Biprateep Dey

Curriculum Vitae

Department of Physics and Astronomy,
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Education

2018-present	**Ph.D. Candidate**, *Department of Physics and Astronomy, University of Pittsburgh*, Pittsburgh, Pennsylvania, USA, (expected graduation: July 2024). **Thesis Title:** Photometric Redshifts for the Next-Generation of Sky Surveys **Advisors:** Prof. Jeff Newman and Prof. Brett Andrews
2020	**M.S. in Physics**, *University of Pittsburgh*, Pittsburgh, Pennsylvania, USA.
2018	**Integrated B.Sc.-M.Sc. in Physics**, *National Institute of Science Education and Research (NISER)*, Bhubaneswar, Odisha, India. **Thesis Title:** Constructing predictors for HI mass in galaxies **Advisor:** Prof. Nishikanta Khandai

Research Interests

Photometric Redshifts of Galaxies; Machine Learning, Statistics, and Uncertainty Quantification for Astrophysics and Cosmology; Galaxy Formation and Evolution.

Publications: 4 lead author, 4 significant contributing author, and 18 contributing author (list attached).

Presentations: 20 invited, 18 contributed (list attached).

Awards and Honors

2023	**"Builder" of the Dark Energy Spectroscopic Instrument (DESI) Collaboration**, Builder status is awarded to DESI members in recognition of a long engagement and a significant contribution to the collaboration infrastructure and service work..
2023	**American Physical Society Topical Group on Data Science IMPACT Award for Excellence in Graduate Research**.
2022	**LSST Corporation Enabling Science Fellowship**, Funding to attend the 2022 Rubin Observatory's Project and Community Workshop.
2022 - 23	**Andrew Mellon Predoctoral Fellowships**, Funding for year long research at the Univ. of Pittsburgh.
2022	**Zaccheus Daniel Predoctoral Fellowship**, Funding for summer term research at the Univ. of Pittsburgh.
2021	**PITT-PACC Fellowship**, Funding for fall term research at the Univ. of Pittsburgh.
2017	**MITACS Globalink Research Fellowship**, Funding for summer research at the Univ. of Alberta.
2014 - 2018	**Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship**, *Dept. of Science and Tech., Govt. of India*, Scholarship for undergraduate studies and research internships.
2013 - 2014	**INSPIRE Fellowship**, *Dept. of Science and Tech., Govt. of India*, Scholarship for undergraduate studies.

Leadership & Service

2023	**Member**, LSST-DESC Collaboration Council Nominating Committee.
2023 - present	**Research Mentor**, Research Supervisor for Emma R. Moran, undergraduate student at Univ. of Pittsburgh.
2023 - present	**Full Member**, LSST Dark Energy Science Collaboration.
2023	**Reviewer**, International Conference on Machine Learning (ICML) Synergy of Scientific and Machine Learning Modeling.
2023	**Co-Chair**, DESI photo-z Topical Group.
2022	**Reviewer**, Neural Information Processing Systems (NeurIPS) Machine Learning and the Physical Sciences.
2022	**Chair**, LSST-DESC Collaboration Council Nominating Committee.
2022 - 2023	**Graduate Student Mentor**, Mentor for 5 incoming students at the Dept. of Physics and Astronomy, University of Pittsburgh.
2022 - 2023	**Member**, DESI Committee for Early Career Scientists.
2021 - 2022	**Chairperson**, DESI Committee for Early Career Scientists.
2020 - 2022	**Member**, DESI Outreach Committee.
2020 - 2021	**Graduate Student Mentor**, Mentor for 3 incoming students at the Dept. of Physics and Astronomy, University of Pittsburgh.
2020 - 2021	**Coordinator**, Astrosnacks, Dept. of Physics and Astronomy, University of Pittsburgh. Organized student driven talk and tutorial series
2020 - 2021	**Secretary**, Executive Committee, Bengali Association of Pittsburgh.
2019 - 2021	**Coordinator**, Astronomy on Tap, Pittsburgh.

Awarded Super-computing Time

2023	**Perlmutter Supercomputer at NERSC**, *Making the Largest Map of Our Universe*, **8000 GPU Hours**, PI: **B. Dey**, Co-I: J. Newman, B. Andrews.
2022	**Neocortex (Cerebras Wafer Scale Engine) at Pittsburgh Supercomputing Center** , *Making the Largest Map of Our Universe*, **500 machine hours**, PI: **B. Dey**, Co-I: J. Newman, B. Andrews, J. Rajasegaran.

