

Curriculum Vitae

Name: Dr. Jais Kumar

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Research Interests

My research focuses on the Cosmic Dawn, the Epoch of Reionization (EoR), and 21-cm cosmology. Specifically, I investigate the observational challenges in detecting redshifted 21-cm signals from the EoR, with an emphasis on understanding the impact of time- and frequency-dependent gain errors in power spectrum measurements. This includes the development of advanced calibration techniques and novel power spectrum estimators to mitigate systematic effects.

Through the 21-cm signal from neutral hydrogen, I aim to probe the early universe and address fundamental questions about its phase transition from neutral to ionized and the broader cosmological evolution. I am also interested in the synergy between 21-cm observations and other cosmological probes such as the Cosmic Microwave Background (CMB) and Ly- α emitters.

Additionally, I explore the application of high-performance computing, machine learning, and artificial intelligence to address complex problems in radio astronomy, particularly those arising in 21-cm cosmology.

Career Overview / Experience

Assistant Professor (Aug 19, 2021 – Present)
Department of Physics, KN Government PG College,
Gyanpur, Bhadohi, Uttar Pradesh, India

Education

Ph.D. in Physics (Radio Astronomy and Astrophysics) (2016–2022)
Department of Physics, IIT (BHU), Varanasi

M.Sc. in Physics (2014–2016), CGPA: 8.15/10
Department of Physics, IIT Kharagpur

B.Sc. in PCM (2011–2014), 65%

Ewing Christian College, Allahabad (University of Allahabad)

Higher Secondary (Class XII, 2008–2010), 67.6%

Standard Inter College, Allahabad (U.P. Board)

Secondary (Class X, 2008), 68%

Arvind Ghosh HSS, Allahabad (U.P. Board)

Research Experience

Ph.D. Thesis: Calibration Requirements for EoR Observations – Effect of Time and Frequency Correlated Gains

Supervisor: Dr. Prasun Dutta

M.Sc. Thesis: Fast Radio Bursts - A Mysterious Transient Events

Supervisors: Prof. Somnath Bharadwaj & Dr. Nirupam Roy

Visiting Research Student: The Discipline of Astronomy, Astrophysics and Space Engineering (DAASE) IIT Indore (8-30 June 2019)

Teaching Experience

Undergraduate: Newtonian Mechanics, Mathematical Physics, Relativity, Statistical Mechanics

Postgraduate: Classical Mechanics, Atomic & Molecular Physics, Statistical Mechanics

Teaching Assistant (IIT BHU): Classical, Quantum and Relativistic Mechanics, Nuclear Physics Lab

Fellowships & National Level Exams

- JRF (UGC 2016) & SRF (UGC 2018)

- JAM (2014), CSIR-NET JRF (Dec 2014 & June 2015), GATE (2016)

Publications

1. Jais Kumar, Prasun Dutta, Nirupam Roy, “Calibration requirements for epoch of reionization 21-cm signal observations – I. Effect of time-correlated gains”, Monthly Notices of the Royal Astronomical Society, Volume 495, Issue 4, July 2020, Pages 3683–3694,

<https://doi.org/10.1093/mnras/staa1371>

2. J. Kumar, P. Dutta, S. Das and N. Roy, "Instrumental Calibration for Observations of Redshifted 21-cm Signal from Neutral Hydrogen," 2020 URSI Regional Conference on Radio Science (URSI-RCRS), Varanasi, India, 2020, pp. 1-3,

doi: <https://doi.org/10.23919/URSIRCRS49211.2020.9113590>

Electronic ISBN: 978-908-25987-8-0

Print on Demand(PoD) ISBN: 978-1-7281-5571-5

3. Pavan Kumar Vishwakarma, Jais Kumar, “Trans-Alfvenic Magnetohydrodynamic Turbulence in the Vicinity of Supernova Remnant Cassiopeia-A Shocks”, Monthly Notices of the Royal Astronomical Society, Volume 498, Issue 1, October 2020, Pages 1093-1100,
<https://doi.org/10.1093/mnras/staa2293>

4. Jais Kumar, Prasun Dutta, Samir Choudhuri, Nirupam Roy, “Calibration requirements for Epoch of Reionization 21- cm signal observations – II. Analytical estimation of the bias and variance with time-correlated residual gains”, Monthly Notices of the Royal Astronomical Society, Volume 512, Issue 1, May 2022, Pages 186–198
<https://doi.org/10.1093/mnras/stac499>

5. Shaw et al. 2022, “Probing early Universe through redshifted 21-cm signal: Modeling and observational challenges”, Review article, Journal of Astrophysics and Astronomy, July 2022,
<https://doi.org/10.1007/s12036-022-09889-6>

6. Saikat Gayen et al. 2024, “Calibration requirement for Epoch of Reionization 21-cm signal observation - III. Bias and variance in uGMRT ELAIS-N1 field power spectrum”, Journal of Cosmology and Astroparticle Physics, Volume 2024, Issue 05, id.068, 24 pp.
<https://doi.org/10.1088/1475-7516/2024/05/068>

7. Saikat Gayen, Jais Kumar et al. 2025 “Calibration requirements for Epoch of Reionization 21-cm signal observations - IV. Bias and variance with time and frequency correlated residual gains” **Accepted** for Publication in Journal of Cosmology and Astroparticle Physics **[Equal Author]**

Book Chapters

1. Dr. Jais Kumar, Dr. Pavan Kumar Vishwakarma, “Astrophysics Beyond the Horizon:Exploring the Future of the Universe”, IIPV3EBS07_G33 Futuristic Trends in Physical Sciences, Volume 3, 2023

Talks and Presentations in Workshops & Conferences

Presented and delivered talks/posters in over 10 national and international conferences/workshops including ASI, URSI-RCRS, NCRA, ISI Kolkata, KSO Kodaikanal, SAZERAC, and SKA science meetings etc.

Schools, Workshops & Conferences Attended

Participated in 20+ school/conference and workshops organized by/at ICTS, NCRA-TIFR, IUCAA, Presidency Univ., ISI Kolkata, SKA-India, and NARIT Thailand etc.

Technical Skills

OS: UNIX (Ubuntu, CentOS, macOS), Windows

Languages: C, Python, MATLAB

Document Tools: LaTeX, LibreOffice, MS Office

Graphics: GNUPlot, Matplotlib, MATLAB GUI, DS9

Referee/Recommendations

1. Dr. Prasun Dutta (Associate Professor)

Department of Physics, Indian Institute of Technology (BHU) Varanasi

Phone No : 9405167286

Email : pdutta.phy@itbhu.ac.in

2. Dr. Nirupam Roy (Associate Professor)

Department of Physics, Indian Institute of Science Bangalore

Phone No : 8022932056

Email : nroy@iisc.ac.in

3. Dr. Abhirup Datta (Professor)

Department of Astronomy, Astrophysics & Space Engineering (DAASE), IIT Indore

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