

# Arka Banerjee

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## CONTACT INFORMATION

Department of Physics  
Indian Institute of Science Education and Research  
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Maharashtra 411008, India

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## RESEARCH POSITIONS

**Indian Institute of Science Education and Research (IISER)**, Pune, Maharashtra India  
**Assistant Professor of Physics**, March 2022 —.

**Fermilab**, Batavia, Illinois USA

**Schramm Fellow in Theoretical Astrophysics**, Dec 2020 - Feb 2022.

**Kavli Institute for Particle Astrophysics and Cosmology**, Stanford University, Stanford,  
California USA

**KIPAC Postdoctoral Fellow**, Sep 2017 - Dec 2020.

## EDUCATION

**University of Illinois, Urbana-Champaign**, Urbana, Illinois USA

Ph.D., August 2017

- Dissertation Topic: “Cosmological Signatures of Fundamental Physics”
- Advisor: Neal Dalal

**Tata Institute of Fundamental Research**, Mumbai, India

M.Sc., Physics, 2011

- Dissertation Topic: “Onset of nonlinear neutrino oscillations in core collapse supernovae”
- Advisor: Amol Dighe

**St. Stephen’s College**, Delhi, India

B.Sc., Physics, 2008

## HONORS AND AWARDS

UIUC University Fellowship, Fall 2016.

UIUC University Fellowship, Spring 2013.

Outstanding Teaching Award, UIUC

- Spring 2016
- Fall 2012
- Spring 2012

Kamla Bajaj Award for Best Student in Physics Honours, St. Stephen’s College, 2008.

## MENTORING EXPERIENCE

PhD students:

- **Eishica Chand**, 2022 —.
- **Vikhyat Sharma**, 2022 —.

Graduate student supervision for research projects:

- **Adrian Bayer**, UC Berkeley. *A fast particle-mesh simulation of non-linear cosmological structure formation with massive neutrinos*, [JCAP 01 \(2021\) 016](#).
- **Ethan Nadler**, Stanford University. *Signatures of Velocity-Dependent Dark Matter Self-Interactions in Milky Way-mass Halos*,

[Astrophys.J. 896 \(2020\) 112.](#)

- **Andrew Eberhardt**, Stanford University. *Investigating the use of field solvers for simulating classical systems*, [Phys.Rev.D 101 \(2020\) 4, 043011.](#)
- **Yunchong Wang**, Stanford University, *Detection of spatial clustering in the 1000 richest SDSS DR8 redMaPPer clusters with Nearest Neighbor distributions*, [arXiv:2112.04502](#) .
- **Sean McLaughlin**, Stanford University.

Undergraduate research:

- **Jacob Stanton**, Brown University.
- **Kaustubh Gupta**, IISER Pune.
- **Kwanit Gangopadhyay**, IISER Pune.

CONFERENCES AND MEETINGS ORGANIZED *Workshop on applications of nearest neighbor distributions in cosmology and astrophysics*, Stanford University, Jan 2021.

KIPAC Postdoctoral Lunch Talks, 2018-2020.

KIPAC Hack Day, May 2019.

Local Group Meeting (Stanford, UC Berkeley, UC Davis) on Local Group Science, November 2019.

PUBLICATIONS **Banerjee**, and Abel, *Tracer-Field Cross-Correlations with  $k$ -Nearest Neighbor Distributions*, [arXiv:2210.05140](#).

Storey-Fisher, *et al.*, *The Aemulus Project VI: Emulation of beyond-standard galaxy clustering statistics to improve cosmological constraints*, [arXiv:2210.03203](#).

Nadler, *et al.*, *Symphony: Cosmological Zoom-in Simulation Suites over Four Decades of Host Halo Mass*, [arXiv:2209.02675](#).

Adhikari, **Banerjee**, *et al.*, *Astrophysical Tests of Dark Matter Self-Interactions*, [arXiv:2207.10638](#).

Glennon, *et al.*, *Tidal disruption of solitons in self-interacting ultralight axion dark matter*, [Phys.Rev.D 105 \(2022\) 12, 123540](#).

