

Daniel Muthukrishna

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MIT Kavli Institute, 77 Massachusetts Avenue, McNair Building 37-438h, Cambridge, MA 02139, USA

Education

University of Cambridge

PHD IN ASTROPHYSICS

Cambridge, UK

Oct. 2017 - Jun. 2021

- **Thesis:** Data-driven Discovery of Transients in the New Era of Time-Domain Astronomy
- **Advisers:** Prof Kaisey Mandel, Prof Gautham Narayan

University of Queensland

BACHELOR OF SCIENCE, PHYSICS

Brisbane, Australia

Mar. 2012 - Dec. 2016

High Distinction Average

University of Queensland

BACHELOR OF ENGINEERING, ELECTRICAL AND AEROSPACE

Brisbane, Australia

Mar. 2012 - Dec. 2016

Awarded 1st Class Honours - High Distinction Average

- **Thesis:** Deep Learning for the Spectral Classification of Supernovae
- **Advisers:** Prof David Parkinson, Dr Brad Tucker

Research and Work Experience

Massachusetts Institute of Technology

POSTDOCTORAL RESEARCHER, *Kavli Institute for Astrophysics*

Cambridge, MA, USA

Sep. 2021 - Present

- Lead development of deep learning and statistical frameworks for analyzing astronomical time-series data from the Transiting Exoplanet Survey Satellite (TESS), with direct applications to ZTF and the upcoming Vera Rubin Observatory's LSST.
- Directly supervise the research program of 6 students (2 Graduate, 3 Undergraduate, 1 high school) advancing novel machine learning methods in astronomy, with many of my students leading first-author papers published/submitted.
- Pioneered new diffusion model architectures to remove systematic effects from TESS space telescope data, essential for future space missions.
- Lead Astronet Group for exoplanet classification by developing convolutional neural networks and recurrent architectures.

University of Cambridge

PHD CANDIDATE, *Institute of Astronomy*

Cambridge, UK

Oct. 2017 - Jun. 2021

- Developed first real-time anomaly detection framework for large-scale time-domain surveys using Bayesian models and temporal convolutional neural networks.
- Created **RAPID** (astrorapid.readthedocs.io), a widely-adopted algorithm (170+ citations) for classifying astronomical transients in survey data using recurrent neural networks.
- Worked with the LSST DESC collaboration to develop PLAsTiCC, a photometric classification challenge.
- Published **DASH** (<https://astrodash.readthedocs.io>), reducing supernova spectral classification time from days to seconds with CNNs, deployed on major surveys.

University of California, Santa Cruz

KAVLI STUDENT FELLOW

Santa Cruz, California, USA

Jul. 2019 - Aug. 2019

- Developed generative models of common astronomical objects and used the model predictions for real-time anomaly detection.

Australian National University

RESEARCH ASSISTANT, *Mount Stromlo Observatory*

Canberra, Australia

Mar. 2017 - Aug. 2017

- Worked with large international Dark Energy Survey collaboration (OzDES) and the SkyMapper Transient Survey Telescope.
- Helped develop software pipeline in the SkyMapper search for Planet 9 and the BBC Stargazing living citizen science project.

Gemini South Observatory

RESEARCH INTERNSHIP

La Serena, Chile

Dec. 2016 - Feb. 2017

- Analysed the internal kinematics of giant star-forming regions in interacting galaxies.
- Developed spectral emission line fitting tool called **FitELP** (<https://fitelp.readthedocs.io/>).

University of Queensland

RESEARCH ASSISTANT

Brisbane, Australia

Jan. 2014 - Feb. 2016

- Analysed cosmological data (Type Ia Supernovae and Baryonic Acoustic Oscillations) with Bayesian statistics. Modelled cosmic acceleration without invoking a theory of gravity by using a Taylor expansion of the scale-factor.

Micreo Limited

RADIO FREQUENCY ENGINEER

Brisbane, Australia

Dec. 2014 - Sep. 2015

- Radio Frequency Engineer at a leading Microwave and Electro-optic engineering company focused on electronic warfare for defence contracts.
- Researched, designed, simulated, and manufactured various Microwave Frequency equipment.

