Dr. Rajesh Mondal

Contact Information

The Oskar Klein Centre
Department of Astronomy
Stockholm University
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Date Of Birth 18th May 1990

Academic Position

Wenner-Gren Postdoctoral Fellow — **1 Jun 2020 – present**
Stockholm University, Stockholm, Sweden

Postdoctoral Research Fellow — **30 Oct 2017 – 31 May 2020**
University of Sussex, Brighton, UK

Education

Doctor of Philosophy (PhD) — **20 Jul 2018**
Indian Institute of Technology Kharagpur, WB, India
Thesis title: Statistics of Epoch of Reionization 21-cm signal: The non-Gaussian effects on the power spectrum error predictions
PhD supervisor: Prof. Somnath Bharadwaj somnath@phy.iitkgp.ernet.in

Master of Science (MSc, Physics) — **Jun 2012**
Indian Institute of Technology Kharagpur, WB, India

Bachelor of Science (BSc, Physics) — **Jun 2010**
Scottish Church College, University of Calcutta, Kolkata, India

Research Interests

Epoch of Reionization (EoR), Large-Scale Structure of the Universe, Cosmological N-body Simulations, Simulations of 21-cm signal, Statistical inference, Dark Matter, Low-Frequency Radio Interferometry, Cosmic Microwave Background (CMB)

Collaborators

Garrelt Mellema (Stockholm University), Ilian Iliev (University of Sussex), Somnath Bharadwaj (IIT Kharagpur), Suman Majumdar (IIT Indore), Kanan K. Datta (Presidency University), Tirthankar R. Choudhury (NCRA-TIFR), Anastasia Fialkov (University of Cambridge), Erik Zackrisson (Uppsala University), Shiv. K. Sethi (RRI), Subinoy Das (IIA)

Publications

Total **32** publications. **24** publications in Peer-reviewed Journals. Total citations **640+**. h-index **14**. i10-index **19**. **0000-0001-7728-3756** **Google Scholar** **NASA/ADS**

First or Second Author Publications

15. **R. Mondal**, G. Mellema, S. Murray, B. Greig, **2022**, *The multi-frequency angular power spectrum in parameter studies of the cosmic 21-cm signal*, submitted to MNRAS Letters. arXiv:2203.11095
14. **R. Mondal**, et al., **2021**, *The Epoch of Reionization 21-cm Bispectrum: The impact of light-cone effects and detectability*, MNRAS, 508, 3848. arXiv:2107.02668
13. **R. Mondal**, A. Fialkov, et al. (LOFAR EoR collaboration), **2020**, *Tight Constraints on the Excess Radio Background at $z = 9.1$ from LOFAR*, MNRAS, 498, 4178. arXiv:2004.00678
12. **R. Mondal**, et al., **2020**, *Predictions for measuring the 21-cm multi-frequency angular power spectrum using SKA-Low*, MNRAS, 494, 4043. arXiv:1910.05196
11. S. Bag, **R. Mondal**, et al., **2019**, *Studying the morphology of HI isodensity surfaces during reionization using Shapefinders and percolation analysis*, MNRAS, 485, 2235. arXiv:1809.05520
10. **R. Mondal**, et al., **2019**, *A method to determine the evolution history of the mean neutral Hydrogen fraction*, MNRAS *Letters*, 483, L109. arXiv:1810.06273
9. S. Majumdar, **R. Mondal**, et al., **2019**, *A comprehensive study of the EoR 21-cm signal bispectrum*, URSI AP-RASC, New Delhi, India, Article no. 8738660
8. S. Das, **R. Mondal**, et al., **2018**, *On dark matter - dark radiation interaction and cosmic reionization*, JCAP, 08, 045. arXiv:1712.03976
7. S. Bag, **R. Mondal**, et al., **2018**, *The shape and size distribution of HII regions near the percolation transition*, MNRAS, 477, 1984. arXiv:1801.01116
6. K. K. Datta, **R. Mondal**, et al., **2018**, *Understanding the impact of Light cone effect on the EoR/CD 21-cm power spectrum*, Proceedings of IAU, Dubrovnik, Croatia, 12(S333), 12-17

