

Anirban ROY

www.anirbanroy.in

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PERSONAL DATA

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Department of Astronomy
Cornell University,
Ithaca, NY, USA 14853

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Skype: galpogujob
Citizenship: Indian
Date of Birth: March 17, 1993

PRESENT POSITION

OCT, 2023 - PRESENT

Postdoctoral fellow
The Center for Cosmology and Particle Physics
New York University, NY, USA
Mentor: Anthony Pullen

PROFESSIONAL EXPERIENCE

OCT, 2019 - SEP, 2023

Research Associate
Cornell Center for Astrophysics and Planetary Science
Cornell University, Ithaca, USA
Mentor: Nicholas Battaglia

EDUCATION

OCT, 2015 - SEP, 2019

PhD cum laude in Astrophysics
SISSA/ ISAS- International School for Advanced Studies, Trieste
Title: Probing patchy reionization via CMB, LSS, and their cross-correlations
Supervisors: Carlo Baccigalupi, Andrea Lapi, and David Spergel
Award date: 19/09/2019

SEP, 2013 - JUL, 2015

Master Degree in Physics (M.Sc.)
University of Burdwan, Burdwan, India
Master thesis: Secondary anisotropies in Cosmic Microwave Background
Supervisor: Sarbeswar Chaudhuri

AUG, 2010 - JUL, 2013

Bachelor Degree in Physics (B.Sc.)
Asutosh College, Kolkata, India

WORK EXPERIENCE

MAY, 2018 - AUG, 2018

Visiting Student
University of Cambridge, UK
Project Title: The study of reionization induced *B*-mode signal
Collaborators: Girish Kulkarni, Daan Meerburg, Anthony Challinor, and Martin Haehnelt

JAN, 2014 - MAY, 2015

Project Student
Presidency University, India
Project Title: Modelling Sunyaev Zeldovich effect in active galaxies
Supervisor: Suchetana Chatterjee

RESEARCH INTEREST

Cosmic Microwave Background (CMB): secondary anisotropies in CMB by lensing, reionization and Sunyaev-Zeldovich effect, imprints of non-Gaussianity in CMB, cross-correlation studies with multiple tracers.

Interface of Astrophysics and Cosmology: multi-line intensity mapping, redshifted 21-cm signal, star formation history in high redshift galaxies.

RESEARCH PAPERS

In preparation

15) "Line-line cross-correlation studies: a technique for interloper removal"
Anirban Roy and Nicholas Battaglia

14) "Estimators for the analysis of multi-line intensity mapping"
Anirban Roy, Kailai Wang, et al.

Published

13) LIMpy: A Semi-analytic Approach to Simulating Multi-line Intensity Maps at Millimetre Wavelengths
Anirban Roy, Dariannette Valentín-Martínez, Kailai Wang, Nicholas Battaglia, Alexander van Engelen, Accepted for publication in APJ,
[\[arXiv:2304.06748\]](https://arxiv.org/abs/2304.06748)

12) "Probing circumgalactic medium from the CMB polarization statistical anisotropy"
Anirban Roy, Vera Gluscevic, Alexander Van Engelen, and Nicholas Battaglia,
[\[arXiv:2201.05076\]](https://arxiv.org/abs/2201.05076), APJ (2023), 951, 1

11) "CCAT-prime Collaboration: Science Goals and Forecasts with Prime-Cam on the Fred Young Submillimeter Telescope"
Aravena et al. (including **Anirban Roy**),
[\[arXiv:2008.12619\]](https://arxiv.org/abs/2008.12619), APJ Supplement Series (2022), 264, 1

10) "Constraining reionization with the first measurement of the cross-correlation between the CMB optical-depth fluctuations and the Compton y -map"
Toshiya Namikawa, **Anirban Roy**, Blake Sherwin, Nicholas Battaglia, and David Spergel
[\[arXiv:2102.00975\]](https://arxiv.org/abs/2102.00975), PRD, (2021) 6, 104, 063514

9) "The correlation of high-redshift galaxies with the thermal Sunyaev-Zel'dovich effect traces reionization"
Eric J. Baxter, Lewis Weinberger, Martin Haehnelt, Vid Irsic, Girish Kulkarni, Shivam Pandey, **Anirban Roy**
[\[arXiv:2006.09742\]](https://arxiv.org/abs/2006.09742), MNRAS (2021), 501, 4, 6215

