

# Luke A. Barnes

Phone: +61 2 47360 610  
Email: L.Barnes2@westernsydney.edu.au  
Website: www.lukebarnes.info

School of Computing, Engineering  
and Mathematics  
Y2 13, Kingswood Campus  
Western Sydney University  
NSW, Australia 2751

---

## Employment

2018-present	<b>John Templeton Fellow</b>	Western Sydney University
2015 - 2017	<b>John Templeton Fellow</b>	University of Sydney, Australia
2011 - 2014	<b>SuperScience Fellow</b>	University of Sydney, Australia
2009 - 2011	<b>Postdoctoral Researcher</b>	Institute for Astronomy, ETH, Zurich

## Education

2006 - 2009	<b>PhD - Astronomy</b> Institute of Astronomy University of Cambridge	Supervisor: Dr. Martin Haehnelt <i>Studying Galaxy Formation through Lyman Alpha in Emission and Absorption</i>
2006	<b>MSc - Physics</b> School of Physics University of Sydney	Supervisor: A/Prof. Geraint Lewis <i>Geodesics, General Relativity and Spacetime</i>
2002-2005	<b>BSc (Hons) - Physics</b> School of Physics University of Sydney	Supervisor: A/Prof. Geraint Lewis <i>Dark Energy and Cosmic Acceleration</i>

## Research Interests

I am a theoretical astrophysicist and cosmologist with a broad range of interests. I have modelled galaxy formation in a cosmological context with supercomputer simulations. I have connected those simulations to observations with modeling of radiative transfer (particularly Lyman alpha emission and absorption) and realistic models of IFU observations. I have investigated the fine-tuning of the universe for intelligent life, modelling the effect of the cosmological constant on galaxy formation and the effect of alternative nuclear physics on stars. I have contributed to the philosophy of science by considering the challenges of testing multiverse theories using probability theory.

## Public Outreach

(videos of talks available at [lukebarnes.info](http://lukebarnes.info))

Since 2008, I have given over 50 public lectures on astronomy, cosmology and physics to amateur astronomy societies, undergraduate and school students, science festivals, and philosophers. I was invited to present the Astronomical Society of Australia's prestigious 2016 Harley Wood Lecture.

In October 2016, Cambridge University Press published my popular-level book, written with Geraint Lewis, titled "A Fortunate Universe: Life in a Finely-Tuned Cosmos". The

book was very favourably reviewed in the Wall Street Journal: “charming, intelligent and exceedingly well-written.” We launched the book with Dr Karl, and to promote the book, I have written press releases, made an animated promotional video ([youtu.be/bRvRMNprRIk](https://youtu.be/bRvRMNprRIk)), given public talks, done radio interviews, published online articles, promoted on social media, and organised workshops for astronomers and particle physicists on fine-tuning at Sydney. I have given over **55** public talks in 2016-7.

## Teaching

2016-7	<b>Lecturer - Special Relativity</b> (12 lectures, Intermediate Physics) University of Sydney
2015	<b>Summer School Lecturer - Fine-tuning of the Universe for life</b> (Four 1 hour lectures) St. Thomas Summer Seminar in Philosophy of Religion, Minnesota
2013-2015	<b>Supervisor and tutor</b> University of Sydney Astronomy (2013) Computational Physics: Engineering Optics (2013, 2015) Experimental Physics (2014) Computational Physics: Quantum Mechanics (2015)
2013	<b>Summer School Lecturer - Fine-tuning of the Universe for life</b> (Two 1.5 hour lectures) University of California Santa Cruz Summer Institute in Philosophy of Cosmology
2012	<b>Lecturer - Cosmology</b> (10 lectures, Senior Physics) University of Sydney
2011	<b>Summer School Lecturer - Fine-tuning of the Universe for life</b> (Four 1 hour lectures) St. Thomas Summer Seminar in Philosophy of Religion, Minnesota
2011	<b>Lecturer - Cosmology</b> (5 lectures) ETH Zurich
2010	<b>Tutor – Cosmology, Electromagnetism</b> ETH Zurich
2007-2009	<b>Tutor – Part II (3rd Year) Astrophysics</b> Institute of Astronomy, University of Cambridge Topics in Contemporary Astrophysics Statistical Physics General Relativity