Awarded Telescope Time

2023	**Dark Energy Spectroscopic Instrument (DESI)**, *Testing ELG Selections for DESI-2*, **18k fiber hours**, PI: J. Newman, Co-I: **B. Dey** and others.
2023	**Dark Energy Spectroscopic Instrument (DESI)**, *Four in one: A consolidated program for DESI-2 and DESI-1b science cases in the COSMOS field*, **5k fiber hours**, PI: **B. Dey**, Co-PI: A. Leauthaud, J. Newman, R. Wechsler, Y. Mao.
2022	**Dark Energy Spectroscopic Instrument (DESI)**, *DESI-2 for Deep Spectroscopic Samples for LSST Photo-z's*, **6k fiber hours**, PI: **B. Dey**, Co-I: J. Newman, B. Andrews, R. Zhou,J. Myles, J. McCullough, D. Gruen, N. Weaverdyck.
2022	**Hubble Space Telescope Cycle 30 SNAP Proposal**, *Post-starbursts from DESI: Timing quenching and morphological transformation at* $1 < z < 1.3$, **409 Orbits**, PI: D. Setton, Co-I: **B. Dey** and others.

Successful Funding Proposals

2023	**Nancy Grace Roman Space Telescope Research and Support Participation Opportunities**, *Exploiting Deep Learning to Improve Roman Photometric Redshifts*, ∼**$219k**, PI: J. Newman, Co-I: **B. Dey** and others.

2023	**Nancy Grace Roman Space Telescope Research and Support Participation Opportunities**, *A Statistical Framework for Optimizing Roman Spectroscopic Training Sets*, ∼**$219k**, PI: J. Newman, Co-I: **B. Dey** and others.
2022	**Hubble Space Telescope Cycle 30 SNAP**, *Post-starbursts from DESI: Timing quenching and morphological transformation at* $1 < z < 1.3$, ∼**$203k**, PI: D. Setton, Co-I: **B. Dey** and others.
2021	**2022 ACCelerate Creativity + Innovation Festival**, Secured funding (∼**$12K**) from the University of Pittsburgh and the Atlantic Coast Conference (ACC) to produce a museum exhibit on *Making the largest Maps of our Universe*, **PI: B. Dey**, Co-I: J. Newman.

Teaching

Summer 2022	**AstroPGH Bootcamp**, Presented two lectures on Astropy.
Summer 2021	**AstroPGH-TAMU Bootcamp**, Presented two lectures on introductory Numpy.
Summer 2020	**AstroPGH Bootcamp**, Presented three lectures on introductory and advanced Numpy.
Spring 2019	**Teaching Assistant**, *PHYS 0110: Introduction to Physics 1*, with Prof. Matteo Broccio and Brian Pardo at Univ. of Pittsburgh.
Fall 2018	**Teaching Assistant**, *ASTRON0088: From Stonehenge to Hubble*, with Prof. Carles Badenes and Prof. Sandhya Rao at Univ. of Pittsburgh.

Software

(List of software packages I am the primary developer of)

- **Cal-PIT**, *Python package to produce, diagnose and recalibrate PDFs to ensure conditional coverage.*
- **desigal**, *Python package providing standardized utilities to use DESI spectra for studies of galaxies.*
- **spline_basis**, *Python package* `B-spline` *and* `I-spline` *basis functions to represent PDFs.*

Outreach

5. *Making the Largest Maps of Our Universe.* Produced an exhibit for the 2022 ACCelerate Creativity + Innovation Festival at the Smithsonian National Museum of American History, April 2022. Secured funding of ∼$10,000. Event attended by more than 10,000 visitors over 3 days.

4. *How Stars Helped to Build Human Civilizations.* Biophilia Pittsburgh at the Phipps Conservatory and Botanical Gardens, Pittsburgh, November 2020.

3. *Demystifying Research Internships Abroad: Mitacs Globalink Research Fellowship.* Student Development Council Talk Series, IISER Bhopal, September 2020.

2. *Mapping the Universe using Sky Surveys.* NISER Astronomy Club Alumni Talk, National Institute of Science Education and Research, August 2020.

1. *Tutor for DESI High: Enabling high school students to use data from DESI* at the 2020 Bay Area Science Festival, 2021 North Carolina Science Festival, 2021 Boston Science Festival, and DESI High@Nepal 2021.