5. **R. Mondal**, S. Bharadwaj, K. K. Datta, **2018**, *Towards simulating and quantifying the light-cone EoR 21-cm signal*, MNRAS, 474, 1390. arXiv:1706.09449
4. **R. Mondal**, et al., **2017**, *Statistics of the epoch of reionization (EoR) 21-cm signal – II. The evolution of the power spectrum error-covariance*, MNRAS, 464, 2992. arXiv:1606.03874
3. A. Sarkar, **R. Mondal**, et al., **2016**, *The effects of the small-scale DM power on the cosmological neutral hydrogen (HI) distribution at high redshifts*, JCAP, 04, 012. arXiv:1512.03325
2. **R. Mondal**, S. Bharadwaj, S. Majumdar, **2016**, *Statistics of the epoch of reionization 21-cm signal – I. Power spectrum error-covariance*, MNRAS, 456, 1936. arXiv:1508.00896
1. **R. Mondal**, et al., **2015**, *The effect of non-Gaussianity on error predictions for the Epoch of Reionization (EoR) 21-cm power spectrum*, MNRAS *Letters*, 449, L41. arXiv:1409.4420

Publications with significant contribution/As A Member Of Core Science Team

15. A. Pathak, S. Bag, S. Majumdar, **R. Mondal**, et al., **2022**, *Distinguishing reionization models using the largest cluster statistics of the 21-cm maps*, submitted to MNRAS. arXiv:2202.03701
14. B. K. Gehlot, (Including **R. Mondal**) et al., **2022**, *Degree-Scale Galactic Radio Emission at 122 MHz around the North Celestial Pole with LOFAR-AARTFAAC*, submitted to A&A. arXiv:2112.00721
13. I. Georgiev, G. Mellema, S. K. Giri, **R. Mondal**, **2021**, *The large-scale 21-cm power spectrum from reionization*, submitted to MNRAS. arXiv:2110.13190
12. Mohd Kamran, (Including **R. Mondal**) et al., **2021**, *Probing IGM Physics during Cosmic Dawn using the Redshifted 21-cm Bispectrum*, submitted to Phys. Rev. Lett. arXiv:2108.08201
11. Mohd Kamran, R. Ghara, S. Majumdar, **R. Mondal**, et al., **2021**, *Redshifted 21-cm bispectrum II: Impact of the spin temperature fluctuations and redshift space distortions on the signal from the Cosmic Dawn*, MNRAS, 502, 3800. arXiv:2012.11616
10. B. Greig, (Including **R. Mondal**) et al., **2021**, *Interpreting LOFAR 21-cm signal upper limits at $z \sim 9.1$ in the context of high-z galaxy and reionisation observations*, MNRAS, 501, 1. arXiv:2006.03203
9. S. Majumdar, M. Kamran, J. R. Pritchard, **R. Mondal**, et al., **2020**, *Redshifted 21-cm Bispectrum I: Impact of the Redshift Space Distortions on the Signal from the Epoch of Reionization*, MNRAS, 499, 5090. arXiv:2007.06584
8. A. K. Shaw, S. Bharadwaj, **R. Mondal**, **2020**, *The impact of non-Gaussianity on the Epoch of Reionization parameter forecast using 21-cm power spectrum measurements*, MNRAS, 498, 1480. arXiv:2005.06535
7. F. G. Mertens, (Including **R. Mondal**) et al., **2020**, *Improved upper limits on the 21-cm signal power spectrum of neutral hydrogen at $z = 9.1$ from LOFAR*, MNRAS, 493, 1662. arXiv:2002.07196
6. R. Ghara, (Including **R. Mondal**) et al., **2020**, *Constraining the intergalactic medium at $z \sim 9.1$ using LOFAR Epoch of Reionization observations*, MNRAS, 493, 4728. arXiv:2002.07195
5. E. Zackrisson, S. Majumdar, **R. Mondal**, et al., **2020**, *Bubble mapping with the Square Kilometer Array – I. Detecting galaxies with Euclid, JWST, WFIRST and ELT within ionized bubbles in the intergalactic medium at $z > 6$*, MNRAS, 493, 855. arXiv:1905.00437
4. A. K. Shaw, S. Bharadwaj, **R. Mondal**, **2019**, *The impact of non-Gaussianity on the error covariance for observations of the Epoch of Reionization 21-cm power spectrum*, MNRAS, 487, 4951. arXiv:1902.08706
3. A. Hutter, (Including **R. Mondal**) et al., **2019**, *Astro2020 Science White Paper: A proposal to exploit galaxy-21cm synergies to shed light on the Epoch of Reionization*, Bulletin of the AAS, 51, 3, 57. arXiv:1903.03628
2. S. Majumdar, J. Pritchard, **R. Mondal**, et al., **2018**, *Quantifying the non-Gaussianity in the EoR 21-cm signal through bispectrum*, MNRAS, 476, 4007. arXiv:1708.08458
1. C. Watkinson, S. Majumdar, J. Pritchard, **R. Mondal**, **2017**, *A fast estimator for the bispectrum and beyond - a practical method for measuring non-Gaussianity in 21-cm maps*, MNRAS, 472, 2436. arXiv:1705.06284