Zhai, Tinker, **Banerjee** *et al.*, *The Aemulus Project V: Cosmological constraint from small-scale clustering of BOSS galaxies*, [arXiv:2203.08999](#).

**Banerjee**, Das, Maharana, and Sharma, *Signatures of Light Massive Relics on nonlinear structure formation*, [MNRAS 516 \(2022\) 2, 2038-2049](#).

Wang, **Banerjee**, Abel, *Detection of spatial clustering in the 1000 richest SDSS DR8 redMaPPer clusters with Nearest Neighbor distributions*, [MNRAS 514 \(2022\) 3, 3828-3843](#)

Nadler, **Banerjee**, Adhikari, Mao, Wechsler, *The Effects of Dark Matter and Baryonic Physics on the Milky Way Subhalo Population in the Presence of the Large Magellanic Cloud*, [ApJL 920 L11](#).

Bayer, **Banerjee**, Seljak, *Beware of Fake  $\nu$ s: The Effect of Massive Neutrinos on the Non-Linear Evolution of Cosmic Structure*, [Phys.Rev.D 105 \(2022\) 12, 123510](#)

**Banerjee**, Kokron, and Abel, *Modeling Nearest Neighbor distributions of biased tracers using Hybrid Effective Field Theory*, [MNRAS, Volume 511, Issue 2, April 2022](#).

Aviles, **Banerjee**, Niz, and Slepian, *Clustering in Massive Neutrino Cosmologies via Eulerian Perturbation Theory*, [JCAP11\(2021\)028](#).

Bhattacharya, Adhikari, **Banerjee et al.**, *The Signatures of Self-Interacting Dark Matter and Subhalo Disruption on Cluster Substructure*, [Astrophys.J. 932 \(2022\) 1, 30](#).

**Banerjee**, and Abel, *Cosmological cross-correlations and nearest neighbor distributions*, [MNRAS, Volume 504, Issue 2, June 2021](#).

Bayer, **Banerjee**, and Feng, *A fast particle-mesh simulation of non-linear cosmological structure formation with massive neutrinos*, [JCAP 01 \(2021\) 016](#).

**Banerjee**, and Abel, *Nearest Neighbor distributions: new statistical measures for cosmological clustering*, [MNRAS, Volume 500, Issue 4, Feb. 2021](#).

Aviles, **Banerjee**, *A Lagrangian Perturbation Theory in the presence of massive neutrinos*, [JCAP 10 \(2020\) 034](#).

Fang, **Banerjee**, Charles, Omori, *A Cross-Correlation Study of High-energy Neutrinos and Tracers of Large-Scale Structure*, [Astrophys.J. 894 \(2020\) 02](#).

Nadler, **Banerjee**, Adhikari, Mao, Wechsler, *Signatures of Velocity-Dependent Dark Matter Self-Interactions in Milky Way-mass Halos*, [Astrophys.J. 896 \(2020\) 112](#).

Eberhardt, **Banerjee**, Kopp, Abel, *Investigating the use of field solvers for simulating classical systems*, [Phys.Rev.D 101 \(2020\) 4, 043011](#).

Uhlemann, Friedrich, Villaescusa-Navarro, **Banerjee**, Codis, *Fisher for complements: Extracting cosmology and neutrino mass from the counts-in-cells PDF*, [MNRAS, Volume 495, Issue 4, July 2020](#).

Villaescusa-Navarro, Hahn, Massara, **Banerjee et al.**, *The Quijote simulations*, [Astrophys.J.Suppl. 250 \(2020\) 1, 2](#).

McClintock, Rozo, **Banerjee et al.**, *The Aemulus Project IV: Emulating Halo Bias*, [arXiv:1907.13167](#).

**Banerjee et al.**, *Weighing neutrinos with the halo environment*, [JCAP 06 \(2020\) 032](#).

**Banerjee et al.**, *Signatures of Self-Interacting dark matter on cluster density profile and subhalo distributions*, [JCAP 02 \(2020\) 024](#).