8) "Revised estimates of CMB B -mode polarization induced by patchy reionization"
Anirban Roy, Girish Kulkarni, P. Daniel Meerburg, Anthony Challinor, Carlo Baccigalupi, Andrea Lapi, Martin G. Haehnelt
[\[arXiv:2004.02927\]](https://arxiv.org/abs/2004.02927), JCAP (2021), 01, 003

7) "CMB-S4: Forecasting Constraints on Primordial Gravitational Waves"
Kevork Abazajian et al., including **Anirban Roy**
[\[arXiv:2008.12619\]](https://arxiv.org/abs/2008.12619), August, 2020, accepted for publication in APJ

6) "Detectability of the $\tau - 21\text{ cm}$ cross-correlation: a tomographic probe of patchy reionization"
Anirban Roy, Andrea Lapi, David Spergel, Carlo Baccigalupi
[\[arXiv:1904.02637\]](https://arxiv.org/abs/1904.02637), JCAP (2020), 3, 62

5) "Cosmology with low-redshift observations: No signal for new physics"
Koushik Dutta, **Anirban Roy**, Ruchika, Anjan A. Sen, M.M. Sheikh-Jabbari
[\[arXiv:1808.06623\]](https://arxiv.org/abs/1808.06623), PRD (2019), 100, 103501

4) "The Simons Observatory: Science goals and forecasts"
Peter Ade et al., (including **Anirban Roy**)
[\[arXiv:1808.07445\]](https://arxiv.org/abs/1808.07445), JCAP(2019), 56

3) "Beyond Λ CDM with Low and High Redshift Data: Implications for Dark Energy"

Koushik Dutta, **Anirban Roy**, Ruchika, Anjan A. Sen, M.M. Sheikh-Jabbari

[arXiv:1908.07267], GRG (2020), 52, 15

2) "CMB-S4 Science Case, Reference Design, and Project Plan",

Kevork Abazajian et al. (including **Anirban Roy**)

[arXiv:1907.04473] (2019)

1) "Observing Patchy Reionization With Future CMB Polarization Experiments",

Anirban Roy, Andrea Lapi, David Spergel, Carlo Baccigalupi

[arXiv:1801.02393], JCAP (2018), 5, 014

White paper/ Proceedings

3) "CMB-S4 Decadal Survey APC White Paper"

Kevork Abazajian et al.

[arXiv:1908.01062], Bull.Am.Astron.Soc. 51 (2019) no.7, 209

2) "The Simons Observatory: Astro2020 Decadal Project Whitepaper"

Simons Observatory Collaboration

[arXiv:1907.08284], Bull.Am.Astron.Soc. 51 (2019) 147

1) "Unique Probes of Reionization with the CMB: From the First Stars to Fundamental Physics"

Alvarez et al. (including **Anirban Roy**)

Bulletin of the American Astronomical Society, Vol. 51, Issue 3, 482 (2019)

AWARDS/ HONORS

JUL, 2022 - LIFE TIME Life Member, Indian Astronomical Society

NOV, 2015-OCT, 2019 PhD Fellowship in Astrophysics Division, SISSA, Italy

OCT, 2015-NOV, 2015 Postgraduate Fellowship in Astrophysics Division, SISSA, Italy

MARCH, 2015 1st Prize in Poster Presentation in West Bengal Science and Technology Congress , Burdwan, India

COLLABORATION

Fred Young Submillimeter Telescope (FYST): Intensity mapping and galaxy cluster working group

Simons Observatory: SZ and Cluster working group

CMB S4: Maps to other statistics working group

CMB Bharat (An India based space CMB mission): Reionization and lensing working group

COMPUTER SKILLS

PROGRAMMING LANGUAGES Python (advanced), C (working knowledge), MATLAB, Fortran (basic knowledge)

DEVELOPED PACKAGES **LIMpy** (line intensity mapping in python), and SECpy (code for CMB secondary observables)

SCIENTIFIC PACKAGES CLASS, Monte Python, CosmoMC, CAMB, HEALPY, emcee, Lenspix, Quicklens, LensIt, CMB4CAST, Cosmology, 21cmFAST, 21cmSense, Picola, and Pylians

SIMULATION Worked on **Sherwood simulation suite**, IllustrisTNG, and UniverseMachine

OS & OTHERS Windows, Linux, Mac, and LaTeX

STUDENTS SUPERVISED

Kailai Wang (Cornell University): "Development of analysis tools for line intensity mapping."