Teaching and Courses Developed

Cambridge Centre for International Research

Online Course

LECTURER

Feb. 2023 - Present

- Designed and lectured comprehensive undergraduate-level course “Data-driven Astronomy: Machine Learning and Statistics for Modern Astronomy” (13 weeks)
- Developed comprehensive curriculum covering advanced topics including Bayesian inference, machine learning architectures, time-series analysis, and practical applications to astronomical datasets
- Created hands-on programming assignments using real astronomical data from major surveys.
- Received excellent student feedback on course materials and teaching effectiveness

DPMMS, Centre for Mathematical Sciences, University of Cambridge

Cambridge, UK

COURSE ORGANISER AND SUMMER LECTURER

Jul. 2018, Jul. 2019

- Prepared and lectured an intensive computer training course for Part II and Part III (third and fourth-year undergraduate) students.
- Began with an introduction to Python and shell environments, and extended to big-data analysis, Markov Chain Monte Carlo sampling, solving ODEs, visualising data, and machine learning architectures using scikit-learn and Tensorflow.

School of Mathematics & Physics and School of Engineering, University of Queensland

Brisbane, Australia

UNIVERSITY TUTOR

Mar. 2013 - Nov. 2016

- Led classes of 20-70 students and graded coursework for undergraduate-level engineering, physics, and calculus courses.
 - ELEC3100: Fundamentals of Electromagnetic Fields & Waves
 - ENGG1300: Introduction to Electrical Systems
 - MATH1051: Calculus and Linear Algebra
 - MATH1052: Multivariate Calculus & ODEs
 - PHYS1002: Electromagnetism and Modern Physics
 - PHYS1001: Mechanics and Thermal Physics
 - ENGG1500: Engineering Thermodynamics

Mentoring

GRADUATE STUDENTS

Anna Tartaglia	Astrophysics, PhD student, Oct. 2024 - Present	Harvard
Pablo Mercader	CS and Eng., PhD student, Oct. 2024 - Present	MIT
Torsha Majumder	Verizon Data Scientist, Masters student, Dec. 2021 - Dec. 2023	University of Texas

UNDERGRADUATE STUDENTS

Peter Dong	CS and Eng., Sophomore., Jan. 2025 - Present	MIT
Joseph Lupo	CS and Eng., Senior, paper submitted., Jun. 2023 - Aug. 2024	MIT
Hali Huang	CS, Junior, paper accepted at NeurIPS workshop, Jun. 2022 - Jan 2024	MIT
Prajna Nair	Astrophysics, Junior, co-authored accepted at NeurIPS workshop, Mar. 2022 - Jan 2024	MIT
Zimi Zhang	CS and Physics, Junior, co-authored accepted, Jun. 2022 - Jan 2024	MIT
Miguel Chacon	CS and Physics, Sophomore, Sep. 2022 - Dec. 2023	MIT
Andrew Jenkins	CS and Elec. Engineering, 3rd year undergraduate, Jun. - Sep. 2022	MIT, Tesla
Saul Balcarcel	Astrophysics, 2nd year undergraduate, Mar. - Jun. 2022	MIT
Anahita Srinivasan	CS, 2nd year undergraduate, Dec. 2021 - May. 2022	MIT
Jaya Chand	Astronomy, 3rd year undergraduate, Jun. - Aug. 2021	University College London

HIGH SCHOOL STUDENTS

Rithwik Gupta	Two papers accepted at RASTI and Neurips workshops, Mar. 2022 - Present	High School
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Selected Awards

2025 AstroAI Fellowship , AI for Astrophysics fellowship, SAO	Harvard University and Smithsonian
2024 DAAD Alnet Fellow , Selected outstanding international early career AI researchers	DAAD, German Academic Exchange
2021 Paul Murdin Prize , Best Published Journal Paper by an Astronomy PhD Student	University of Cambridge
2019 Astrostatistics Student Paper Competition , Finalist	American Statistical Association
2019 Kavli Student Fellow , Selected fellow of the Kavli Summer Program in Astrophysics	UC Santa Cruz
2017 Bok Prize Highly Commended , Awarded to top three astronomy Masters theses in Australia	Astronomical Society of Australia
2017 Cambridge Australia Poynton Scholarship , Awarded to top applicants from Australia	Cambridge Trust
2017 President's PhD Scholarship , Awarded to the top applicants across Imperial College	Imperial College
2017 AAO Scholarship , Awarded to top astrophysics graduate students	Australian Astro. Observatory

