

Daniel Muthukrishna

DOB: March 1994

Email: daniel.muthukrishna@gmail.com

Web: <http://www.danielmuthukrishna.com/>

EDUCATION

- 2017 – Present **PhD, Astronomy**
Institute of Astronomy, University of Cambridge, United Kingdom
- 2017 **PhD Graduate Program, Astronomy and Astrophysics**
Mt Stromlo Observatory, Australian National University, Canberra, Australia
- 2012 – 2016 **Bachelor of Science, Physics**
University of Queensland, Brisbane, Australia
High Distinction Average
- 2012 – 2016 **Bachelor of Engineering, Electrical and Aerospace**
University of Queensland, Brisbane, Australia
Awarded 1st Class Honours (High Distinction Average)
- 2004 – 2011 **High School Certificate**
Villanova College, Coorparoo, Australia
Completed with the highest grades (VHA) in all subjects
-

RESEARCH EXPERIENCE

- 2017 **Research Student, Australian National University, Australia**
- I worked with the Australian Dark Energy Survey (OzDES) and the SkyMapper Transient Survey. I developed a spectral classification tool (DASH) and used it to analyse the DES supernova sample (paper in preparation). I analysed the physical mechanism behind peculiar core-collapse transients from the DES. I also helped develop the software pipeline in the SkyMapper search for Planet 9.
- 2016 – 2017 **Research Internship, Gemini South Observatory, Chile**
- I analysed the internal kinematics of giant star-forming regions in interacting galaxies. To do this, I made use of IRAF and lmfit to fit the emission lines in spectra taken with the MIKE echelle spectrograph at the Las Campanas Observatory. (Paper in preparation).
- 2016 – 2017 **Research Student, University of Queensland, Australia**
- I applied Deep Neural Networks (a machine learning algorithm) to the classification of supernova spectra. I developed a novel spectral classification tool called DASH for the Dark Energy Survey (OzDES). The software is being used in the OzDES pipeline. I have made the software available on my GitHub (<https://github.com/daniel-muthukrishna/DASH>) and PyPI for installation with 'pip install astrodash'.
- 2014 – 2016 **Research Student, University of Queensland, Australia**
- I used Python to analyse cosmological data with statistical methods including Bayesian statistics and MCMC methods. (Paper published).
 - I researched the nature of dark energy and modelled the acceleration of the universe with SNIa and BAO data.
-

WORK EXPERIENCE

- 2013 – 2016 **Tutor, University of Queensland, Australia**
- Tutored large classes of up to 20-70 students in each of the following subjects:
 - 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

- FYELC: Tutored a range of first year engineering subjects
 - The roles involved lesson preparation, marking, and teaching content with the use of power-point or whiteboard presentations.
- 2014 – 2016 **Participation Assistant, Student Services, University of Queensland, Australia**
 - Assisted a hearing-impaired student with their engineering subjects.
- 2014 – 2015 **Vocational RF Engineer, Micreo Limited, Australia**
 - Summer vacation position as a Radio Frequency Engineer at a leading Microwave and Electro-optic based engineering company. The primary work is in electronic warfare for its Defence contracts.
 - Researched, designed, simulated, and manufactured various RF equipment.
 - Tested equipment using Vector Network Analysers, Spectrum Analysers, Oscilloscopes, and soldered test components onto PCBs.
 - Wrote reports, submitted improvement requests and analysed data.
- 2012 – 2014 **Private Tutor, Aim High Tuition, Australia**
 - Tutored a range of subjects to high-school and primary school students
- 2011 – 2012 **Salesperson, Brisbane’s Wholesale City, Australia**
 - A commission-based sales role selling various furniture.

INVITED TALKS & CONFERENCE PRESENTATIONS

- 2017 **Invited Talk, CAASTRO Area Meeting**
“Deep Learning for supernova classification in OzDES”
- 2017 **Astronomical Society of Australia Conference, Australian National University**
“DASH: Deep Automated Supernova and Host spectral classification”
- 2017 **DES Collaboration Meeting Talk, University of Chicago**
“Spectral classification of the Type-Ia supernova sample”
- 2017 **Invited Talk, Machine Learning in Astronomy Meeting**
“DASH: Deep Learning for the Spectral Classification of Supernovae”
- 2017 **Project Presentation, Gemini South Observatory**
“Modelling emission line profiles in Giant HII Regions”
- 2017 **Invited Talk, University of Chile**
“DASH: Deep Learning for the Spectral Classification of Supernovae”
- 2016 **Invited Feast of Facts Talk, Australian National University**
“Model-independent Cosmology”
- 2016 **OzDES Science Workshop Presentation, University of Queensland**
“Automated Spectral Analysis and Classification of Transient Objects”

AWARDS

- 2017 **Bok Prize Highly Commended Award, The Astronomical Society of Australia**
Awarded to the top three astronomy-related Honours/Masters theses in Australia.
- 2017 **Cambridge Australia Poynton Scholarship, University of Cambridge**
PhD living stipend and full tuition awarded to top applicants from Australia.
- 2017 **Presidents PhD Scholarship, Imperial College**
PhD living stipend and full tuition awarded to top applicants across the university.
- 2017 **AAO PhD Scholarship, Australian Astronomical Observatory**
Top-up scholarship awarded to high-achieving applicants.
- 2017 **RSAA ANU Supplementary Scholarship, Australian National University**
Top-up scholarship awarded to high-achieving applicants.
- 2017 **Australian Postgraduate Award Scholarship, Australian Government**
PhD living stipend and full tuition.