List of Publications

Lead/Significant Contributing Author

9. **B. Dey**, J. A. Newman, DESI Collaboration et al. 2023, *in prep*, expected submission by Nov. 2023.
   DESI Deep Spectroscopy for Photometric Redshift Training and Calibration for LSST.

8. **B. Dey**, D. Zhao, J. A. Newman, et al. 2022, Submitted to Annals of Applied Statistics.
   Conditionally Calibrated Predictive Distributions by Probability-Probability Map: Application to Galaxy Redshift Estimation and Probabilistic Forecasting. arXiv:2205.14568.

7. D. J. Setton, **B. Dey**, G. Khullar, et al., 2023, ApJL, 947, L31.
   DESI Survey Validation Spectra Reveal an Increasing Fraction of Recently Quenched Galaxies at $z \sim 1$. arXiv:2212.05070.

6. R. Zhou, **B. Dey**, J. A. Newman, et al., 2023, AJ, 165, 58,.
   Target Selection and Validation of DESI Luminous Red Galaxies. arXiv:2208.08515.

5. **B. Dey**, J. A. Newman, B. H. Andrews, et al., 2022, MNRAS, 515, 4.
   Photometric redshifts from SDSS images with an interpretable deep capsule network. arXiv:2112.03939.

4. T. Chen, **B. Dey**, A. Ghosh, et al., Proceedings of the US Community Study on the Future of Particle Physics (Snowmass 2021).
   Interpretable Uncertainty Quantification in AI for HEP. arXiv:2208.03284.

3. **B. Dey**, J. A. Newman, B. H. Andrews, et al., 2021, Fourth Workshop on Machine Learning and the Physical Sciences (NeurIPS 2021).
   Re-calibrating Photometric Redshift Probability Distributions Using Feature-space Regression. arXiv:2110.15209.

2. **B. Dey**, E. Rosolowsky, Y. Cao, et al., 2019, MNRAS, 488, 2.
   The EDGE-CALIFA survey: exploring the star formation law through variable selection. arXiv:1906.02273.

1. S. Bhattacharjee, **B. Dey** and A.K. Mohapatra, 2018, Eur. J. Phys., 39, 035404.
   Study of geometric phase using classical coupled oscillators. arXiv:2110.15711.

Contributing Author

18. R. Zhou, S. Ferraro, M. White et al.[including **B. Dey**]. Submitted to JCAP.
    DESI luminous red galaxy samples for cross-correlations. arXiv:2309.06443

17. M.J. Yantovski-Barth, J.A. Newman, **B. Dey**, et al. Submitted to MNRAS.
    The CluMPR Galaxy Cluster-Finding Algorithm and DESI Legacy Survey Galaxy Cluster Catalogue. arXiv:2307.10426.

16. J. Han, A. Dey, A. Price-Whelan et al.[including **B. Dey**]. 2023, Submitted to the call for white papers for the Roman Core Community Survey, and to the Bulletin of the AAS.
    NANCY: Next-generation All-sky Near-infrared Community surveY. arXiv:2306.06315 .

15. DESI Collaboration, et al.[including **B. Dey**]. Submitted to AJ.
    Validation of the Scientific Program for the Dark Energy Spectroscopic Instrument. arXiv:2306.06307.

14. DESI Collaboration, et al.[including **B. Dey**]. Submitted to AJ.
    The Early Data Release of the Dark Energy Spectroscopic Instrument. arXiv:2306.06308.

13. F. Prada, J. Ereza, A. Smith et al.[including **B. Dey**]. Submitted to MNRAS.
    The DESI One-Percent Survey: Modelling the clustering and halo occupation of all four DESI tracers with Uchuu. arXiv:2306.06308.

12. E. Chaussidon, C. Yèche, N. Palanque-Delabrouille et al.[including **B. Dey**], 2023, ApJ, 944, 1.
    Target Selection and Validation of DESI Quasars. arXiv:2208.08511.

11. C. Hahn, M. J. Wilson, O. Ruiz-Macias et al.[including **B. Dey**], 2023, AJ, 165, 6.
    DESI Bright Galaxy Survey: Final Target Selection, Design, and Validation. arXiv:2208.08512.

