AYAN MITRA

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RESEARCH SUMMARY

Cosmologist working at the intersection of statistics, machine learning and AI. Pipeline Scientist in the LSST Dark Energy Science Collaboration, CAPS Fellow at NCSA and active member of the LSST DESC AI Group. Collaborator to EUCLID consortium. I develop autonomous AI driven analysis pipelines, simulation-based inference (SBI) and statistical validation methods for Type Ia supernova cosmology with Rubin LSST and Euclid, with a focus on photometric SN analysis and reliable inference.

RESEARCH INTERESTS

• Observational Cosmology with Type Ia Supernova Cosmology
• Dark Energy modelling
• Photometric Classification & Photo-z Systematics
• Rubin Observatory LSST DESC Time Domain Pipeline development
• Cosmological Inference & Likelihood Modelling (Firecrown, SNANA etc.)
• Machine Learning & Interpretable AI

PROFESSIONAL APPOINTMENTS

CAPS Fellow, NCSA, University of Illinois Urbana-Champaign (Dec 2023–Present)
Pipeline Scientist, LSST Dark Energy Science Collaboration (Mar 2023–Present)
Rubin Postdoctoral Fellow, IUCAA, India (2021–Dec 2023) (Supervisor: Prof. **Surhud More**)
Postdoctoral Fellow, Energy Cosmos Laboratory, Nazarbayev University (2019–2020) (Supervisor: Prof. **Eric Linder**)
Visiting Scientist, Indian Statistical Institute (2016–2018)

SERVICE & LEADERSHIP

- LSST DESC Builder Status
- Internal Reviewer, LSST DESC
- Journal Referee: *Nature Communications, MNRAS, ApJ* etc.
- Panel Member, NOIRLab Time Allocation Committee (2026B)
- Conference Organisation:
    - LSST DESC Annual conference 2025 (LoC)
    - ESA 2026 Lausanne (SoC)

RESEARCH OVERVIEW & SELECTED PUBLICATIONS

Full list of publication available here

Selected publications:
Supernova Cosmology in the LSST Era
- Leading development of photometric SNe Ia cosmology analyses [2512.06319, 2210.07560]
- Investigating photo-z systematics and mitigation strategies [2011.08206, 1907.00985]
- Developing fully photometric cosmology pipelines [SNANA].
- Integration of Firecrown likelihood framework into LSST time-domain pipeline [Firecrown].
- Photometric Classifier, SCONE developer

Dark Energy Forecast with Future surveys
Joint forecast LSST SNIa + SO CMB + DESI2 BAO [2603.09973]
Alternate Gravity theory with Einstein Telescope [2010.00189]
Gravitational Waves with LIGO [2209.14542, 2310.15649, 2409.14508]

EDUCATION

Ph.D. in Supernova Cosmology, Université Pierre et Marie Curie (UPMC), Paris (2013–2016)
Thesis: Gravitational Lensing with Supernovae Ia in the SNLS
Supervisor: Mme **Delphine Hardin**
M.Sc. in Cosmology, University of Sussex (2011–2013)
Supervisor: Prof. **Andrew Liddle**
B.Sc. (Hons) in Physics, St. Xavier's College, University of Calcutta (2008–2011)

GRANTS & RECOGNITIONS

- PI, Anthropic AI4Science Program, awarded $50,000 credit (2026).
- PI, NSF ACCESS Explore allocation: 1,500 GPU hours on NCSA DeltaAI (2026).
- CAPS Fellowship (2023–)
- National top 1 percent, National Graduate Physics Examination, India (2011).
- Rubin Postdoctoral Fellowship (2021–2023)
- ACME-TNA (2025–2026)
- Lagrange Fellowship, CNRS France (2013–2016)
- Data Incubator Fellowship (€16,000), 2017
- Master's Studentship Grant, Queen's University Belfast (Declined)

TEACHING EXPERIENCE

• Solid State Physics – KBTU (2021–22)
• Introduction to General Relativity – ISI
• Introduction to Cosmology – ISI
• Quantum Mechanics – ISI
• Introduction to Electrodynamics – Nazarbayev University

MENTORING

Graduate Students (UIUC): Tanner Murphy, Amanda Wasserman, Aadya Agrawal: SN Cosmology
Ben Boyd (University of Cambridge) : DESC SN Pipeline
Rebecca Chen (Stanford University) : Photometric SN cosmology
Jonah Medoff (Harvard University) : DESC SN Pipeline
Undergraduate Students: Ray Ruixing Liang: Photometric redshift

INVITED TALKS & CONFERENCES

Rethinking Cosmology, December 2025, RRI, India Presentation
Sussex University, July 2025, UK Presentation
Cosmic Lighthouse, July 2025, University of Cambridge, Presentation
PPC, October 2024, India Presentation
Heidelberg University, June 2024, Presentation
Zurich University, July 2024, Switzerland, Presentation
LSST DESC Annual Meeting, July 2024, Zurich, Switzerland, Presentation
EAS, 2024, Padova, June 2024, Italy, Presentation
CAPS Seminar, University of Illinois, January 2023, USA, Presentation
Stony Brook University, January 2023, USA, Presentation
Michigan State University, January 2023, USA, Presentation
North Western University, January 2023, USA, Presentation
University of Rutgers, January 2023, USA, Presentation
Duke University, January 2023, USA, Presentation
AAS winter conference, 2023, Seattle, USA, Presentation
LSST DESC Annual Meeting, 2022, Online
BOOM 2022, USA, Online
COSMO'21 2021 Poster: Online

SKILLS

Programming: Python, R, Bash, Fortran, C-shell
Data Science: ML workflows (scikit-learn), Bayesian inference
Astronomy Tools: SNANA, SALT3, Firecrown
HPC: NERSC Perlmutter, SLURM systems

LANGUAGES

English (Native)
Bengali (Native)
French (B2)
Hindi (Working)
Russian (Advanced)