2016	IEEE Student Thesis Prize , Best Engineering thesis from all undergraduates in Queensland	<i>Institute of Electrical Engineers</i>
2016	GBST Best Software Project , Best software-related thesis at the University of Queensland	<i>GBST and University of Queensland</i>
2016	Gemini Studentship , Two students from Australia selected	<i>Australian Astro. Observatory</i>
2016	Dean's Commendations for High Achievement , Awarded to students with top-ranking GPAs	<i>University of Queensland</i>
2015	RSAA Astronomy Winter School , Four students from Australia and New Zealand were selected	<i>RSAA, Canberra</i>
2014	Micreo Scholarship in Electrical Engineering , Awarded to one student each year in Queensland	<i>University of Queensland</i>
2013	Mpemba Effect Competition , Selected in the top 10 out of 22000 entrants	<i>Royal Society of Chemistry</i>
2012	Students for the Future Award , Awarded to the top 100 engineering students in Queensland	<i>Queensland Resource Council</i>

Selected Seminars & Conference Presentations

Oct. 2024	Tufts University , Astronomy Seminar, <i>Invited speaker</i>	<i>Somerville, MA</i>
Jul. 2024	University of Oxford , Breakthrough Discuss, New Searches for Intelligence, <i>Invited speaker</i>	<i>Oxford, UK</i>
Apr. 2024	University of Washington , Institute for Data-Intensive Research (DiRAC), <i>Invited speaker</i>	<i>Seattle, WA</i>
Nov. 2023	Yale University , Yale Data Science x Astronomy & Astrophysics, <i>Invited speaker</i>	<i>New Haven, CT</i>
Sep. 2023	Harvard University , Center for Astrophysics Seminar, <i>Invited speaker</i>	<i>Pasadena, CA</i>
Mar. 2023	NASA Jet Propulsion Laboratory , Machine Learning and Instrument Autonomy group	<i>Los Angeles, CA, USA</i>
May. 2022	ESO Garching , SciOps 2022: Artificial Intelligence for Science in Astronomy, Contributed	<i>Garching, Germany</i>
Mar. 2022	Korea Astronomy and Space Science Institute , Cosmology Seminar Series, <i>Invited speaker</i>	<i>Online</i>
Mar. 2021	Telstra Telecommunications Company , AI ML forum, <i>Invited speaker</i>	<i>Online</i>
Dec. 2020	University of Sheffield , Astronomy Seminar, <i>Invited speaker</i>	<i>Online</i>
Feb. 2020	Stanford University, SLAC National Accelerator Laboratory , AI Seminar Series, <i>Invited</i>	<i>Stanford, CA, USA</i>
Feb. 2020	University of California Berkeley, SETI , Search for Extraterrestrial Intelligence Weekly Meeting	<i>Berkeley, CA, USA</i>
Feb. 2020	Texas A&M University , Astronomical Data Science Workshop, <i>Invited speaker</i>	<i>Texas, USA</i>
Nov. 2019	DESY (Deutsches Elektronen-Synchrotron) , Astroparticle Seminar, <i>Invited speaker</i>	<i>Hamburg, Germany</i>
Aug. 2019	Northwestern University , Hotwiring the transient universe workshop, <i>Invited speaker</i>	<i>Evanston, IL, USA</i>
Jul. 2019	Joint Statistical Meeting , Astrostatistics Best Student Paper Session	<i>Denver, CO, USA</i>
Jun. 2019	Institute of Astronomy, University of Cambridge , Wednesday Seminar	<i>Cambridge, UK</i>
Apr. 2019	Space Telescope Science Institute , Enabling Multi-messenger Astrophysics in the Big Data Era	<i>Baltimore, MD, USA</i>
Mar. 2019	Royal Astronomical Society , Machine Learning and AI applied to Astronomy, Contributed	<i>London, UK</i>
Mar. 2019	University of California, Santa Cruz , Invited Talk to Transient group	<i>Santa Cruz, CA, USA</i>
Jan. 2019	Harvard University , CHASC Topics in Astrostatistics group	<i>Online seminar</i>
Jun. 2018	University of Oxford , Planning for Surprises in the era of Data-Driven Astronomy, Contributed	<i>Oxford, UK</i>

