Supranta Sarma Boruah

CONTACT

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EMPLOYMENT

Center for Particle Cosmology, University of Pennsylvania

CfPC Fellow — *Jan 2024-present*

Steward Observatory, University of Arizona

Postdoctoral Research Associate — *Sep 2020-Dec 2023*

EDUCATION

University of Waterloo

Ph.D., Department of Applied Mathematics — *Sep 2016-Aug 2020*

Indian Institute of Technology (IIT) Kanpur — *Jul 11-May 16*

B.S-M.S dual degree, Department of Physics

PUBLICATIONS AND PREPRINTS

1. E. Saraivanov, K. Zhong, V. Miranda, **S. S. Boruah**, T. Eifler, E. Krause, *Attention-Based Neural Network Emulators for Multi-Probe Data Vectors Part II: Assessing Tension Metrics.* [arXiv:2403.12337]
2. **S. S. Boruah**, T. Eifler, V. Miranda, E. Farah, J. Motka, E. Krause, X. Fang, P. Rogozenski *Machine Learning LSST 3x2pt analyses - forecasting the impact of systematics on cosmological constraints using neural networks.* [arXiv:2403.11797].
3. **S. S. Boruah**, P. Fiedorowicz, E. Rozo, *Bayesian mass mapping with weak lensing data using KARMMA – validation with simulations and application to Dark Energy Survey Year 3 data.* [arXiv:2403.05484].
4. K. Zhong, E. Saraivanov, J. Caputi, V. Miranda, **S. S. Boruah**, T. Eifler, E. Krause, *Attention-based Neural Network Emulators for Multi-Probe Data Vectors Part I: Forecasting the Growth-Geometry split.* [arXiv:2402.17716]
5. **S. S. Boruah**, E. Rozo, *Map-based cosmology inference with weak lensing – information content and its dependence on the parameter space.* MNRAS Letter, L162, 527[arXiv:2307.00070]
6. P. Fiedorowicz, E. Rozo, **S. S. Boruah** *KaRMMa 2.0 – Kappa Reconstruction for Mass Mapping.* Submitted to MNRAS [arXiv:2210.12280]
7. **S. S. Boruah**, E. Rozo, P. Fiedorowicz, *Map-based cosmology inference with lognormal cosmic shear maps.* MNRAS, 516, 4111, [arXiv:2204.13216].
8. **S. S. Boruah**, T. Eifler, V. Miranda, S. Krisanth P.M, *Accelerating cosmological inference with Gaussian processes and neural networks – application to LSST Y1 weak lensing and galaxy clustering.* MNRAS, 518, 4818, [arXiv:2203.06124].

9. **S. S. Boruah**, G. Lavaux and M. Hudson, *Reconstructing dark matter distribution with peculiar velocities: Bayesian forward modelling with corrections for inhomogeneous Malmquist bias.* MNRAS, 517, 4529, [arXiv:2111.15535]
10. W. Rahman, R. Trotta, **S. S. Boruah**, M. Hudson and D. van Dyk, *New Constraints on Anisotropic Expansion from Supernovae Type Ia.* MNRAS, 514, 139, [arXiv:2108.12497]
11. P. Fiedorowicz, E. Rozo, **S. S. Boruah**, C. Chang and M. Gatti, *KarMMa - Kappa Reconstruction for Mass Mapping.* MNRAS, 512, 73, [arXiv:2105.14699]
12. B. Stahl, T. de Jaeger, **S. S. Boruah**, W. Zheng, A. Filippenko and M. Hudson, *Peculiar-velocity cosmology with Types Ia and II supernovae.* MNRAS, 505, 2349, [arXiv:2105.05185]
13. **S. S. Boruah**, M. Hudson and G. Lavaux, *Peculiar velocities in the local Universe: comparison of different models and the implications for H_0 and dark matter.* MNRAS, 507, 2697, [arXiv:2010.01119]
14. **S. S. Boruah**, M. Hudson and G. Lavaux, *Cosmic flows in the nearby Universe: new peculiar velocities from SNe and cosmological constraints.* MNRAS, 498, 2703, [arXiv:1912.09383]
15. T. Charnock, G. Lavaux, B. Wandelt, **S. S. Boruah**, J. Jasche and M. Hudson, *Neural physical engines for inferring the halo mass distribution function.* MNRAS, 494, 50, [arXiv:1909.06379]
16. T. Yang, **S. S. Boruah**, and N. Afshordi, *Gravitational Potential from small-scale clustering in action space: Application to Gaia DR2.* MNRAS, 493, 3061, [arXiv:1908.02336]
17. **S. S. Boruah**, H. J. Kim, M. Rouben and G. Geshnizjani. *Cuscuton Bounce.* JCAP 08, 031 (2018), [arXiv:1802.06818]
18. **S. S. Boruah**, H. J. Kim and G. Geshnizjani, *Theory of Cosmological Perturbations with Cuscuton.* JCAP 07, 022 (2017), [arXiv:1704.01131]

