

Sayan Saha

Curriculum Vitae

Département de Physique Théorique,
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Personal Information

Date of Birth 9th August 1996
Nationality Indian

Present Position

Aug. 2019 - Present **PhD student**, Department of Physics, Indian Institute of Science Education and Research, Pune, India
Sep. 2022 - Aug. 2023 **Swiss Government Excellence Fellow**, Département de Physique Théorique, Université de Genève, Switzerland
April 2022 - Present **Visiting Research Fellow**, Astronomy and Astrophysics, Raman Research Institute, Bengaluru, India

Education

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

Awards & Scholarship

March 2023 Recipient of **Infosys Foundation Travel Award** (50,000 INR) to attend the **Future Cosmology** workshop at IESC Cargese, France. Designated as **Infosys Foundation Fellow** - [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](#)
Sep 2022 - Aug 2023 Recipient of **Swiss Government Excellence Scholarship (Research)**, ESKAS No. 2022.0316, hosted by the University of Geneva. - [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 S. Saha, L. Legrand, and J. Carron, **Cluster profiles from beyond-the-QE CMB lensing mass maps**, [arXiv:2307.11711 \[astro-ph.CO\]](#).
2021 S. Saha, S. Shaikh, S. Mukherjee, T. Souradeep, and B. 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.

Research Experience

- Current Studying 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. Building a sophisticated estimator to estimate cluster mass for CMB S4-like experiments. I am building upon the clusterlens part of python module [Lensit](#) by Julien Carron.
- Last project Studied signatures of statistical isotropy violation of the CMB due to the motion of our observation frame. Estimated the velocity of our local motion with a high significance using Bayesian parameter estimation and 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 and trained ML and DL models for particle classification.

Experiments & Collaborations

- CMB-S4 Working on the forecast of galaxy cluster mass detection and its significance
- Planck Studying the violation signatures of isotropy of foreground cleaned CMB maps
- Cosmoglobe Working on implementing Hamiltonian Monte-Carlo (HMC) in Commander3 and part of the OpenHFI group
- CMB-Bharat Still at proposal stage

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**.

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

Computation Skills

- OS Windows, Linux, macOS
- Languages Python, Fortran 90, Shell script
- Tools Git, LaTeX, HTML, MS Office
- Codes LensIt, plancklens, CAMB, HEALPix (healpy).
- Sampling MCMC Sampling (Metropolis-Hastings, HMC).
- ML/DL Libs scikit-learn, tensorflow.

Relevant Online 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).

Languages

- Bengali Mother tongue
- English Fluent
- Hindi Fluent

Referees

- PhD advisor Prof Tarun Souradeep, Director at Raman Research Institute, Bengaluru, India, Email: tarun@rri.es.in
- Collaborator Prof Julien Carron, Assistant Professor at the University of Geneva, Switzerland, Email: julien.carron@unige.ch