

# Sayan Saha

## Curriculum Vitae

Astronomy and Astrophysics,  
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### Personal Information

Nationality Indian  
Languages Bengali (native), English (fluent), Hindi (fluent)

### Education

Aug 2019 - **PhD**, Department of Physics, Indian Institute of Science Education and Research (IISER), Pune,  
Feb 2024 India, Thesis - **Novel Bayesian Inferences from the Cosmic Microwave Background**, Thesis  
[Expected] Supervisor - **Prof. Tarun Souradeep**  
2017–2019 **M.Sc. in Physics**, Department of Physics, IISER-Pune, India  
2014–2017 **B.Sc. in Physics**, Ramakrishna Mission Residential College, Narendrapur (Calcutta University),  
India

### Visiting Positions

April 2022 - **Visiting Researcher**, Astronomy and Astrophysics, Raman Research Institute, Bengaluru, India,  
Present Academic Host - **Prof. Tarun Souradeep**  
Sep 2022 - **Swiss Government Excellence Fellow**, Département de Physique Théorique, Université de  
Aug 2023 Genève, Switzerland, Academic Host - **Prof. Julien Carron**

### Awards & Scholarship

Sep 2022 - Recipient of **Swiss Government Excellence Scholarship (Research)**, ESKAS No. 2022.0316,  
Aug 2023 hosted by the University of Geneva. - [Award Letter](#)  
March 2023 Recipient of grant (2000 CHF) from **Société académique de Genève (SACAD)** to attend the  
**Future Science with CMB x LSS** workshop at YITP, Kyoto University. - [Award letter](#)  
March 2023 Recipient of **Infosys Foundation Travel Award** (50,000 INR) to attend the **Future Cosmology**  
workshop at IESC Cargèse, France. Designated as **Infosys Foundation Fellow** - [Award letter](#)  
August 2019 Recipient of Institute PhD fellowship from IISER-Pune, MHRD.  
2017 - 2019 Recipient of Institute M.Sc. fellowship from IISER-Pune, MHRD.  
2017 Certificate of merit as **State Topper** for being placed among the top 1% of 774 candidates in  
**National Graduate Physics Examination 2017** conducted by **Indian Association of Physics**  
**Teachers (IAPT)**.  
2014–2017 Recipient of DST-Inspire Scholarship for College & University students by MHRD, Govt. of India.

### Publications

2023 **Sayan Saha**, Louis Legrand, and Julien Carron, **Cluster profiles from beyond-the-QE CMB**  
**lensing mass maps**, [arXiv:2307.11711 \[astro-ph.CO\]](#), accepted for publication in JCAP,  
2021 **Sayan Saha**, Shabbir Shaikh, Suvodip Mukherjee, Tarun Souradeep, and Benjamin D. Wandelt,  
**Bayesian estimation of our local motion from the Planck-2018 CMB temperature map**,  
[arXiv:2106.07666 \[astro-ph.CO\]](#), JCAP 10 (2021) 072.

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## Research Experience

- PhD Proj. 1 Studied **weak gravitational lensing of the CMB by galaxy clusters** in small angular scales. Developing simulations of a CMB flat sky patch lensed by galaxy clusters. Have built a sophisticated **Maximum-a-Posteriori (MAP)** estimator to estimate cluster mass for CMB S4-like experiments. I am building upon the clusterlens part of python module [LensIt](#) by Julien Carron.
- PhD Proj. 2 Studied signatures of **statistical isotropy violation of the CMB due to the motion of our observation frame**. In a Bayesian approach, we have estimated the velocity of our local motion with a high significance using **Hamiltonian Monte-Carlo (HMC)** technique.
- M.Sc. Worked on data analysis of high-energy cosmic ray air-shower data using Machine Learning (ML) and Deep Learning (DL) techniques. Developed a Monte-Carlo pipeline to simulate air-showers for different primaries.