10. A. Raichoor, J. Moustakas, J. A. Newman et al.[including **B. Dey**], 2023, AJ, 165, 3.
    Target Selection and Validation of DESI Emission Line Galaxies. arXiv:2208.08513.

9. T. Lan, R. Tojeiro, E. Armengaud et al.[including **B. Dey**], 2023, ApJ, 943, 1.
   The DESI Survey Validation: Results from Visual Inspection of Bright Galaxies, Luminous Red Galaxies, and Emission Line Galaxies. arXiv:2208.08516.

8. D. M. Alexander, T. M. Davis, et al.[including **B. Dey**], 2023, AJ, 165, 3.
   The DESI Survey Validation: Results from Visual Inspection of the Quasar Survey Spectra. arXiv:2208.08517.

7. J. Guy, S. Bailey, A. Kremin, et al.[including **B. Dey**], 2023, AJ, 165, 4.
   The Spectroscopic Data Processing Pipeline for the Dark Energy Spectroscopic Instrument. arXiv:2209.14482.

6. A. D. Myers, J. Moustakas, S. Bailey, et al.[including **B. Dey**], 2023, AJ, 165, 2.
   The Target-selection Pipeline for the Dark Energy Spectroscopic Instrument. arXiv:2208.08518.

5. DESI Collaboration, et al.[including **B. Dey**], 2022, AJ, 164, 5.
   Overview of the Instrumentation for the Dark Energy Spectroscopic Instrument. arXiv:2205.10939.

4. K. R. Sand, et al.[including **B. Dey**], 2022, ApJ, 932, 2.
   Multiband Detection of Repeating FRB 20180916B. arXiv:2111.02382 .

3. S Dutta, N Khandai and **B. Dey**, 2020, MNRAS, 494, 2.
   The population of galaxies that contribute to the HI mass function. arXiv:1909.03077.

2. R. Zhou, et al. [including **B. Dey**], 2020, RNAAS, 4, 10.
   Preliminary Target Selection for the DESI Luminous Red Galaxy (LRG) Sample. arXiv:2010.11282.

1. K. R. Sand, et al.[including **B. Dey**], 2020, ATel, 13781.
   Low-frequency detection of FRB180916 with the uGMRT. ATel:13781.

List of Presentations

(20 Invited and 18 Contributed Presentations)

Invited

20. *Photometric Redshifts for Next-Generation Sky Surveys.* Cosmology X Data Science Meeting, Centre for Computational Astrophysics, Flatiron Institute, USA, November 2023.

19. *Photometric Redshifts for Next-Generation Sky Surveys.* Yale Cosmology Seminar, Yale University, USA, November 20, 2023.

18. *Photometric Redshifts for Next-Generation Sky Surveys.* Survey Science Meeting, Princeton University, USA, November 2023.

17. *Photometric Redshifts for Next-Generation Sky Surveys.* Astrolunch seminar, University of Pittsburgh, USA, October 2023.

16. *Photometric Redshifts for Next-Generation Sky Surveys.* CCAPP Seminar, The Ohio State University, USA, October 2023.

15. *Photometric Redshifts for Next-Generation Sky Surveys.* JPL Dark Sector Meeting, NASA Jet propulsion Laboratory, USA, September 2023.

14. *Photometric Redshifts for Next-Generation Sky Surveys.* Caltech/IPAC Lunch Seminar, Infrared Processing & Analysis Center (IPAC), Pasadena, USA, September 2023.

13. *Photometric Redshifts using Interpretable Deep Capsule Networks.* Talk at the DESI@UCL symposium, University College London, London, UK, July 2023.

12. *Photometric Redshifts using Interpretable Deep Capsule Networks.* Tea Talk, Kavli Institute for Particle Astrophysics and Cosmology, Stanford University, USA, April 2023.

11. *Calibrated Predictive Distributions for Photometric Redshifts.* Building a physical understanding of galaxy evolution with data-driven astronomy, Kavli Institute for Theoretical Physics, USA, February 2023.

10. *Calibrated Predictive Distributions.* NSF AI Planning Institute for Data-Driven Discovery in Physics, Carnegie Mellon University, USA, September 2022.

9. *Photometric redshifts for next generation sky surveys.* STAtistical Methods for the Physical Sciences (STAMPS) meeting, Carnegie Mellon University, USA, February 2022.

8. *The Dark Energy Spectroscopic Instrument: One year and 13 million redshifts later.* Plenary talk at Summer 2022 LSST-DESC Collaboration meeting at Kavli Institute for Cosmological Physics, University of Chicago, Chicago, USA, August 2022.

