Jiten Dhandha

PhD student - University of Cambridge

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Research Interests

My research focus lies in the study of the early Universe, spanning the **Dark Ages, Cosmic Dawn, and the Epoch of Reionization** (redshift $z \sim 6 - 50$). I have expertise in analytic modelling (e.g. RECFAST++) and semi-numerical simulations (e.g. 21CMSPACE) of the cosmic 21-cm signal of neutral hydrogen, and on early stellar and galactic astrophysics (both Pop II and Pop III). I have extensively used machine learning and Bayesian inference techniques to accelerate simulations and perform parameter estimation using multi-wavelength datasets, including recent JWST observations and 21-cm interferometric data. I also have experience using AREPO for hydrodynamic simulations of molecular clouds and star-formation.

Education

2022 - *present*	**PhD in Astronomy**, Institute of Astronomy, University of Cambridge. Funded by Boustany Astronomy Scholarship & Isaac Newton Studentship at Pembroke College. Supervised by Prof. Anastasia Fialkov and Dr. Eloy de Lera Acedo.
2018 - 2022	**MPhys. Physics with Astrophysics** First Class, University of Manchester. Project involved simulating turbulent molecular clouds in ISM and studying filament and star formation. Performed with Zoe Faes and supervised by Dr. Rowan Smith.
2016 - 2018	**All India Senior School Certificate Examination**, DPS - Modern Indian School, Doha, Qatar. Average of 95.2% in AISSCE examination.

Employment

Jul. 2024 - Aug. 2024	**Summer volunteer internship**, Boustany Foundation, Monaco. Partnering with Open Cultural Center, a humanitarian NGO focused on providing teaching, advice and extracurricular activities to asylum-seekers and refugees in the Nea Kavala camp in Greece.
Jun. 2021 - Aug. 2021	**Summer research project**, University of Manchester. Modelling the cosmological 21-cm signal in `Recfast++` and `CosmoTherm` to study their synergy with CMB spectral distortions. Supervised by Prof. Jens Chluba.
Jun. 2020 - Sep. 2020	**Summer research project**, University of Manchester. Testing and debugging `LOFAR-VLBI` calibration/imaging pipeline for gravitational lenses. Supervised by Dr. Neal Jackson.
Jul. 2019 - Sep. 2019	**Summer intern programme**, British Petroleum / University of Manchester. Simulating mitigation techniques for sulphate reducing bacteria responsible for fouling crude oil. Supervised by Dr. Thomas Waigh.

Grants and awards

April 2024	**DiRAC Resource Allocation Committee 16th Call**, awarded 4.15M CPUh (worth £41,500) on DiRAC's COSMA-8 supercomputer.
July 2022	**Tessella Prize for Software** (£125), for outstanding work implementing software in Mphys project.
March 2022	**Boustany Scholarship for Astronomy**, for pursuing PhD at University of Cambridge.
April 2019	**BP Achievement Award** (£1000), for best essay on petrophysical logging tools.
December 2018	**Physics Success Scholarship** (£2000), for academic excellence in physics and maths.

Services

Conference and Workshop organization

July 2025	One day workshop: Radio cosmology and science with the 21-cm signal, member of Organising Committee and session chair, KICC, University of Cambridge.
February 2024	Kavli Science Focus: Science with the 21-cm line, member of Organising Committee and session chair, KICC, University of Cambridge.

Other committees

Feb. 2025 - Mar. 2025	**International Womens Day Committee** member, Institute of Astronomy, UoC.
May 2023 - *present*	**EDI Inclusion and Fairness** subgroup member, Institute of Astronomy, UoC.
Jul. 2023 - Jul. 2024	**Graduate Parlour**, Ethnic Minorities officer, Pembroke College, UoC.
Oct. 2022 - *present*	**Postgraduate Forum** representative, Institute of Astronomy, UoC.
Oct. 2022 - Apr. 2023	**Pembroke Papers** committee memeber, Pembroke College, UoC.