Academic Service

National Science Foundation (NSF) *Alexandria, VA*
 REVIEW PANELIST *2024*

- Invited review panelist for large survey grant proposals up to \$2 million

NASA TESS Guest Investigator Program *Milwaukee, WI*
 REVIEW PANELIST *2024*

- Invited review panelist for proposals on variable stars and stellar astrophysics. (up to \$150,000)
- Evaluated technical feasibility and scientific merit of TESS observing programs

Schmidt Sciences LINCC Frameworks Project *CMU, Pittsburgh, PA*
 REVIEW PANELIST *2025*

- Invited review panelist to for Rubin Observatory's LINCC (LSST Interdisciplinary Network for Collaboration and Computing) mid-project review (\$3 million per year)
- Selected on the review panel based on my leading expertise on software and AI for astrophysical surveys

Academic Journal Referee

- The Astrophysical Journal (ApJ)
- Astronomy & Astrophysics (A&A)
- Monthly Notices of the Royal Astronomical Society (MNRAS)
- The Astronomical Journal (AJ)
- Neural Information Processing (NeurIPS) workshops
- International Conference of Machine Learning (ICML) workshops
- Institute of Electrical and Electronics Engineers (IEEE) Journals.

Leadership & Organizing

- Co-organizer of the first “*Freedom Trail of Code: Boston Astrophysics x Machine Learning Hackathon 2024*”, Cambridge, MA
- Co-organizer of the “*Accelerating Physics with ML*” workshop, Cambridge, MA
- LOC for the *TESS Science Conference III*, Cambridge, MA

International Collaborations

- Legacy Survey of Space and Time’s Dark Energy Science Collaboration (LSST DESC) member, 2018-Present
- Young Supernova Experiment member, 2024-Present
- Habitable Worlds Observatory, AI/ML Working Group member, 2024-Present
- Dark Energy Survey and OzDES member, 2016-2020
- 4MOST Time-Domain Extragalactic Survey (TiDES) member, 2018-2022

Selected Publications

See [full publication list on ADS](#). Over 2000 citations. H-index: 17.

*My student (under my direct supervision)

IN PREPARATION

1. **Muthukrishna, D.**, Audenaert, J., Villar, A., Hogg, D., *A causal foundation model for variable stars: Disentangling physical properties from instrumental effects in TESS and Kepler*. in prep.
2. **Muthukrishna, D.**, *Lupo, J., Vanderspek, R., *BEAM: Conditional Diffusion models for Correcting Systematic Effects in Astronomical Images from Space Telescopes*. in prep.
3. Gupta, R., **Muthukrishna, D.**, *Building Supervised, Domain-Agnostic Foundation Models That Leverage Human Priors To Expedite Machine Learning Discovery in Astronomy*, in prep.