Books/Book Chapters

2. *SKA-India Science Book (Version 2)*: S. Majumdar, K. Datta, R. Ghara, **R. Mondal**, et al., **2016**, *Line of sight anisotropies in the Cosmic Dawn and EoR 21-cm power spectrum*, Journal of Astrophysics and Astronomy, 37, 32. arXiv:1610.08180
1. *SKA-India Science Book (Version 2)*: T. Roy Choudhury, K. Datta, S. Majumdar, R. Ghara, A. Paranjape, **R. Mondal**, et al., **2016**, *Modelling the 21 cm Signal From the Epoch of Reionization and Cosmic Dawn*, Journal of Astrophysics and Astronomy, 37, 29. arXiv:1610.08179

Journal Reviewer

2. Monthly Notices of the Royal Astronomical Society (MNRAS)
1. Journal of Astrophysics and Astronomy (JoAA)

Fellowships, Grants, Awards and Memberships

11. **Decoding the early Universe: A novel approach**, Sponsor: Israel Academy of Sciences and Humanities - Council for Higher Education, Role: PI, Amount: 320000 Israeli New Shekel **2022**
10. **Visiting Fellow**, Astronomy Centre, University of Sussex, UK **Jun 2020** – present
9. **Decoding the early Universe: A novel approach**, Sponsor: Wenner-Gren Foundations, Sweden, Role: Co-PI, Amount: 660000 Swedish Krona (Tax free) **2020**
8. **Fellow of the Royal Astronomical Society** **Mar 2018**
7. Membership of the **LOFAR EoR Key Science Project (KSP)** **2018** – present
6. Membership of the **SKA Cosmology SWG** **Jun 2017** – present
5. Membership of the **SKA CD/EoR SWG** **Dec 2016** – present
4. Membership of the **SKA India EoR SWG** **Sep 2015** – present
3. **CSIR – UGC** test for JRF and Eligibility for Lectureship **Jun 2012**
2. **Graduate Aptitude Test (GATE)** **2012**
1. **Joint Admission test for M.Sc. (JAM)** **2010**

Computing Skill

Operating Systems: Linux, Windows
Programming Language: C, Python
Parallel Computing: OpenMP, MPI
Application Packages:

- Scientific Packages: Numerical Recipes in C, FFTW, GSL, NumPy, MATLAB
- Text Processing: LaTeX, MS Office, Open Office
- Graphics: GNUplot, matplotlib, Origin, Xfig

Markup Language: HTML

Code/GitHub Repositories

rajeshmondal18

5. **DviSukta**: A direct estimator of the bispectrum **ascl:2109.004**
4. **MAPS**: The Multi-frequency Angular Power Spectrum (MAPS) estimator **ascl:2108.003**
3. **ReionYuga**: A semi-numerical reionization code **ascl:2107.005**
2. **FoF Halo finder** code **ascl:2107.004**
1. **Particle-Mesh *N*-body** code **ascl:2107.003**

Teaching & Related Experiences

11. B.Sc. **Scientific Computing** (F3212), University of Sussex, UK Autumn term **2019**
10. B.Sc. **Scientific Computing** (F3212), University of Sussex, UK Autumn term **2018**
9. M.Sc. Integrated 3rd year and M.Sc. 1st year **Computational Physics Lab** (PH39002 and PH45006), IIT Kharagpur, India Spring semester **2016**
8. B.Tech. 1st year, **Physics-I Tutorial**, IIT Kharagpur, India Autumn semester **2015**
7. M.Sc. Integrated 3rd year and M.Sc. 1st year **Computational Physics Lab** (PH39002 and PH45006), IIT Kharagpur, India Spring semester **2015**
6. B.Tech. 1st year, **Physics-I Tutorial**, IIT Kharagpur, India Autumn semester **2014**
5. B.Tech. 1st year **Physics Lab** (PH19001), IIT Kharagpur, India Spring semester **2014**
4. M.Sc. Integrated 3rd year and M.Sc. 1st year **Computational Physics Lab** (PH39002 and PH45006), IIT Kharagpur, India Spring semester **2014**
3. B.Tech 1st year **Physics Lab** (PH19001), IIT Kharagpur, India Autumn semester **2013**
2. M.Sc. Integrated 4th year and M.Sc. 2nd year **Statistical Physics I** (PH41007 and PH53007) Tutorial, IIT Kharagpur, India Autumn semester **2013**
1. B.Tech. 1st year **Physics Lab** (PH19001), IIT Kharagpur, India Spring semester **2013**