Ariel Marxena Baksh (Cornell University): "Noise simulations for line intensity mapping observations."

Dariannette Valentin (Arizona State University): "Modeling CII & OIII line emission during the epoch of reionization."

CONFERENCE/WORKSHOP/SCHOOL/ VISIT

JUNE 2023	CCAT collaboration meeting, Cornell University, USA	
APRIL 2023	Present and Future of Line-Intensity Mapping, Max Planck Institute for Astrophysics, Germany	
APRIL 2023	Academic visit to Heidelberg University and Stockholm University	
SEPTEMBER 2022	Academic visit, Cambridge University.	
APRIL 2022	CCAT-p collaboration meeting, (online).	
APRIL 2021	CCAT-p collaboration meeting, (online).	
JUNE 2020	Simons observatory collaboration meeting, (online).	rl
APRIL 2020	CCAT-p collaboration meeting, (online).	
JANUARY 2020	Academic visit, New York University, Abu Dhabi.	
JUNE 2019	"Quantum to Cosmos", Tubitak Tusside, Gebze, Turkey.	
MARCH 2019	Academic visit, NASA Jet Propulsion Laboratory, Pasadena, USA.	
JUNE 2018	CMB S4 Collaboration Meeting, Fermilab, Chicago, USA.	
AUGUST 2018	Academic visit and CMB S4 collaboration meeting, Princeton University, Princeton, USA.	
JUNE 2018	Simons Observatory Collaboration Meeting, University of Pennsylvania, Philadelphia, USA.	
MARCH 2018	Academic Visit, Center for Computational Astrophysics, New York, USA.	
OCTOBER 2017	Post Planck Cosmology-Enigma, Challenges and Visions, IUCAA, Pune, India.	
SEPTEMBER 2017	Astro-Trieste conference, SISSA, Trieste, Italy.	
JULY 2017	Probing the space-time fabric: from concepts to phenomenology, SISSA, Trieste, Italy.	
JANUARY 2017	III Saha Theory Workshop: Aspects of Early Universe Cosmology, SINP, Kolkata, India.	
DECEMBER 2016	Academic Visit, Tata Institute of Fundamental Research, Mumbai, India.	
JUNE 2016	Summer School in Cosmology, ICTP, Trieste, Italy.	
NOVEMBER 2014	"Observational Aspects of Astrophysics and Cosmology", Visva Bharati University, Shantiniketan, India.	
FEBRUARY 2013	Workshop on Solar Physics, Vivekananda University, Belur, India.	
DECEMBER 2012	Workshop on "Virtual Observatory In Astrophysics", University of Calcutta, Kolkata, India.	

TALKS

- INVITED "Simulating multi-line intensity maps",
Indian Statistical Institute (ISI) Kolkata, India, January 11, 2023
- CONTRIBUTED "Cosmology with cosmic microwave background and multi-line intensity mapping",
AlbaNova University Center, Stockholm University, Sweden, June 2, 2023
- INVITED "Probing reionization and CGM with tSZ and cross-correlations",
CCA, Flatiron Institute, USA, June 2, 2022
- INVITED "Electrons and baryons in the Universe: from first billion years to the present day",
remote presentation, IISER Kolkata, India, April 20, 2022
- CONTRIBUTED "Towards the optimal statistics for LIM estimators",
remote presentation, CCAT-prime collaboration meeting, April 5, 2022
- INVITED "Cosmology with the first light in the Universe: from first billion years to the present day",
Istanbul University (remote presentation), Turkey, February 28, 2022
- INVITED "Cross-correlation studies with future CMB experiments",
Tata Institute of Fundamental Research, India (remote presentation), May 21, 2021
- INVITED "Cross-correlation studies as a probe of reionization",
CMB-S4 workshop, University of Chicago, USA (remote presentation), August 11, 2021
- CONTRIBUTED "Late-time universe: surprises, tension, and prospects", rl
IISER Pune, India, January 7, 2020
- INVITED "Patchy Reionization and induced B -mode signal",
Conference Speaker, Tor Vergata, Rome, Italy, August 12, 2020
- CONTRIBUTED " B -mode signal from patchy reionization",
Conference Speaker, ICTS, Bangalore, India, January 24, 2019
- INVITED "Probing the new physics with future CMB experiments",
Seminar Speaker, Jamia Millia Islamia, New Delhi, India, December 20, 2018
- CONTRIBUTED "Do we need to worry about patchy reionization?",
Fire slide, Simons Observatory Collaboration meeting, Upenn, USA, June 18, 2018
- INVITED "Probing the reionization with Cosmic Microwave Background",
Seminar Speaker (Remote), IIT-Indore, Indore, India, May 14, 2018
- INVITED "Precision Cosmology with the baby picture of the Universe ",
Seminar speaker, Akdeniz University, Turkey, March 13, 2018
- INVITED "Precision Cosmology with the baby picture of the Universe ",
Seminar speaker, Istanbul University, Turkey, March 12, 2018

