Sayan Saha

Curriculum Vitae

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 s-sayan

Personal Information

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

Current position

Oct 2024– Present	**Post-doctoral Research Associate**, *Northeastern University, Boston, MA 02115, USA*, working with Prof. Jacqueline Mccleary on a NASA Balloon-borne Imaging Telescope , SuperBIT

Education

Aug 2019 - Sep 2024	**PhD**, *Department of Physics, Indian Institute of Science Education and Research (IISER), Pune, India*, Thesis - **Novel Bayesian Inferences from the Cosmic Microwave Background**, Thesis 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 - Present	**Visiting Researcher**, *Astronomy and Astrophysics, Raman Research Institute, Bengaluru, India*, Academic Host - **Prof. Tarun Souradeep**
Sep 2022 - Aug 2023	**Swiss Government Excellence Fellow**, *Département de Physique Théorique, Université de Genève, Switzerland*, Academic Host - **Prof. Julien Carron**

Awards & Scholarship

Sep 2022 - Aug 2023	Recipient of **Swiss Government Excellence Scholarship (Research), ESKAS No. 2022.0316**, 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 Cargese, 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**, JCAP 01 (2024) 024, arXiv:2307.11711 [astro-ph.CO],
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**, JCAP 10 (2021) 072, arXiv:2106.07666 [astro-ph.CO].

Research Experience

Postdoc Proj.	Development of shape measurement and convergence reconstruction pipeline for SuperBIT, NASA's balloon-based telescope, to extract unbiased shear estimates from targeted cluster observations.
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.

Experiments & Collaborations

SuperBIT	Leading development of the shape-measurement pipeline
CMB S4	Member of Cluster-working group
Cosmoglobe	part of the OpenHFI group
CMB-Bharat	Web Coordinator (for the proposed CMB telescope from India)

Contributed talks & posters

July 2024	Relativistic effects and Novel Observables in Cosmology, University of Geneva, Switzerland, Talk - **Novel Bayesian Inferences from the Cosmic Microwave Background**,
November 2023	Neighbourhood Cosmology Meeting, Raman Research Institute (RRI), Bengaluru, India. Talk - **Exploring Cutting-Edge Statistical Methods for Parameter Inference in Present and Future CMB Surveys** [link],
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

Computational Skills

Programming Languages	Python, Fortran 90, Shell scripting

Open-Source Contributions	○ Lensit – Maximum-a-posterior (MAP) reconstruction tool of CMB-lensing potential ○ superbit-lensing – Shear measuremnet pipeline for the SuperBIT telescope ○ SMPy – A Python-based tool to reconstruct convergence maps from shear-measurements. ○ ShearNet – Neural network-based tool for galaxy shape measurement. ○ CosmoHMC – Hamiltonian Monte Carlo sampler for field level inference in Cosmology
Scientific Codes	plancklens, CAMB, HEALPix (healpy)
Sampling Methods	MCMC (Metropolis–Hastings, Hamiltonian Monte Carlo)
Machine Learning	JAX, PyTorch, scikit-learn, TensorFlow
Software & Tools	Git, LaTeX, HTML, HPC computing, Microsoft Office

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].
IISF 2024	Participated as a part the RRI representation team at the India International Science Festival (IISF) 2024, engaging with the general public to showcase RRI's work, received the "Best Conceptual Pavilion Award"

Referees

PhD Supervisor	Prof Tarun Souradeep, Raman Research Institute, Bengaluru, India, Email: tarun@rri.res.in
Postdoc advisor	Prof Jacqueline McCleary, Northeastern University, Boston, USA Email: j.mccleary@northeastern.edu

Collaborator   Prof Julien Carron, University of Geneva, Switzerland, Email: julien.carron@unige.ch

Collaborator   Prof Benjamin D. Wandelt, Institut d'Astrophysique de Paris, France, Email: bwandelt@iap.fr

Collaborator   Prof Suvodip Mukherjee, Assistant Professor at the Tata Institute of Fundamental Research, Mumbai, India Email: suvodip@tifr.res.in