Teaching responsibilities

Oct. 2024 - Jul. 2025	**Co-Supervision: Jacques Valkenberg** (MPhil. student) with Prof. Anastasia Fialkov and Dr. Sandro Tacchella. Work on studying the impact of metal enrichment and Population II stellar IMF on the 21-cm signal of neutral hydrogen.
Oct. 2024 - Jul. 2025	**Co-Supervision: Kyle Wong** (Part III student) with Prof. Anastasia Fialkov. Work on studying the impact of varying cosmology and matter power spectrum on the 21-cm signal of neutral hydrogen.
Oct. 2023 - Jul. 2024	**Co-Supervision: Jamie Incley** (Part III student) with Prof. Anastasia Fialkov. Work on comparison of Epoch of Reionization in simulation codes `21cmSPACE` and `C2-Ray`.
Feb. 2023 - Mar. 2023	**Demonstration of Part IA Scientific Computing** for 22 hours, University of Cambridge.

Talks

Invited talks

September 2025	*An overview of 21-cm cosmology and how we can constrain the discovery space of the 21-cm signal*, 8th Global 21-cm Workshop, California Institute of Technology.

Conference and Workshop talks

June 2025	*Exploiting synergies between JWST and cosmic 21-cm observations to uncover star formation in the early Universe*, SKAO General Science Meeting 2025, Görlitz, Germany.
October 2024	*Constraining star-formation efficiency in the early Universe using JWST and the cosmic 21-cm signal*, Introduction to KICC, Kavli Institute for Cosmology, Cambridge.
September 2024	*Constraining star-formation efficiency in the early Universe using JWST and the cosmic 21-cm signal*, 7th Global 21-cm Workshop, Raman Research Institute.
May 2024	*Synergies between 21-cm experiments and JWST observations*, Reionization in Relic Radiation (R3), Institut d'Astrophysique Spatiale, Université Paris-Saclay.
February 2024	*Synergies between 21-cm experiments and JWST observations*, Science with the 21-cm line, KICC, University of Cambridge.
September 2023	*FIlamEntary STructure Analysis (fiesta)*, AREPO-ISM workshop, University of Manchester.
October 2022	*Can accreting primordial black holes explain the excess radio background?*, PDAT Laboratory, K. N. Toosi University of Technology (virtual webinar).

Meeting talks

September 2025	*What do we know about the 21-cm signal so far?*, group meeting presentation (Gravitational Wave Astrophysics Group headed by Prof. Michela Mapelli), Centre for Astronomy of Heidelberg University.

September 2023	*Bringing 21-cm simulations to the JWST era*, 2nd REACH Annual Meeting, University of Malta.

Outreach talks

October 2022	*Like beads on a string... Where do massive stars in our Universe come from? A brief look into studying our cosmos*, Pembroke Papers, Pembroke College, University of Cambridge.

Workshops attended

September 2025	IWR School on Machine Learning for Fundamental Physics, Faculty of Mathematics and Computer Science, Heidelberg University.

Software development

`eor_limits`	Author and maintainer of the new beta-release of the web-app: eorlimits.streamlit.app, which allows users to compare upper limits on the 21-cm power spectrum from different experiments.
`21cmSimulators`	Main author and maintainer: Community-led and comprehensive public repository of the widely used 21-cm signal simulation codes.
`21cmExperiments`	Main author and maintainer: Community-led and comprehensive public repository of past & ongoing 21-cm experiments.
`CFit`	Main author and maintainer: Smart curve fitting tool using method of least squares in Python.
`fiesta`	Main author and maintainer: Toolkit for analyzing filament networks and density field meshes.

In the media

August 2021	Most detailed-ever images of galaxies revealed using LOFAR. Press release for LOFAR observations from ASTRON.
August 2021	Astronomers develop novel way to 'see' first stars through fog of early Universe. Press release for LOFAR observations from BBC.

Extracurricular activities

Sep. 2021 - Jul. 2022	**Student Representative** representing astronomy/astrophysics, UoM.
Jul. 2020 - Jul. 2022	**Touch Rugby Society**, Inclusion officer and COVID-19 safety officer, UoM.
Sep. 2019 - Jun. 2020	**Peer-Assisted Study Session** leader, Peer Support Scheme,UoM.
Nov. 2016 - *present*	**English Wikipedia**, volunteer editor.

Publications

I have **3 first author** publications and **9 contributing author** publications.