- INVITED "Cosmic Reionization: what can future CMB experiments tell us?",
Seminar speaker, SINP, Kolkata, India, October 10, 2017
- INVITED "Cosmic Reionization: what can future CMB experiments tell us?",
Seminar speaker, Challenges and Visions, IISER, Kolkata, India, October 13, 2017
- CONTRIBUTED "Observing Patchy Reionization with Future CMB Polarization Experiments",
Post Planck Cosmology-Enigma, Challenges and Visions, IUCAA, Pune, India, October 10, 2017
- CONTRIBUTED "Observing Patchy Reionization with CMB S4",
Astro-Trieste Conference, SISSA, Trieste, Italy, September 26, 2017
- CONTRIBUTED "Effects of inhomogeneous reionization on CMB anisotropy",
III Saha Theory Workshop: Aspects of Early Universe Cosmology,
Saha Institute of Nuclear Physics, Kolkata, India, January 16, 2017
- INVITED "Our Universe: Through The Eyes of A Cosmic Detective ",
"Challenges in Modern Cosmology", Seminar Speaker,
University of Dhaka, Dhaka, Bangladesh, January 7, 2016,

OUTREACH ACTIVITIES

I'm dedicated to promoting science among students and the public, especially in developing countries. I've shared my research at over ten schools and six colleges in India, Bangladesh, Nepal, and the USA. Since 2018, I've annually organized "Women in Science" events in Contai, my hometown, to inspire rural Indian female students to pursue science careers. Notably, I held interview sessions with Professors Cora Dvorkin, David Spergel, and Avi Loeb, garnering positive responses.

ARTICLES FOR PUBLIC

I am enthusiastic about composing articles on Astronomy and research for the general public. Additionally, I am a staunch advocate for promoting science in native languages, particularly in my mother tongue, Bengali. I contribute articles to online magazines in Bengali to further this cause.

- 2) "Bipulo Tarongo re", Anirban Roy, Bongodorshon, [\[link\]](#)
1) "Gobeshonar Galpokatha", Anirban Roy, Elebele magazine, [\[link\]](#)

LANGUAGES

Bengali (native), English (fluent), Hindi (speaking)

REFERENCES

- | | |
|--------------------|--|
| Nicholas Battaglia | <i>Assistant Professor, Astrophysics Division</i>
Cornell University, USA
E-mail: nb572@cornell.edu
Homepage: https://astro.cornell.edu/nicholas-battaglia |
| David Spergel | <i>Emeritus Professor, Princeton University, USA</i>
President, Simons Foundation
E-mail: dns@astro.princeton.edu
Homepage: http://www.astro.princeton.edu/~dns |
| Carlo Baccigalupi | <i>Full Professor, Department of Astronomy</i>
SISSA/ ISAS- International School for Advanced Studies, Italy
E-mail: bacci@sisssa.it
Homepage: http://www.people.sissa.it/~bacci |
| Andrea Lapi | <i>Full Professor, Department of Astronomy</i>
SISSA/ ISAS- International School for Advanced Studies, Italy
E-mail: lapi@sisssa.it
Homepage: https://lapi.jimdofree.com/ |
| Girish Kulkarni | <i>Assistant Professor, Department of Physics</i>
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