# BRIAN DENNIS NORD, JR.

Fermi National Accelerator Laboratory (FNAL)
Scientist

## EDUCATION AND TRAINING

| | | | |
|---|---|---|---|
| Johns Hopkins University | Physics | B.A. | 2003 |
| University of Michigan | Physics | M.S. | 2008 |
| University of Michigan | Physics (August E. Evrard) | PhD | 2010 |

## PROFESSIONAL APPOINTMENTS

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| Graduate Research Assistant | University of Michigan | 2004-2010 |
| NSF AGEP Postdoctoral Fellow | University of Michigan | 2010-2012 |
| Postdoctoral Research Associate | FNAL | 2012-2017 |
| Visiting Research Assistant Prof. | University of Chicago | 2017-2019 |
| Associate Scientist | FNAL | 2017-2020 |
| Senior Member | Kavli Institute for Cosmological Physics | 2017-Present |
| CASE Scientist | University of Chicago | 2019-Present |
| Scientist | FNAL | 2020-Present |

## HONORS AND AWARDS

Builder Status, Dark Energy Survey, 2010-Present

National Science Foundation, AGEP Postdoctoral Fellowship, 2010-2012

FNAL Exceptional Performance Recognition Award, Co-organizing Strike for Black Lives, 2020

## PEER-REVIEWED PUBLICATIONS

1. H.T. Diehl, et al. The DES Bright Arcs Survey: Hundreds of Candidate Strongly Lensed Galaxy Systems from the Dark Energy Survey Science Verification and Year 1 Observations. ApJS. 2017; 232(15).

2. A. Agnello et al. Models of the strongly lensed quasar DES J0408-5354. MNRAS. 2017; 472(4): 4038–4050.

3. I. Sevilla-Noarbe et al. Star-galaxy classification in the Dark Energy Survey Y1 data set. MNRAS. 2018; 481(4):5451–5469.

4. T.M.C. Abbott et al. (DES Collaboration). Dark Energy Survey Year 1 results: weak lensing mass calibration of redMaPPer galaxy clusters. MNRAS. 2019; 482(1):1352–1378.

5. T.M.C. Abbott et al. (DES Collaboration). First Cosmology Results using Type Ia Supernovae from the Dark Energy Survey: Constraints on Cosmological Parameters. ApJL. 2019; 872(2).

6. A. Dey et al. Overview of the DESI Legacy Imaging Surveys. AJ. 2019; 157(5).

7. H. Dominguez Sanchez et al. Transfer learning for galaxy morphology from one survey to another. MNRAS. 2019; 484(1): 93–100.

8. C. Jacobs et al. Finding high-redshift strong lenses in DES using convolutional neural networks. MNRAS. 2019; 484(4): 5330–5349.

9. J. Caldeira, et al. DeepCMB: Lensing Reconstruction of the Cosmic Microwave Background with Deep Neural Networks. Astron. Comput. 2019; 28(100307).

10. T.M.C. Abbott et al. Dark Energy Survey year 1 results: Joint analysis of galaxy clustering, galaxy lensing, and CMB lensing two-point functions. Phys. Rev. D. 2019; 100(023541).

11. B. Nord, et al. Observation and Confirmation of Nine Strong Lensing Systems in The Dark Energy Survey Y1 Data. MNRAS. 2019; 494(1): 1308–1322.

12. A. Ciprijanovic, et al. DeepMerge: Classifying high-redshift merging galaxies with deep neural networks. Astron. Comput. 2020; 32(100390).

13. T.M.C. Abbott et al. Dark Energy Survey Year 1 Results: Cosmological constraints from cluster abundances and weak lensing. Phys. Rev. D. 2020; 102(023509).

14. A. Amara, et al. SkyPy: A package for modelling the Universe. J. Open Source Softw. 2021, 6(65): 3056.

15. A. Feinstein, et al. Flare Statistics for Young Stars from a Convolutional Neural Network Analysis of TESS Data. AJ. 2020; 160(5).

16. J. Caldeira and B. Nord. Deeply uncertain: comparing methods of uncertainty quantification in deep learning algorithms. Mach. Learn.: Sci. Technol. 2020; (2)1.

17. R. Morgan, et al. deeplenstronomy: A dataset simulation package for strong gravitational lensing J. Open Source Softw. 2021; 6(58): 2854.

18. F. Sahneh, et al. Ten simple rules to cultivate transdisciplinary collaboration in data science. PLoS Comput. Biol. 2021; 17(5): e1008879.

19. A. Ćiprijanović, et al. DeepMerge - II. Building robust deep learning algorithms for merging galaxy identification across domains. MNRAS. 2021; 506(1): 677–691.

20. M. Cranmer, et al. Unsupervised Resource Allocation with Graph Neural Networks NeurIPS 2020 Workshop on Pre-registration in Machine Learning, PMLR 148:272-284

21. Z. Lin, et al. DeepSZ: identification of Sunyaev–Zel'dovich galaxy clusters using deep learning. MNRAS. 2021; 507(3): 4149–4164.