MAJOR CONTRIBUTIONS

1. *Gupta, R. & **Muthukrishna, D.** *Transfer Learning for Transient Classification: From Simulations to Real Data and ZTF to LSST*. 2025, submitted. [[ads](#)]
2. *Gupta, R., **Muthukrishna, D.**, Lochner, M., *A Classifier-Based Approach to Multi-Class Anomaly Detection for Astronomical Time-Series*. 2024, accepted at the International Conference for Machine Learning’s AI for Science Workshop. [[ads](#)][[doi](#)]
3. *Gupta, R., **Muthukrishna, D.**, Lochner, M., *A Classifier-Based Approach to Multi-Class Anomaly Detection for Astronomical Transients*. 2024, Royal Astronomical Society Techniques & Instruments Journal (RASTI), 4, rzae054. [[ads](#)][[doi](#)]
4. *Huang, H., **Muthukrishna, D.**, *Nair, P., *Zhang, Z., Fausnaugh, M., *Majumder, T., Foley, R., Ricker, G. *Predicting the Age of Astronomical Transients from Real-Time Multivariate Time Series*. 2023, Machine Learning and the Physical Sciences Workshop, Neural Information Processing Systems (NeurIPS) 2023. [[ads](#)] [[doi](#)]
5. **Muthukrishna, D.**, Mandel, K., Lochner, M., Webb, S., & Narayan, G. *Real-time detection of anomalies in large-scale transient surveys*. 2022, MNRAS, 517, 393. [[ads](#)][[doi](#)]
6. **Muthukrishna, D.**, Mandel, K., Lochner, M., Webb, S., & Narayan, G. *Real-time Detection of Anomalies in Multivariate Time Series of Astronomical Data*. 2021, Machine Learning and the Physical Sciences Workshop, Neural Information Processing Systems (NeurIPS) 2021. [[ads](#)][[doi](#)]
7. Webb, S., Lochner, M., **Muthukrishna, D.**, et al., *Unsupervised machine learning for transient discovery in Deeper, Wider, Faster light curves*. 2020, MNRAS, 498, 3077. [[ads](#)][[doi](#)]
8. **Muthukrishna, D.**, Narayan, G., Mandel, K., Biswas, R., & Hložek, R. *RAPID: Early classification of explosive transients using Recurrent Neural Networks*. 2019, PASP, 131, 118002. [[ads](#)][[doi](#)]
9. **Muthukrishna, D.**, Parkinson, D., & Tucker, B. *DASH: Deep Learning for the Automated Spectral Classification of Supernovae and their Hosts*. 2019, ApJ, 885, 85. [[ads](#)][[doi](#)]
10. **Muthukrishna, D.** & Parkinson, D. *A cosmographic analysis of the transition to acceleration using SN-Ia and BAO*. 2016, J. Cosmol. Astropart. Phys, 11, 052. [[ads](#)][[doi](#)]
11. Agarwal, M., et al. (incl **Muthukrishna, D.**) *Applications of Deep Learning to physics workflows*. 2023, submitted. [[arXiv](#)]
12. *Lupo, J., **Muthukrishna, D.**, Vanderspek, R., *Conditional Diffusion models for Correcting Systematic Effects in Astronomical Images from Space Telescopes*. 2024, submitted.

13. **Muthukrishna, D.**, Audenaert, J., Villar, A., Hogg, D., *A causal foundation model for variable stars: Disentangling stellar properties from instrument effects in TESS and Kepler*. in prep.
14. **Muthukrishna, D.**, Haviland, J., Vanderburg, A., Shporer, A., Audenaert, J., Ricker, G., *Identifying Exoplanets with Deep Learning. VII. Astronet Vetting Model*, in prep.

