Jiten Dhandha

PhD student - University of Cambridge

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Research interests

My research focuses on the study of the early Universe, spanning the **Dark Ages**, **Cosmic Dawn**, and the **Epoch of Reionization** (redshift $z \sim 6-50$). My expertise lies in the theoretical modelling of the **cosmic 21-cm signal** of neutral hydrogen, and of **stellar and galactic astrophysics**; this includes numerical simulations of present-day ($z \sim 0$) Population I star-formation in molecular clouds, as well as analytic and semi-numerical simulations of high-redshift ($z \gtrsim 6$) Population II and Population III stars. I have extensively used **machine learning and Bayesian inference techniques** to accelerate simulations and perform parameter inference, combining data from multi-wavelength facilities (e.g. from JWST and 21-cm experiments).

Education

2022 - $present$	PhD in Astronomy, Institute of Astronomy, University of Cambridge. Funded by Boustany Astron-
	omy 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 calibra-
	tion/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 ($\sim £100,530$), for 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
May 2023 - present
Jul. 2023 - Jul. 2024
Oct. 2022 - present
Oct. 2022 - Apr. 2023

International Womens Day Committee member, Institute of Astronomy, UoC.

EDI Inclusion and Fairness subgroup member, Institute of Astronomy, UoC.
Graduate Parlour, Ethnic Minorities officer, Pembroke College, UoC.

Postgraduate Forum representative, Institute of Astronomy, UoC.
Pembroke Papers committee member, Pembroke College, UoC.

Teaching responsibilities

Oct. 2025 - present	Co-Supervision: Saughn Sekhon (Part III student) with Prof. Anastasia Fialkov and Dr. Peter
	Sims. Work on machine learning accelerated Bayesian inference of early Universe star-formation.
Oct. 2025 - present	Co-Supervision: Seowon Jung (Part III student) with Prof. Anastasia Fialkov and Prof. Alexan-
	der Belyaev. Work on probing the nature of dark matter with 21-cm cosmology.
Oct. 2024 - Jul. 2025	Co-Supervision: Jacques Valkenberg (MPhil. student) with Prof. Anastasia Fialkov and Prof.
	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 com-
	parison 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 Univer-
G	sity.

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.

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

omy & Astrophysics, 658, A7

First Author

October 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, Accepted in Monthly Notices of the Royal Astronomical Society

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

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 <i>Improved upper limits</i>
	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 <i>Ultraviolet photon</i>
	production rates of the first stars: Impact on the He II $\lambda 1640 \mathring{A}$ 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,
D 1 2000	382, 20230068
December 2022	S. K. Acharya, J. Dhandha, J. Chluba Can accreting primordial black holes explain the excess radio
F.1 2022	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, Astron-