First Author

September 2025	**J. Dhandha**, A. Fialkov, T. Gessey-Jones, H. T. J. Bevins, S. Tacchella, S. Pochinda, E. de Lera Acedo, S. Singh, R. Barkana *Exploiting synergies between JWST and cosmic 21-cm observations to uncover star formation in the early Universe*, Monthly Notices of the Royal Astronomical Society, 542, 2292-2322
August 2025	**J. Dhandha**, A. Fialkov, T. Gessey-Jones, H. T. J. Bevins, S. Tacchella, S. Pochinda, E. de Lera Acedo, S. Singh, R. Barkana *Narrowing the discovery space of the cosmological 21-cm signal using multi-wavelength constraints*, arXiv e-prints, arXiv:2508.13761
April 2024	**J. Dhandha**, Z. Faes, R. J. Smith *Decaying turbulence in molecular clouds: how does it affect filament networks and star formation?*, Monthly Notices of the Royal Astronomical Society, 529, 4699-4718

Contributing Author

August 2025	S. Munshi, F. G. Mertens, J. K. Chege, L. V. E. Koopmans, A. R. Offringa, B. Semelin, R. Barkana, **J. Dhandha**, A. Fialkov, R. Mériot, S. Sikder, A. Bracco, S. A. Brackenhoff, E. Ceccotti, R. Ghara, S. Ghosh, I. Hothi, M. Mevius, P. Ocvirk, A. K. Shaw, S. Yatawatta, P. Zarka *Improved upper limits on the 21-cm signal power spectrum at z = 17.0 and z = 20.3 from an optimal field observed with NenuFAR*, Monthly Notices of the Royal Astronomical Society,
August 2025	B. Liu, D. Kessler, T. Gessey-Jones, **J. Dhandha**, A. Fialkov, Y. Sibony, G. Meynet, V. Bromm, R. Barkana *Effects of chemically homogeneous evolution of the first stars on the 21-cm signal and reionization*, Monthly Notices of the Royal Astronomical Society, 541, 3113-3133
July 2025	J. Wasserman, E. Zackrisson, **J. Dhandha**, A. Fialkov, L. Noble, S. Majumdar *Ultraviolet photon production rates of the first stars: Impact on the He II λ1640Å emission line from primordial star clusters and the 21-cm signal from cosmic dawn*, arXiv e-prints, arXiv:2507.21764
March 2025	O. S. D. O'Hara, Q. Gueuning, E. de Lera Acedo, F. Dulwich, J. Cumner, D. Anstey, A. Brown, A. Fialkov, **J. Dhandha**, A. Faulkner, Y. Liu *Uncovering the effects of array mutual coupling in 21-cm experiments with the SKA-Low radio telescope*, Monthly Notices of the Royal Astronomical Society, 538, 31-48
February 2025	S. Pochinda, **J. Dhandha**, A. Fialkov, E. de Lera Acedo *Cosmological super-resolution of the 21-cm signal*, arXiv e-prints, arXiv:2502.00852
September 2024	O. S. D. O'Hara, F. Dulwich, E. de Lera Acedo, **J. Dhandha**, T. Gessey-Jones, D. Anstey, A. Fialkov *Understanding spectral artefacts in SKA-Low 21-cm cosmology experiments: the impact of cable reflections*, Monthly Notices of the Royal Astronomical Society, 533, 2876-2892
May 2024	A. Fialkov, T. Gessey-Jones, **J. Dhandha** *Cosmic mysteries and the hydrogen 21-cm line: bridging the gap with lunar observations*, Philosophical Transactions of the Royal Society of London Series A, 382, 20230068
December 2022	S. K. Acharya, **J. Dhandha**, J. Chluba *Can accreting primordial black holes explain the excess radio background?*, Monthly Notices of the Royal Astronomical Society, 517, 2454-2461
February 2022	S. Badole, D. Venkattu, N. Jackson, S. Wallace, **J. Dhandha**, P. Hartley, C. Riddell-Rovira, A. Townsend, L. K. Morabito, J. P. McKean *High-resolution imaging with the International LOFAR Telescope: Observations of the gravitational lenses MG 0751+2716 and CLASS B1600+434*, Astronomy & Astrophysics, 658, A7