OTHER CO-AUTHOR

15. Hon, M., et al. (incl **Muthukrishna, D.**), *A Disintegrating Rocky Planet with Prominent Comet-like Tails Around a Bright Star*. 2025, accepted to AAS Journals. [[ads](#)][[doi](#)]
16. Tey, E., et al. (incl **Muthukrishna, D.**), *Identifying Exoplanets with Deep Learning. V. Improved Light Curve Classification for TESS Full Frame Image Observations*. 2022, AJ, 165, 95. [[ads](#)][[doi](#)]
17. Fausnaugh, M., et al. (incl **Muthukrishna, D.**), *Four years of Type Ia Supernovae Observed by TESS*. 2022, ApJ, 956, 108. [[ads](#)][[doi](#)]
18. Biswas, E., Ishida, E., et al. (incl **Muthukrishna, D.**), *Enabling the discovery of fast transients: A science module for the Fink broker*. 2022, A&A, 677, A77. [[ads](#)][[doi](#)]
19. Chatterjee, D., Narayan, D., Aleo, P. D., Malanchev, K., **Muthukrishna, D.**, *Electromagnetic Counterpart Identification of Gravitational-wave candidates using deep-learning*. 2021, Accepted in NeurIPS 2021. [[ads](#)]
20. Chatterjee, D., Narayan, D., Aleo, P. D., Malanchev, K., **Muthukrishna, D.**, *El-CID: A filter for Gravitational-wave Electromagnetic Identification*. 2021, MNRAS, 509, 914. [[ads](#)]
21. Hložek, R., et al. (incl **Muthukrishna, D.**), *Results of the Photometric LSST Astronomical Time-series Classification Challenge (PLAsTiCC)*. 2021, submitted to ApJS. [[ads](#)]
22. Jones, D. O., et al. (incl **Muthukrishna, D.**), *The Young Supernova Experiment: Survey Goals, Overview, and Operations*. 2020, ApJ, 908, 24. [[ads](#)][[doi](#)]
23. Stachie, C., Coughlin, M., Christensen, N. & **Muthukrishna, D.**, *Differentiating the signal from the noise: towards optimal choices of wide field-of-view telescope transient follow-up*. 2019, MNRAS, 497, 1320. [[ads](#)][[doi](#)]
24. Malz, A. I., et al. (incl **Muthukrishna, D.**), *The Photometric LSST Astronomical Time-series Classification Challenge PLAsTiCC: Selection of a Performance Metric for Classification Probabilities Balancing Diverse Science Goals*. 2019, AJ, 158, 171. [[ads](#)][[doi](#)]
25. Campuzano Castro, F., Hagele, G. F., Bosch, G., Firpo, V., Cardaci, M., **Muthukrishna, D.**, Morrell, N. *Chemodynamics in Blue Compact Dwarf galaxies: II Zw 33 and Mrk 600*. 2019, Boletín de la Asociación Argentina de Astronomía, 61A. [[ads](#)][[doi](#)]
26. Kessler, R., et al. (incl **Muthukrishna, D.**), LSST Dark Energy Science Collaboration, Transient and Variable Stars Science Collaboration *Models and Simulations for the Photometric LSST Astronomical Time Series Classification Challenge (PLAsTiCC)*. 2019, PASP, 131, 094501. [[ads](#)][[doi](#)]
27. Kessler, R., et al. (incl **Muthukrishna, D.**), *First cosmology results using Type Ia supernova from the Dark Energy Survey: simulations to correct supernova distance biases*. 2019, MNRAS, 485, 1171. [[ads](#)][[doi](#)]
28. Brout, D., et al. (incl **Muthukrishna, D.**), *First Cosmology Results Using SNe Ia from the Dark Energy Survey: Analysis, Systematic Uncertainties, and Validation*. 2019, ApJ, 874, 150. [[ads](#)][[doi](#)]
29. Abbott, T., et al. (incl **Muthukrishna, D.**), *First Cosmology Results using Type Ia Supernovae from the Dark Energy Survey: Constraints on Cosmological Parameters*. 2019, ApJL, 872, L30. [[ads](#)][[doi](#)]
30. D'Andrea, R., et al. (incl **Muthukrishna, D.**), *First Cosmology Results Using Type Ia Supernovae From the Dark Energy Survey: Survey Overview and Supernova Spectroscopy*. arXiv:1811.09565. [[ads](#)]
31. Campuzano Castro, F., Bosch, G., Hagele, G., Firpo, V., **Muthukrishna, D.**, Cardaci, M. *Estudio en galaxias BCD: Mrk 600 y II Zw 33*. 2018, Boletín de la Asociación Argentina de Astronomía, 60, 148. [[ads](#)]
32. Childress, M., et al. (incl **Muthukrishna, D.**), *OzDES multifibre spectroscopy for the Dark Energy Survey: 3-yr results and first data release*. 2017, MNRAS, 472, 273. [[ads](#)][[doi](#)]

SELECTED WHITE PAPERS, NOTES, AND ASTRONOMICAL TELEGRAMS

34. de Jong, R., et al. (incl **Muthukrishna, D.**), *4MOST: Project overview and information for the First Call for Proposals*. 2019, The Messenger, 175, 3. [[ads](#)][[doi](#)]