Students Mentored

M.Sc. Students

4. Charlotte Marie Fling, Astronomy Centre, University of Sussex — **2018 – 2019**
3. Apurba Bera, Department of Physics, IIT Kharagpur — **2014 – 2015**
2. Ayan Acharyya, Department of Physics, IIT Kharagpur — **2014 – 2015**
1. Sampath Mukherjee, Department of Physics, IIT Kharagpur — **2013 – 2014**

PhD Students

2. Suman Pramanick, Department of Physics, IIT Kharagpur — **2021 – present**
1. Ivelin Georgiev, Department of Astronomy, Stockholm University — **2020 – present**

Academic Visits

3. Visiting Fellow, **NCRA-TIFR**, Pune, India — **12 Jul – 31 Oct 2017**
2. **Scuola Normale Superiore**, Pisa, Italy — **31 May – 5 Jun 2016**
1. **Raman Research Institute**, Bangalore, India — **15 – 22 Jun 2015**

Talks and Presentations (Selected)

13. **3rd Global 21-cm Workshop**, hosted by University of Cambridge, UK — **19-22 Oct 2020**
12. Invited speaker at **Astrophysics seminars**, Imperial College London, UK — **19 Feb 2020**
11. Invited lecturer in **International conference and school**, IIT Indore, India — **20-31 Jan 2020**
10. **SKA General Science Meeting 2019**, Alderly Park, Cheshire, UK — **8-12 Apr 2019**
9. Invited speaker at **Sussex Astronomy Colloquium**, University of Sussex, UK — **5 Oct 2018**
8. **Rise & shine: galaxies in the EoR**, University de Strasbourg, France — **18-22 June 2018**
7. **RAS Meeting on the EoR: UK community update**, Burlington House, UK — **9 Feb 2018**
6. Invited speaker at the **NCRA Colloquium**, NCRA-TIFR, Pune, India — **13 Oct 2017**
5. **Cosmology with Next Generation Radio Surveys**, ICTP, Italy — **6-17 June 2016**
4. **Workshop on Cosmology with the HI 21-cm Line**, RRI, India — **23-26 June 2015**
3. **The Olympian Symposium 2015: Cosmology and the EoR**, Greece — **18-22 May 2015**
2. **Saha Theory Workshop: Cosmology at the Interface**, SINP, India — **28-30 Jan 2015**
1. **Topical Conference on Gravity and Cosmology**, Presidency University — **9 Aug 2014**

Leadership Skills

Organizer and Coordinator

1. The SKA-India EoR and Cosmology bi-weekly online seminar and discussion

Organizer and SOC

3. School on 21-cm Cosmology and Reionization — **14 – 25 Jun 2021**
2. Workshop on 21-cm Cosmology and Reionization — **19 – 23 Apr 2021**
1. SAZERAC sip: The 21-cm Signal from CD and EoR — **29 Jan 2021**

Local Organising Committee and Website designer

2. The Topical Conference on Gravity and Cosmology (TCGC-ER) — **28 Feb 2015**
1. Computational Physics Lab, IIT Kharagpur, India

General Secretary Social and Cultural

Vidyasagar Hall of Residence, IIT Kharagpur, India — session **2013 – 2014**

Volunteer

FIFA U-17 World Cup India — **2017**

References

- **Prof. Somnath Bharadwaj**, Department of Physics, IIT Kharagpur, Kharagpur, West Bengal - 721302, India, somnath@phy.iitkgp.ernet.in, somnathbharadwaj@gmail.com, +913222283806
- **Prof. Ilian T. Iliev**, Astronomy Centre, Department of Physics and Astronomy, University of Sussex, Falmer, Brighton - BN19QH, UK, I.T.Iliev@sussex.ac.uk, +441273873737
- **Prof. Garrelt Mellema**, The Oskar Klein Centre, Department of Astronomy, Stockholm University, AlbaNova, Stockholm - 106 91, Sweden, garrelt.mellema@astro.su.se, +46855378552
- **Prof. Tirthankar Roy Choudhury**, NCRA-TIFR, Pune University Campus, Post Bag 3, Ganeshkhind, Pune - 411007, India, tirth@ncra.tifr.res.in, +912025719270
- **Dr. Anastasia Fialkov**, Institute of Astronomy, Cambridge University, Madingley Road, Cambridge - CB30HA, UK, afialkov@ast.cam.ac.uk, anastasia.fialkov@gmail.com, +441223766095
- **Prof. Shiv Sethi**, Raman Research Institute, Bangalore - 560080, India, sethi@rri.res.in, +918023610122