

# Soumak Maitra

I am a postdoctoral researcher at DTP-TIFR, exploring large-scale structure and cosmic reionization, with a growing interest in machine learning techniques.



## Contact

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📍 DTP, TIFR, Homi Bhabha Road  
Mumbai 400005, India  
🆔 0000-0002-7684-4205  
🌐 NASA/ADS publication list

## Skills

Programming

Python

MPI

Latex

C/C++

Bash

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ML Framework

Pytorch

JAX

Tensorflow

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Operating Systems

Linux

Windows

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Simulations

GADGET-2

GADGET-3

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Observations

VLT/XSHOOTER

VLT/UVES

KECK/HIRES

HST-COS

SDSS

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Others

VPFit

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## Research Experience

📅 10/2024 - Present	📍 Tata Institute of Fundamental Research, Mumbai, India	Postdoctoral Researcher
📅 11/2021 - 8/2024	📍 INAF-Osservatorio Astronomico di Trieste, Italy	Postdoctoral Researcher
📅 08/2021 - 11/2021	📍 Inter-University Centre for Astronomy and Astrophysics, Pune, India	Enhanced Research Fellow
📅 08/2016 - 07/2021	📍 Inter-University Centre for Astronomy and Astrophysics, Pune, India Advisor: Prof. Raghunathan Srianand	Ph.D (Astrophysics)
Thesis title: <i>Probing the astrophysical and cosmological aspects of Intergalactic Medium using Quasar spectra</i>		

## Education

📅 07/2014 - 07/2016	📍 Indian Institute of Technology - Kanpur, Kanpur, India Specialization in Cosmology and General Relativity GPA Obtained - 9.3/10, First Class	Master of Science (Physics)
📅 06/2011 - 06/2014	📍 Jadavpur University, Kolkata, India Percentage Obtained - 78.25/100, First Class	Bachelor of Science (Physics)
📅 05/2011	📍 B. D. Memorial Institute, Kolkata, India Percentage Obtained - 94.0/100	C.B.S.E Senior School Certificate Exam
📅 05/2009	📍 B. D. Memorial Institute, Kolkata, India Percentage Obtained - 95.2/100	C.B.S.E Secondary School Exam

## Research Interests

- Large-scale structure formation and cosmic reionization
- Astrophysics of the Intergalactic Medium (IGM)
- Lyman- $\alpha$  forest and Lyman- $\alpha$  emitters as cosmological probes
- Quasar absorption lines and high-redshift spectroscopy
- Machine learning in astrophysical and cosmological analysis
- N-body and hydrodynamical simulations
- Observational cosmology with high-redshift tracers

## ACADEMIC ACHIEVEMENTS AND AWARDS

- 🏆 2018- Awarded UGC Senior Research Fellowship
- 🏆 2016- Awarded UGC Junior Research Fellowship for qualifying **National Eligibility Test**

## CONFERENCES/WORKSHOPS AND TALKS

- 📅 April 2025

📍 Kavli Institute for Cosmology, Cambridge, UK

"Beyond power spectrum: LAE bispectrum as a probe of reionization morphology"

Talk at *Sherwood collaboration meeting*.
- 📅 January, 2025

📍 IUCAA, Pune, India

"Parameter estimation from Lyman- $\alpha$  forest in Fourier space using Information Maximising Neural Networks"

Talk at *AI/ML Applications in Astronomy & Astrophysics workshop*.
- 📅 December, 2024

📍 IUCAA, Pune, India

"Neural Network approach in Lyman- $\alpha$  forest for astrophysical & cosmological parameter inference"

Talk at *Baryons Beyond Galactic Boundaries-2024 conference*.
- 📅 June, 2022

📍 Trieste, Italy

"Higher-order clustering study of Lyman- $\alpha$  forest"

Poster at "*HACK100: Past, Present and Future of Astrophysical Spectroscopy*" conference.
- 📅 March, 2022

📍 Kavli IPMU, Japan

"Clustering statistics of Lyman- $\alpha$  forest beyond 2-point "

Talk at *Cosmic Cartography 2022 conference*.
- 📅 January, 2021

📍 TIFR, Mumbai, India

"Higher-order clustering statistics in the Intergalactic Medium using Lyman- $\alpha$  forest"

Invited Talk.
- 📅 September, 2018

📍 Kavli IPMU, Japan

"Three point correlation of the IGM"

Talk at *IGM2018 Conference*.
- 📅 March, 2018

📍 NISER Bhubaneswar, India

"Spatial correlations of the IGM"

Talk at *Introductory school on Galaxy formation*.
- 📅 December, 2017

📍 IUCAA, Pune, India

"Spatial correlations of the IGM"

Talk at *Galaxies in Absorption-2017 international workshop*.
- 📅 February, 2018

📍 IUCAA, Pune, India

Attended *Franco-Indian Astronomy School on "From Re-ionization to large-scale structure: A multiwavelength approach"*.
- 📅 October, 2017

📍 IUCAA, Pune, India

Attended *International Workshop on Post-Planck Cosmology: Enigma, Challenges and Visions*.
- 📅 September, 2017

📍 IUCAA, Pune, India

Attended *Young Astronomers' Meet 2017*.
- 📅 August, 2017

📍 IUCAA, Pune, India

Attended *Meeting on Plasma Universe and its Structure Formation*.