- 2016 **Gemini Undergraduate Summer Studentship, Australian Astronomical Observatory**
Two students from Australia were selected for the studentship at the Gemini South Observatory in Chile.
- 2016 **IEEE Student Thesis Prize, Institute of Electrical and Electronics Engineers**
One award out of all undergraduate theses in Information Technology and Electrical Engineering from all universities in Queensland.
- 2016 **GBST Best Software Project, University of Queensland**
One award out of all software related theses at the University of Queensland.
- 2016 **Dean's Commendations for High Achievement, University of Queensland**
- 2015 **RSAA Astronomy Winter School, Australian National University**
Four students from around Australia and New Zealand were selected. The program included a travel scholarship covering all travel and accommodation.
- 2014 **Micreo Scholarship in Electrical Engineering (2 years)**
- 2013 **Royal Society of Chemistry's Mpemba Effect Competition**
International Competition which attracted 22000 entries from 122 countries. My submission was selected as one of the Top 11 entries. Other winners included post-docs and professional engineers. I was the only student awarded, despite only being in high-school.
- 2012 **Students for the Future Award, Queensland Resources Council**
Scholarship awarded to the top engineering students in Queensland.
- 2012 **Advanced Study Program in Science (invitation only), University of Queensland**
- 2011 **Medallion for academic excellence across all subjects, Villanova College**
- 2011 **Titration National Finalist and Regional Winner, Royal Australian Chemical Institute**

VOLUNTEER EXPERIENCE

- 2010 – 2011 **Member of the Australian Filipino Augustinian Solidarity**
- Assisted the organization of fetes and fundraising activities which raised money for the less fortunate people in the Philippines.
- 2007 – 2011 **Villanova College Student Council**
- Vice-President (2011)
- 2004 – 2011 **Queensland Colleges Music Festival Volunteer**
- Compering events and performances. Assisted in back-stage set-up and acted as an ambassador for the college.
- 2009 **St Vincent De Paul Homeless Shelter Volunteer**
- 2009 **Greenslopes Hospital Volunteer**
- 2009 **Heart Foundation Volunteer**
-

PUBLICATIONS

Journal Papers

- **D. Muthukrishna** and D. Parkinson, *A cosmographic analysis of the transition to acceleration using SN-Ia and BAO*, J. Cosmol. Astropart. Phys. (2016). <https://arxiv.org/abs/1607.01884>.
- M. J. Childress, et al., *OzDES multi-object spectroscopy for the Dark Energy Survey: 3-yr results and first data release*, Monthly Notices of the Royal Astronomical Society. **472** (2017). <https://doi.org/10.1093/mnras/stx1872>.
- **D. Muthukrishna**, D. Parkinson, B. Tucker, *DASH: Deep learning for the Spectral Classification of Supernovae*, ApJ. (2017). (In preparation).
- V. Firpo, **D. Muthukrishna**, F. Campuzano-Castro, S. Torres-Flores, G. Bosch and G. Hagele, *Violent star-forming processes in interacting galaxies*, MNRAS. (2017). (In preparation).

Astronomical Telegrams

- **D. Muthukrishna**, et al., *Classification of 17 DES supernova with OzDES*, The Astronomer's Telegram **10759** (2017). <http://adsabs.harvard.edu/abs/2017ATel10759....1M>.
- B. E. Tucker, et al., *WiFeS Classification of SMT17kdl/SN2017edm as a Type Ia Supernova*, The Astronomer's Telegram **10444** (2017). <http://www.astronomerstelegam.org/?read=10444>.
- B. E. Tucker, et al., *First Confirmed Supernova with the SkyMapper/Zooniverse Supernova Sighting Project*, The Astronomer's Telegram **10426** (2017). <http://adsabs.harvard.edu/abs/2017ATel10426....1T>.
- R. Sharp, et al., *Classification of 11 DES supernova with OzDES*, The Astronomer's Telegram **9961** (2017). <http://adsabs.harvard.edu/abs/2017ATel.9961....1S>
- M. Sullivan et al., *Classification of DES16C3dmp as a SLSN-I by VLT*, The Astronomer's Telegram **9953** (2017). <http://adsabs.harvard.edu/abs/2017ATel.9953....1S>
- J. K. Hoormann, et al., *Classification of 17 DES Supernova with OzDES*, The Astronomer's Telegram **9855** (2016). <http://adsabs.harvard.edu/abs/2016ATel.9855....1H>
- D. Mudd, et al., *Classification of 17 DES supernova with OzDES*, The Astronomer's Telegram **9742** (2016). <http://adsabs.harvard.edu/abs/2016ATel.9742....1M>

Posters

- N. Lowson, **D. Muthukrishna**, and B. Tucker, *Determining the Progenitor of the Peculiar Transient DES16X3bdj*, Poster presented at the *Australian Society of Astronomy Annual Meeting* in Canberra, Australia (2017).
 - V. Firpo, **D. Muthukrishna**, F. Campuzano-Castro, S. Torres-Flores, G. Bosch and G. Hagele, *Violent star-forming processes in interacting galaxies*, Poster presented at the *European Week of Astronomy and Space Science* in Prague, Czech Republic (2017).
 - **D. Muthukrishna**, D. Parkinson and B. Tucker, *DASH: Deep Learning for the Spectral Classification of Supernovae*, Poster presented at the *6th Annual CAASTRO Conference* in Perth, Australia (2016).
-