Talks

1. Invited talk, DES Simulation working group telecon, *July 2023*
2. Invited talk, Largest cosmological surveys and big data science, TIFR-ICTS, Bangalore *May 2023*
3. Invited seminar, TIFR, Mumbai *April 2023*
4. Invited seminar, IUCAA, Pune *April 2023*
5. Invited talk, KIPAC Tea talk *October 2022*
6. Contributed talk, Cosmology from home, 2022 *June 2022*
7. Presentation, DESC Bayesian pipeline telecon *May 2022*
8. Presentation, UMichigan cosmology group *May 2022*
9. Presentation, Arizona Cosmology Day *April 2022*
10. Presentation, Cosmology with WL: beyond 2-point Statistics *April 2022*
11. Colloquium, Physics Department, University of Arizona *March 2022*
12. Presentation, LSST-DESC MCP telecon *March 2022*
13. Presentation, LSST-DESC WL mass mapping telecon *August 2021*
14. Contributed talk, COSMO21 *August 2021*
15. Contributed talk, Cosmology from home, 2021 [video] *July 2021*

16. Invited seminar, TIFR, Mumbai *November 2020*
17. Invited seminar, IAP, Paris *Apr 2020*
18. Invited seminar, Duke University *Feb 2020*
19. Invited seminar, MPA, Garching *Jan 2020*
20. Contributed talk, Theory Canada 12, York University, Toronto *May 2017*
21. Graduate student colloquium, Department of Applied Mathematics, University of Waterloo *Jul 2017*

Service

Co-organizer of weekly cosmology journal club, TACOS at University of Arizona

Co-organizer of Bayesian forward modeling seminar series, LSST-DESC

Referee for MNRAS, Astrophysical Journal, The Open Journal for Astrophysics

Collaboration

Member of the LSST-DESC and the Aquila consortium

Mentoring

1. Namit Chandok, undergraduate student at University of Arizona,
   Project: *Improving lognormal model for better field-based weak lensing analysis*
2. Jonah Lotz, undergraduate student at University of Arizona,
   Project: *Mitigating photo-z outliers in Stage-IV survey 3×2 pt analysis*
3. Elyas Farah, undergraduate student at University of Arizona/Lebanese American University,
   Project: *Impact of baryons on LSST 3×2 pt analysis*
4. Charles Prior, graduate student at Duke University,
   Project: *Impact of Supernovae systematics on peculiar velocity estimates*
5. William Gregory Dallaway, undergraduate student at University of Waterloo
   Project: *Cross-correlation of standard sirens and galaxy surveys to measure* H_0
6. Michelle Xu, summer undergraduate student at Perimeter Institute
   Project: *Iso-curvature modes in reheating*

Workshops / Summer schools Attended

Quarks to cosmos with AI, CMU	*July 2021*
Cosmology summer school, University of Michigan	*June 2020*
Analytics, Inference & Computation in Cosmology, Paris	*Fall 2018*
Analytics, inference & computation in Cosmology school, Corsica	*Sep 2018*
Summer Institute in Philosophy of Cosmology, London	*Jun 2018*
Large-Scale Astrophysics: galaxies and beyond, Montreal	*Jun 2018*
TRISEP school, PITP, Waterloo	*Jul 2018*
Testing Gravity 2017, Simon Fraser University, Vancouver	*Jan 2017*
Theory Canada 12, York University, Toronto	*May 2017*
Bounce Scenarios in Cosmology, PITP, Waterloo	*Jun 2017*

Awards and Achievements

MITACS Globalink Research Award 2018

Research travel assistantship worth CAD 6000 awarded to conduct research under the guidance of Dr. Guilhem Lavaux at Institut d'Astrophysique de Paris for 12 weeks

KVPY Fellowship 2011

Olympiads 2009-2011

Was among the 300 students selected for the Indian National Physics Olympiad (INPhO), 2011.
Represented the state of Assam in the Indian National Mathematics Olympiad (INMO) in the years 2009-2011

Computational Skills

Computer Languages: Python, Julia, C++

Packages and Softwares: MATHEMATICA, JAX, TensorFlow

Teaching

Co-led a hands-on project to reproduce DES-Y3 cosmic shear analysis at *Largest cosmological surveys and big data*, TIFR-ICTS *M*ay 2023

Guest lecturer for ASTR502, a course on Data mining and Machine learning at University of Arizona *J*anuary 2022

Lecture series on Markov Chain Monte Carlo (MCMC) methods at University of Waterloo *M*ay 2020

Teaching Assistant at University of Waterloo for various mathematics and physics courses (a total of 12 terms)