7. *Photometric redshifts for next-generation sky surveys.* Talk at Astro-Data group meeting, Princeton University, USA, July 2022.

6. *Photometric redshifts for next-generation sky surveys.* FLASH Lunch talk, University of California, Santa Cruz, USA, June 2022.

5. *Beyond DESI: Making an even larger map of the Universe.* DESI Lunch, Lawrence Berkeley National Laboratory, USA, June 2022.

4. *Photometric Redshifts for Next Generation Sky Surveys.* STAtistical Methods for the Physical Sciences (STAMPS) meeting, Carnegie Mellon University, USA, February 2022.

3. *Photometric Redshifts using Interpretable Deep Capsule Networks.* Institute seminar, Inter-University Centre for Astronomy and Astrophysics (IUCAA), India, December 2021.

2. *Capsule Networks: An Astronomer's Perspective.* Break-out session on Deep Learning, Statistical Challenges in Modern Astronomy (SCMA) VII, June 2021.

1. *Reducing Photometric Redshift Outliers with Deep Learning.* STAtistical Methods for the Physical Sciences (STAMPS) meeting, Carnegie Mellon University, USA, April 2020.

━━━ Contributed

18. *DESI for photo-z Training and Calibration*, Talk at the 2023 Summer DESC Collaboration Meeting. SLAC National Accelerator Laboratory, USA July 2023.

17. *The DESI Photometric Redshift Topical Group*, Plenary talk at the 2023 Summer DESI Collaboration Meeting. Durham University, Durham, UK July 2023.

16. *Calibrated predictive distributions for photometric redshifts*, Talk at Statistical Challenges in Modern Astronomy (SCMA) VIII, Pennsylvania State University, State College, USA June 2023.

15. *DESI Deep Spectroscopy for Photo-z Training and Calibration.* Talk at DESI-2/ Stage-5 Workshop, Napa, USA, March 2023.

14. *Stellar Masses using Random Forests.* Talk at DESI Collaboration Meeting, Cancun, Mexico, December 2022.

13. *Calibration of Individual Photometric Redshift Estimates.* Talk at Essential Cosmology for the Next Generation VIII (Cosmology on the Beach), Playa De Carmen, Mexico, November 2022.

12. *The Dark Energy Spectroscopic Instrument: One year and 13 million redshifts later.* Astrosnacks presentation, University of Pittsburgh, September 2022.

11. *Calibrated Probability Distributions for Photometric Redshifts.* Poster at Rubin Observatory Project and Community Workshop, Tucson, USA, August 2022.

10. *Calibrated Probability Distributions for Photometric Redshifts.* Poster and Talk at Summer 2022 LSST-DESC Collaboration meeting at Kavli Institute for Cosmological Physics, University of Chicago, Chicago, USA, August 2022.

9. *Calibrated Predictive Distributions for Photometric Redshifts.* Poster at ICML 2022 Workshop on Machine Learning for Astrophysics, Baltimore, USA, July, 2022.

8. *Recalibrating Probability Density Estimates Using Feature-Space Regression.* Refereed talk at the Symposium on Data Science and Statistics, Pittsburgh, USA, June 2022.

7. *Re-calibrating Photometric Redshift Probability Distributions Using Feature-space Regression.* Poster and Talk at the Fourth Workshop on Machine Learning and the Physical Sciences (NeurIPS 2021), December 2021.

6. *Interpretable Photometric Redshifts using Deep Capsule Networks.* Talk at the 2nd Symposium on Artificial Intelligence for Science, Industry, and Society (AISIS 2021), October 2021.

5. *Latent Variable Models: Principal Components.* Talk at AstroPGH-TAMU Bootcamp 2021.

4. *Interpretable Photometric Redshifts with a DeepCapsule Network.* Poster at Statistical Challenges in Modern Astronomy VII, June 2021.

3. *Mapping the Universe using Sky Surveys.* Astrosnacks presentation, University of Pittsburgh, July 2020.

2. *Ancillary Targets: Testing filler samples in Survey validation.* DESI Collaboration meeting, Ohio State University, December 2019.

1. *LRG & ELG Imaging systematic Trends* (with A. Raichoor). DESI virtual collaboration meeting, March 2020.

Last Updated: March 24, 2024