## DATE OF BIRTH

10 November, 1993

## NATIONALITY

India

## GENDER

Male

## LANGUAGES

English  
Hindi  
Bengali

# PROFESSIONAL REFERENCES

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Available upon request

## PUBLICATIONS AND CONFERENCE PROCEEDINGS

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Efficient neutral-IGM inference from noisy 21-cm forest spectra with latent-space U-Net encoding and XGBoost



 Sameer K. Patil, Tomáš Šoltinský, **Soumak Maitra**, Girish Kulkarni

 2025  Submitted to MNRAS

 [arXiv](#)


DeepCHART: Mapping the 3D dark matter density field from Ly $\alpha$  forest surveys using deep learning



 **Soumak Maitra**, Matteo Viel, Girish Kulkarni

 2025  Submitted to MNRAS

 [arXiv](#)

The Lyman- $\alpha$  emitter bispectrum as a probe of reionization morphology

 **Soumak Maitra**, Girish Kulkarni, Shikhar Asthana, James S. Bolton, Martin G. Haehnelt, Laura Keating

 2025  Submitted to MNRAS

 [arXiv](#)

Parameter estimation from Ly $\alpha$  forest in Fourier space using Information Maximising Neural Network

 **Soumak Maitra**, Stefano Cristiani, Matteo Viel, Roberto Trotta, Guido Cupani

 2024  Astronomy&Astrophysics, Volume 690, October 2024

 [ADS](#), [arXiv](#)

Role of ionizing background and galactic feedback on the redshift space clustering of OVI absorbers in hydrodynamical simulations

 **Soumak Maitra**, Sukanya Mallik, Raghunathan Srianand

 2024  Monthly Notices of the Royal Astronomical Society, Volume 530, Issue 3, May 2024, Pages 3013–3019

 [ADS](#), [arXiv](#)


Higher order clustering of Ly $\alpha$  forest



 **Soumak Maitra**

 2023  MemSAIt, Vol.94 n.2

 [arXiv](#)

Spectroscopy of QUBRICS quasar candidates: 1672 new redshifts and a Golden Sample for the Sandage Test of the Redshift Drift



 Stefano Cristiani, Matteo Porru, Francesco Guarneri, Giorgio Calderone, Konstantina Boutsia, Andrea Grazian, Guido Cupani, Valentina D'Odorico, Fabio Fontanot, Carlos J. A. P. Martins, Catarina M. J. Marques, **Soumak Maitra**, Andrea Trost

 2023  Monthly Notices of the Royal Astronomical Society, Volume 522, Issue 2, pp.2019-2028

 [ADS](#), [arXiv](#)


Role of ionizing background on the statistics of metal absorbers in hydrodynamical simulations


 Sukanya Mallik, Raghunathan Srianand, **Soumak Maitra**, Prakash Gaikwad, Nishikanta Khandai

 2023  Monthly Notices of the Royal Astronomical Society, Volume 523, Issue 2, pp.2296-2316

 [ADS](#), [arXiv](#)


Redshift space three-point correlation function of IGM at  $z < 0.48$



 **S. Maitra**, R. Srianand, P. Gaikwad, N. Khandai

 2022  Monthly Notices of the Royal Astronomical Society, Volume 509, Issue 3, pp.4585-4607

 [ADS](#), [arXiv](#)

Measurement of redshift space two- and three-point correlation of Ly $\alpha$  absorbers at  $1.7 < z < 3.5$ : Implications on evolution of the physical properties of IGM

 **S. Maitra**, R. Srianand, P. Gaikwad

 2022  Monthly Notices of the Royal Astronomical Society, Volume 509, Issue 1, pp.1536-1556

 [ADS](#), [arXiv](#)

Three- and two-point spatial correlations of IGM at  $z \sim 2$ : cloud-based analysis using simulations



 **S. Maitra**, R. Srianand, P. Gaikwad, T. R. Choudhury, A. Paranjape, P. Petitjean

 2020  Monthly Notices of the Royal Astronomical Society, Volume 498, Issue 4, pp.6100-6119

 [ADS](#), [arXiv](#)

# Three- and two-point spatial correlations of intergalactic medium at $z \sim 2$ using projected quasar triplets

 **S. Maitra**, R. Srianand, P. Petitjean, H. Rahmani, P. Gaikwad, T. R. Choudhury, C. Pichon

 2019       Monthly Notices of the Royal Astronomical Society, Volume 490, Issue 3, p.3633-3653

 [ADS](#), [arXiv](#)