Chuang *et al.*, *UNIT project: Universe N-body simulations for the Investigation of Theoretical models from galaxy surveys*, [MNRAS, Volume 487, Issue 1, July 2019](#).

**Banerjee**, Powell, Abel, and Villaescusa-Navarro, *Reducing Noise in Cosmological N-body Simulations with Neutrinos*, [JCAP 1809, no. 09, 028 \(2018\)](#).

Secco, Farah, Jain, Adhikari, **Banerjee**, and Dalal, *Probing Self-interacting Dark Matter with Disk*

*Galaxies in Cluster Environments*, [Astrophys.J. 860 \(2018\) no.1, 32.](#)

Villaescusa-Navarro, **Banerjee**, Dalal, Castorina, Scoccimaro, Angulo, and Spergel, *The imprint of neutrinos on clustering in redshift-space*, [Astrophys.J. 861 \(2018\) no.1, 53.](#)

**Banerjee**, Jain, Dalal, and Shelton, *Tests of Neutrino and Dark Radiation Models from Galaxy and CMB surveys*, [JCAP 1801 \(2018\) 01, 022.](#)

**Banerjee**, and Dalal, *Simulating nonlinear cosmological structure formation with massive neutrinos*, [JCAP \(2016\) 11 015.](#)

**Banerjee**, Dighe, and Raffelt, *Linearized flavor-stability analysis of dense neutrino streams*, [Phys.Rev. D84 \(2011\) 053013.](#)

Home, Pan, and **Banerjee**, *Larmor precession reexamined: Testable correction and its ramifications*, [Eur. Phys. J. D, 67, 72\(2013\).](#)

Home, Pan, and **Banerjee**, *Quantitative probing of quantum-classical transition for the arrival time distribution*, [J. Phys. A: Math. Theor. 42, 165302 \(2009\).](#)

OTHER  
CONTRIBUTIONS

Drlica-Wagner *et al.*, *Report of the Topical Group on Cosmic Probes of Dark Matter for Snowmass 2021*, [arXiv:2209.08215.](#)

**Banerjee et al.**, *Snowmass2021 Cosmic Frontier White Paper: Cosmological Simulations for Dark Matter Physics*, [arXiv:2203.07049.](#)

Bechtol *et al.*, *Snowmass2021 Cosmic Frontier White Paper: Dark Matter Physics from Halo Measurements*, [arXiv:2203.07354.](#)

Alvarez *et al.*, *Snowmass2021 Computational Frontier White Paper: Cosmological Simulations and Modeling*, [arXiv:2203.07347.](#)

Drlica-Wagner *et al.*, *Probing the Fundamental Nature of Dark Matter with the Large Synoptic Survey Telescope*, [arXiv:1902.01055.](#)

Bechtol *et al.*, *Dark Matter Science in the Era of LSST*, [arXiv:1903.04425.](#)

Rhodes *et al.*, *The End of Galaxy Surveys*,  
[HTTP://ADSABS.HARVARD.EDU/ABS/2019BAAS...51C.114R](http://ADSABS.HARVARD.EDU/ABS/2019BAAS...51C.114R)

TALKS AND  
PRESENTATIONS

*Cosmology with nonlinear structure formation: Simulations and Statistics*, Presidency University School of Astrophysics Colloquium, December 2022.

*Cosmology with nonlinear structure formation: Simulations and Statistics*, HRI Physics Colloquium, September 2022.

*Cosmology with nonlinear structure formation: Simulations and Statistics*, IISER Pune Physics Colloquium, August 2022.

*Nearest Neighbor distributions: a new approach to cosmological clustering*, Vipolze Berkeley Workshop, July 2022.

*Cosmology with nonlinear structure formation: Simulations and Statistics*, IUCAA Colloquium, May 2022.

*Nearest Neighbor distributions: a new approach to cosmological clustering*, Yale Astronomy Collo-

quium, September 2021.

*Cosmological clustering and Nearest Neighbor Distributions*, University of Waterloo Astro Seminar Series, May 2021.