35. Allen, G., et al. *Multi-Messenger Astrophysics: Harnessing the Data Revolution*. 2018, arXiv:1807.04780. [ads]
36. The PLAsTiCC team, et al. *The Photometric LSST Astronomical Time-series Classification Challenge (PLAsTiCC): Data set*. 2018, arXiv:1810.00001. [ads]
37. **Muthukrishna, D.**, Sharp, R. G., Tucker, B. E., et al., *Classification of 17 DES supernova with OzDES, The Astronomer's Telegram*. 2017, ATel, 10759. [ads]

THESES

38. **Muthukrishna, D.** *Data-driven Discovery of Transients in the New Era of Time-Domain Astronomy*. 2021, PhD Thesis, University of Cambridge. [Online Thesis][doi]
39. **Muthukrishna, D.** *Deep Learning for the Spectral Classification of Supernovae*. 2016, Unpublished Honours Thesis, University of Queensland, Brisbane, Australia. [Online Thesis]
 - Awarded IEEE General Student Thesis prize for the best Electrical Engineering thesis in Queensland.
 - Awarded GBST prize for the best software thesis at the University of Queensland.
 - Awarded Bok Prize Highly Commended for the top three ranked astronomy Honours or Masters theses in Australia.

Skills

Experienced researcher working at the intersection of astronomy and data intensive science. I use deep learning and Bayesian modelling for data-driven astrophysics. I'm enthusiastic about applying novel machine learning methods to new datasets.

Expert Python: Tensorflow, Keras, PyTorch, Numpy, Pandas, Scipy, Scikit-learn, PyMC, Jax.
Experience with: C, C++, Matlab, SQL, HTML, Fortran, IDL, Java

Developer Developed widely used packages based on convolutional and recurrent neural networks:
 astrodash <https://astrodash.readthedocs.io> and astrorapid <https://astrorapid.readthedocs.io>

Other Deep learning, Recurrent Neural Networks, Diffusion Models, Normalizing Flows, Transformer Architectures, Time-series modelling, Bayesian statistics, data augmentation, massive observational datasets, data visualisation, multi-collaborator git version control, teaching, supervising students, managing teams in local and international collaborations, electronics design.

Selected Software Development

1. BEAM (Background Elimination with Advanced Machine learning)
 - GitHub:** <https://github.com/daniel-muthukrishna/BEAM>
 - Description: Software package for training conditional diffusion models to model and remove systematic effects from TESS image data.
2. RAPID (Real-time Automated Photometric Identification)
 - Documentation:** <https://astrorapid.readthedocs.io>
 - GitHub:** <https://github.com/daniel-muthukrishna/astrorapid>
 - Description: Software package to train a deep learning model to classify astronomical transient time-series (light curves).
3. DASH (Deep learning for Automated Supernova and Host classification)
 - Documentation:** <https://astrodash.readthedocs.io>
 - GitHub:** <https://github.com/daniel-muthukrishna/astrodash>
 - Description: Software package to train a deep learning model to classify supernova spectra.
4. FitELP (Fit Emission-Line Profiles)
 - Documentation:** <https://fitelp.readthedocs.io/>
 - GitHub:** <https://github.com/daniel-muthukrishna/FitELP>
 - Description: Tool to fit emission lines in echelle or long-slit spectra, and compute kinematic chemical properties.
5. COVID-19 Country Comparison and LowHighCovid App
 - Website:** <https://covid19-cases-and-deaths.herokuapp.com/>, <https://lowhighcovid.herokuapp.com/>
 - GitHub:** <https://github.com/daniel-muthukrishna/covid19>, <https://github.com/nt409/covid-19>
 - Description: Online dashboard that allows users to compare the growth of COVID-19 across different countries and LowHighCovid is an online dashboard that allows users to implement their own SIR model of COVID-19 growth and compare the effect of different lockdown restrictions on the growth rate. This work was led by a Cambridge Mathematical biologist.