

# Jiten Dhandha

PhD student - University of Cambridge

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## Research Interests

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My research focuses on the study of the early Universe, spanning the **Dark Ages, Cosmic Dawn, and the Epoch of Reionization** (redshift  $z \sim 6 - 50$ ). In particular, I am interested in analytic modelling and semi-numerical simulations of **early galactic astrophysics, and the 21-cm signal of neutral hydrogen**. I have also extensively used machine learning and Bayesian inference techniques to accelerate simulation codes and perform parameter estimation using multi-wavelength datasets.

## Education

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|-----------------------|---|
| 2022 - <i>present</i> | <b>PhD in Astronomy</b> , Institute of Astronomy, University of Cambridge. Funded by <a href="#">Boustany Astronomy Scholarship</a> & <a href="#">Isaac Newton Studentship</a> at Pembroke College. Supervised by Prof. Anastasia Fialkov and Dr. Eloy de Lera Acedo. |
| 2018 - 2022           | <b>MPhys. Physics with Astrophysics</b> 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           | <b>All India Senior School Certificate Examination</b> , DPS - Modern Indian School, Doha, Qatar. Average of 95.2% in AISSCE examination.   |

## Employment

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|-----------------------|--|
| Jul. 2024 - Aug. 2024 | <b>Summer volunteer internship</b> , 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 | <b>Summer research project</b> , University of Manchester. Modelling the cosmological 21-cm signal in <a href="#">Recfast++</a> and <a href="#">CosmoTherm</a> to study their synergy with CMB spectral distortions. Supervised by Prof. Jens Chluba.            |
| Jun. 2020 - Sep. 2020 | <b>Summer research project</b> , University of Manchester. Testing and debugging <a href="#">LOFAR-VLBI</a> calibration/imaging pipeline for gravitational lenses. Supervised by Dr. Neal Jackson.   |
| Jul. 2019 - Sep. 2019 | <b>Summer intern programme</b> , 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

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

## Services

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### Conference and Workshop organization

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|---------------|---|
| 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 | <a href="#">Kavli Science Focus: Science with the 21-cm line</a> , member of Organising Committee and session chair, KICC, University of Cambridge.   |

### Other committees

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

## Teaching responsibilities

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| Oct. 2024 - Jul. 2025 | <b>Co-Supervision: Jacques Valkenberg</b> (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 | <b>Co-Supervision: Kyle Wong</b> (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 | <b>Co-Supervision: Jamie Incley</b> (Part III student) with Prof. Anastasia Fialkov. Work on comparison of Epoch of Reionization in simulation codes <b>21cmSPACE</b> and <b>C2-Ray</b> .  |
| Feb. 2023 - Mar. 2023 | <b>Demonstration of Part IA Scientific Computing</b> for 22 hours, University of Cambridge.  |

## Talks

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### Invited talks

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|----------------|---|
| September 2025 | <i>An overview of 21-cm cosmology and how we can constrain the discovery space of the 21-cm signal</i> , 8th Global 21-cm Workshop, California Institute of Technology. |
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### Conference and Workshop talks

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

### Meeting talks

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

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June 2025 | [IWR School on Machine Learning for Fundamental Physics](#), Faculty of Mathematics and Computer Science, Heidelberg University.

## Software development

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

## In the media

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|-------------|---|
| August 2021 | <a href="#">Most detailed-ever images of galaxies revealed using LOFAR</a> . Press release for LOFAR observations from ASTRON.                    |
| August 2021 | <a href="#">Astronomers develop novel way to ‘see’ first stars through fog of early Universe</a> . Press release for LOFAR observations from BBC. |

## Extracurricular activities

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

## Publications

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

### First Author

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

## Contributing Author

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| August 2025    | S. Munshi, F. G. Mertens, J. K. Chege, L. V. E. Koopmans, A. R. Offringa, B. Semelin, R. Barkana, <b>J. Dhandha</b> , 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 <i>Improved upper limits on the 21-cm signal power spectrum at <math>z = 17.0</math> and <math>z = 20.3</math> from an optimal field observed with NenuFAR</i> , Monthly Notices of the Royal Astronomical Society, |
| August 2025    | B. Liu, D. Kessler, T. Gessey-Jones, <b>J. Dhandha</b> , A. Fialkov, Y. Sibony, G. Meynet, V. Bromm, R. Barkana <i>Effects of chemically homogeneous evolution of the first stars on the 21-cm signal and reionization</i> , Monthly Notices of the Royal Astronomical Society, 541, 3113-3133  |
| July 2025      | J. Wasserman, E. Zackrisson, <b>J. Dhandha</b> , A. Fialkov, L. Noble, S. Majumdar <i>Ultraviolet photon production rates of the first stars: Impact on the He II <math>\lambda 1640\text{\AA}</math> emission line from primordial star clusters and the 21-cm signal from cosmic dawn</i> , 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, <b>J. Dhandha</b> , A. Faulkner, Y. Liu <i>Uncovering the effects of array mutual coupling in 21-cm experiments with the SKA-Low radio telescope</i> , Monthly Notices of the Royal Astronomical Society, 538, 31-48  |
| February 2025  | S. Pochinda, <b>J. Dhandha</b> , A. Fialkov, E. de Lera Acedo <i>Cosmological super-resolution of the 21-cm signal</i> , arXiv e-prints, arXiv:2502.00852   |
| September 2024 | O. S. D. O'Hara, F. Dulwich, E. de Lera Acedo, <b>J. Dhandha</b> , T. Gessey-Jones, D. Anstey, A. Fialkov <i>Understanding spectral artefacts in SKA-Low 21-cm cosmology experiments: the impact of cable reflections</i> , Monthly Notices of the Royal Astronomical Society, 533, 2876-2892   |
| May 2024       | A. Fialkov, T. Gessey-Jones, <b>J. Dhandha</b> <i>Cosmic mysteries and the hydrogen 21-cm line: bridging the gap with lunar observations</i> , Philosophical Transactions of the Royal Society of London Series A, 382, 20230068  |
| December 2022  | S. K. Acharya, <b>J. Dhandha</b> , J. Chluba <i>Can accreting primordial black holes explain the excess radio background?</i> , Monthly Notices of the Royal Astronomical Society, 517, 2454-2461   |
| February 2022  | S. Badole, D. Venkattu, N. Jackson, S. Wallace, <b>J. Dhandha</b> , P. Hartley, C. Riddell-Rovira, A. Townsend, L. K. Morabito, J. P. McKean <i>High-resolution imaging with the International LOFAR Telescope: Observations of the gravitational lenses MG 0751+2716 and CLASS B1600+434</i> , Astronomy & Astrophysics, 658, A7   |