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## Experiments & Collaborations

- Cosmoglobe Implementing Hamiltonian Monte-Carlo (HMC) in Commander3 and part of the OpenHFI group
- CMB-Bharat Web Coordinator (for the proposed CMB telescope from India)
- CMB S4 Provisional member under the supervision of Prof. Julien Carron

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## Contributed talks & posters

- May-June 2023 Third EuCAPT Annual Symposium, CERN, Geneva, Switzerland. Talk - **Extracting Cluster Information from small-scale CMB**. [\[Link\]](#)
- April 2023 Future Cosmology, Institut d'Etudes Scientifiques de Cargèse (IESC), France. Talk - **Dark Matter Halos under the spotlight of CMB-Lensing**.
- April 2023 Future Science with CMB x LSS, Yukawa Institute for Theoretical Physics, Kyoto University, Kyoto, Japan. Talk & [Poster](#) - **Dark Matter Halos under the spotlight of CMB-Lensing**.
- January 2023 Cosmoglobe Winter Workshop, University of Oslo, Oslo, Norway. Talk - **Inferring our local motion from Small-scale CMB**.

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## Schools

- January 2022 **Physics of the Early Universe**, International Centre for Theoretical Sciences (ICTS), Bengaluru, India.
- August 2021 **School-cum-Workshop on Data Analysis in Cosmology and Astroparticle Physics**, Technology Innovation Hub (TIH), Indian Statistical Institute, Kolkata, India. - [Course Certificate](#)
- June 2021 **Summer School in Statistics for Astronomers**, Penn State University. - [Course Certificate](#)
- March, 2019 **Pune-Mumbai Collider Meet**, Indian Institute of Science Education and Research (IISER), Pune-411008, India

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## Computation Skills

- Languages Python, Fortran 90, Shell script
- Tools Git, LaTeX, HTML, HPC computing, MS Office
- Codes [LensIt](#), [plancklens](#), CAMB, HEALPix (healpy)
- Sampling MCMC Sampling (Metropolis-Hastings, HMC)
- ML/DL Libs scikit-learn, tensorflow

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## Relevant ML & DL Courses

- 1 **Neural Networks and Deep Learning**, DeepLearning.AI - [Course Certificate](#)
- 2 **Structuring Machine Learning Projects**, DeepLearning.AI - [Course Certificate](#)

### 3 Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization, DeepLearning.AI - [Course Certificate](#)

#### Teaching Experience

- Aug 2019 - Dec 2019 Teaching Assistant for the course “**Electricity & Magnetism, PHY201**” for 2nd year BS-MS students at IISER, Pune under Dr. Aparna Deshpande and Dr. Diptimoy Ghosh.
- Jan 2020 - April 2020 Teaching Assistant for the course “**Nuclear & Particle Physics, PHY422**” for 4th year BS-MS students at IISER, Pune under Prof. Sunil Mukhi.
- Sep 2020 - Jan 2021 Teaching Assistant for the course “**Group Theory in Physics PHY356**” for 4th year BS-MS students at IISER, Pune under Prof. Sudarshan Ananth.

#### Journal Clubs

- Unige Member of weekly **Cosmology Journal Club** at Département de Physique Théorique, Université de Genève.
- RRI Bengaluru Member of weekly Journal club, **Very Sirius Meeting (VSM)** at Astronomy and Astrophysics Department, Raman Research Institute.
- IISER Pune Organizer of **Astrophysics, Cosmology, and Particle Physics Journal Club** at IISER-Pune (September 2019 - March 2020).

#### Outreach

- NCSC Was invited as a judge for the [National Children's Science Congress](#) 2023 (Regional level) in Bengaluru.
- RRI Outreach Gave a talk as a part of the [outreach program](#) for school children organised by Raman Research Institute (RRI), Talk - **The Universe in your pocket** [[slides](#)].

#### Referees

- Supervisor Prof Tarun Souradeep, Raman Research Institute, Bengaluru, India, Email: [tarun@rri.res.in](mailto:tarun@rri.res.in)
- Collaborator Prof Julien Carron, University of Geneva, Switzerland, Email: [julien.carron@unige.ch](mailto:julien.carron@unige.ch)
- Collaborator Prof Benjamin D. Wandelt, Institut d'Astrophysique de Paris, France, Email: [bwandelt@iap.fr](mailto:bwandelt@iap.fr)