*k-Nearest Neighbor distributions: new statistical measures for cosmological clustering*, Survey Science Meeting, UChicago, January 2021.

*Modeling structure formation in the era of precision cosmology*, IIMSc Chennai, November 2020.

*Modeling structure formation in the era of precision cosmology*, IISER Pune, October 2020.

*k-Nearest Neighbor distributions: new statistical measures for cosmological clustering*, KIPAC tea talk, Stanford University, August 2021.

*Weighing neutrinos with the Large Scale Structure of the Universe*, ICTS, Bangalore, March 2020.

*Weighing neutrinos with the Large Scale Structure of the Universe*, IISER, Bangalore, March 2020.

*Signatures of Dark Matter Self-Interactions in the Milky Way*, Local Group Meeting, Stanford, November, 2019.

*Signatures of Self-Interacting dark matter on cluster density profile and subhalo distributions*, Cosmic Controversies Conference, Chicago, October 2019.

*Signatures of Self-Interacting dark matter on cluster density profile and subhalo distributions*, LSST Dark Matter Workshop, U. Chicago, August 2019.

*Signatures of Self-Interacting dark matter on cluster density profile and subhalo distributions*, New York University, June 2019.

*Massive neutrinos and environmental scale dependence*, Cosmology Seminar, ICTS Bangalore, January 2019.

*Imprints of massive neutrinos on Large Scale Structure*, IMSC Chennai, January 2019.

*Cosmology with massive neutrinos*, INPA Seminar, Lawrence Berkeley Laboratory, October 2018.

*Massive Neutrinos and the Environmental Scale Dependence of Halo Bias*, Nonlinear Universe Conference, Smartno, July 2018.

*Reducing Noise in Cosmological N-body simulations with neutrinos*, KIPAC Tea, SLAC, January 2018.

*Reducing Noise in Cosmological N-body simulations with neutrinos*, Cosmology Lunch, Princeton University, December 2017.

*Imprints of massive neutrinos on Large Scale Structure*, Cosmology Seminar, UC Davis, October 2017.

*Cosmological effects of massive neutrinos*, IIT Bombay, August 2017.

*Void biasing in the presence of massive neutrinos*, LBL, April 2017.

*Simulating nonlinear structure formation with massive neutrinos*, KIPAC, Stanford University, March 2017.

*Cosmological structure formation with massive neutrinos*, IPMU, Tokyo, February 2017.

*Simulating nonlinear structure formation with massive neutrinos*, CCAPP, Ohio State University, January 2017.

*Large scale biasing of voids in the presence of massive neutrinos*, University of Pennsylvania, August 2016.

*Simulating cosmologies with “fast” particles*, Santa Fe Cosmology Workshop, July 2014.

TEACHING  
EXPERIENCE

**Instructor**

Electricity and Magnetism, PH1213, April 2022, April 2023.  
Mechanics, PH1113, Nov 2022.

**Senior Teaching Assistant**

Quantum Mechanics and Statistical Physics, UIUC

- Fall 2016

**Teaching Assistant**

Quantum Mechanics and Statistical Physics, UIUC

- Spring 2016
- Spring 2012
- Fall 2011

Special Relativity and Math Applications, UIUC

- Fall 2012

Graduate course in Electromagnetism, TIFR

- Fall 2010

PROFESSIONAL  
SERVICE

Referee for JCAP, PRD, ApJ, ApJ Letters, MNRAS.

COMPUTING SKILLS  
AND EXPERIENCE

Programming Languages: C, C++, Python, Mathematica, LaTeX.

Extensive experience in cluster computing and parallel computing.

REFERENCES

**Prof. Tom Abel**

Department of Physics  
Stanford University  
Stanford, CA-94305  
USA

**Prof. Risa Wechsler**

Department of Physics  
Stanford University  
Stanford, CA-94305  
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Perimeter Institute  
Waterloo, Ontario N2L 2Y5  
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Department of Astronomy and Astrophysics  
The University of Chicago  
Chicago, IL 60637  
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