, Mohali
1. INSPIRE Fellowship (2016 – 2021)

Service and Mentoring

Referee *2023 – present*
ApJ, MNRAS

Undergraduate Research Co-Supervisor, Heidelberg University *2023 – present*
Qi Guo (April 2024 – present)
Ole Wittig (April 2023 – May 2024)

Teaching Assistant, Heidelberg University *2023 – 2024*
Introduction to Astronomy and Astrophysics (October 2023 – February 2024)
Introduction to Computational Physics (March – July 2023)
Introduction to GPU Accelerated Computing (February 2023)