## SELECTED PATENTS

1. Cohen, B. M. and Nord, B., Systems and Methods for Automated Design, 2021. We developed an algorithm for automating the design of discretely structure scientific and engineering apparatus. The algorithm is general, and we apply to the problems of optical systems, as well as symbolic regression.

## RESEARCH SUPPORT

PI      Oak Ridge National Lab Director's Discretionary Time on Titan Supercomputer, Grant No. OLCF-HEP115: Machine Learning for Astrophysics & Cosmology, 2.5M core hours, 2018-2019

Co-PI      University of Chicago, Grant No. N/A: Automated Cosmic Experimental Design, $51K, 2019

Co-PI      LSST Enabling Science, Grant No. 2019-UG03: Data Science Summer Internship for Undergraduates, $30K, 2019

Co-I      DOE Target of Opportunity, Grant No. FNAL 18-32: HEP ML and Optimization Go Quantum, $500K, 2019-2020

Co-I      DOE Target of Opportunity, Grant No. FNAL 19-34: High-Velocity Artificial Intelligence, $400K, 2019-2020

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| Co-PI | DOE Workforce Development for Teachers and Scientists, Grant No. N/A: Fermi Explorers: Upskilling in STEM Research Environments, $40K, 2019-2020 |
| PI | Oak Ridge National Lab Director's Discretionary Time on Summit Supercomputer, Grant No. OLCF-HEP118: Machine Learning for Astrophysics & Cosmology, 15K core hours, 2019-2020 |
| PI | FNAL Lab-Directed R&D, Grant No. L2018.006: Modeling Physical Systems with Deep Learning, $750K, 2018-2021 |
| Co-PI | University of Chicago, Grant No. N/A: CS4All initiative for data science education in Chicago high schools, $15K, 2021 |
| PI | LSST Enabling Science, Grant No. 2020-09: Data Science Internship for Undergraduates, $14K, 2021 |
| Co-I | DOE Target of Opportunity, Grant No. N/A: Generative model development for domain adaptation and simulation in HEP, $400K, 2021-2022 |
| PI | NSF AAG, Grant No. 2009944: Collaborative Research: DeepCMB: Deep Learning for Studies of the Cosmic Microwave Background, $500K, 2020-2023 |
| PI | FNAL Lab-Directed R&D, Grant No. 2021.004: Developing uncertainty quantification and instrument automating for next-generation cosmological discoveries, $900K, 2021-2024 |
| PI | DOE Early Career Award, Grant No. 0000258217: Simulation-based inference for cosmological parameter estimation and discovery, $2.5M, 2021-2026 |

## SCIENTIFIC LEADERSHIP

Co-Chair: First Diversity & Inclusion Session, American Physical Society, Particles & Fields, 2017
Member, Lead Author: Vision for Education and Public Outreach Committee, FNAL, 2017-2018
Chair: Outreach Subcommittee of the Users Executive Committee, FNAL, 2017-2018
Sci. Organizing Cmte: Ethics in Computing Workshop, Kavli & Chicago Quantum Exchange, 2019
Sci. Organizing Cmte: Petabytes to Science Workshop, Kavli Foundation, 2019
Member: Joint Task Force Initiative for AI, University of Chicago, 2019-2020
Co-organizer: Change Now – Calls to Action for Racial Justice, FNAL, 2020
Co-organizer: Academic Strike 4 Black Lives, int'l campaign for racial justice in academia, 2020
Faculty Sponsor: Inclusivity, Diversity, and Equity in Astronomy, University of Chicago, 2017-2021
Sci. Organizing Cmte: Workshop on Machine Learning for Physical Sciences, Neurips, 2020-2021
Member: Steering Committee, Science Public Engagement Partnership, DOE and Kavli, 2020-2021
Co-chair: Strong Lensing Working Group, Dark Energy Survey, 2016-Present
Lead: Space Explorers Outreach Program, University of Chicago, 2017-Present
Director, Co-Founder: Deep Skies Community, International collab., 2017-Present
Co-Chair: Equitable Scientist Hiring Task Force, FNAL, 2020-Present
Co-Founder, Board Member: Skypy Project, University of Portsmouth, 2020-Present
Lead: Citizen Science Engagement, LSST and Vera Rubin Observatory, 2021-Present
Member: Data Science Advisory Group, National Optical-IR Astron. Research Lab, 2021-Present

## INVITED TALKS AND LECTURES

Keynote Address, Louis Stokes Alliance for Minority Participation, 2017

Heinz Pagels Lecture, Aspen Physics Center Summer Institute, 2018

Plenary, Special Session on AI at American Physical Society, 2018

Press Conference, American Physical Society, 2018

Lectures on AI, LSST Data Science Fellowship Program, 2018

Plenary, Annual National Society of Black Physicists Meeting, 2020

Keynote Address, Rubin Observatory Annual Community Meeting, 2020

Keynote Address, Statistical Challenges in Modern Astronomy VII, 2021

Keynote Address, NASA Science Mission Directorate AI Workshop, 2021

Keynote Address, American Physical Society, 2021

Keynote Address, American Astronomical Society Meeting #237, 2021