## Awards and Grants

2015	John Templeton Foundation grant (\$450k)
2007	CISRA Postgraduate Physics Prize Best refereed publication in a leading international journal
2006-2009	Cambridge Australia Trust Poynton Scholarship
2006-2009	Overseas Research Studentship
2006	Henry Chamberlain Russell Prize in Astronomy Best Honours research project in Astronomy, USyd
2006	Australian Postgraduate Award

2006	School of Physics Denison Merit Award, University of Sydney
2005	University Medal, University of Sydney
2005	University of Sydney Honours Scholarship
2005	School of Physics Honours Scholarship

## Conference and Seminars

### LOC and SOC

- 2017 Workshop: “A Fractured Universe? Fundamental Physics, Symmetry and Life”, hosted at the University of Sydney. [www.physics.usyd.edu.au/~luke/2017FTConf/](http://www.physics.usyd.edu.au/~luke/2017FTConf/)
- 2016 “Fine-tuning, the Multiverse and Life Workshop”, hosted at the University of Sydney. [www.physics.usyd.edu.au/~luke/2016FTConf/](http://www.physics.usyd.edu.au/~luke/2016FTConf/)

### Invited Conference Talks

- International Conference on the Physics of Fine-Tuning, part of Oxford University’s Consolidation of Fine-Tuning Project. Crete (June 2017)
- Australian Frontiers of Science Symposium: The Edges of Astronomy, Australian Academy of Science (December 2014)

### Awarded Conference Talks

- 13th International Symposium on Cosmology and Particle Astrophysics (CosPA), Sydney (November 2016)
- Diving into the Dark: Bridging Cosmological Theory & Observation, Cairns (July 2016)
- Astronomical Society of Australia Annual Scientific Meeting, Sydney (July 2016)
- Australian National Institute for Theoretical Astrophysics (ANITA) workshop, Monash University (February 2016)
- Bolton Symposium, CSIRO Astronomy & Space Science (February 2016)
- Philosophy of Cosmology Conference, Tenerife (August 2014)
- Australian National Institute for Theoretical Astrophysics (ANITA) workshop, University of Sydney (February 2014)
- Lyman alpha as an Astrophysical Tool, Nordita, Stockholm (September, 2013)
- Feeding, Feedback and Fireworks Conference, Hamilton Island (June 2013)
- SIFa Research Seminar, University of Sydney (May 2013)
- Australian National Institute for Theoretical Astrophysics (ANITA) workshop, University of Queensland (February 2013)
- ATNF/AAO Bolton Symposium, Australia Telescope National Facility, Marsfield (December 2012)
- Astronomy Research Colloquium, University of Melbourne (September 2012)
- Galactic Winds of Change, Sesto Italy (July 2012)
- School of Physics Research Bite, University of Sydney (May 2012)
- Inaugural Symposium of Super Science Fellows, University of Tasmania (April 2012)
- ETH Astronomy Seminar/Lecture, ETH Zurich (January 2011)
- ETH Astronomy Research Seminar, Zurich (April 2010)
- XXVth IAP Annual Colloquium: the Lyman Alpha Universe, Paris (July 2009)

- Understanding Lyman-alpha Emitters, MPA Heidelberg (Poster, October 2008)

## Computing

- 1,100,000+ hours of computing time awarded by ASTAC in 2012-17
- Proficient in Python, Fortran, Matlab, HTML, Latex, MPI.
- Familiar with C, C++, Unix and Linux, MIDAS, VIPGI, EZ, Bash

## Publications

All citation statistics from Google Scholar, November 2017.

- One published book, with Cambridge University Press (2016)
- 33 published refereed papers since 2005, with 2019 citations
- 12 first author papers (numbered in **bold** below), with 257 citations
- h-index: 19

Of the 33 peer-reviewed papers in my publication list, most appear in journals ranked as A\* (60%) or A (12%) by the 2010 Excellence in Research for Australia (ERA) initiative. In my publication list, the number of citations to each article is provided (from Google Scholar) along with the journal's impact factor, which measures the yearly average number of citations to recent articles published in that journal. For A\* astronomy journals, this number is typically about 4.9 (*Monthly Notices of the Royal Astronomical Society*) to 6.7 (*The Astrophysical Journal*).

The *European Journal for Philosophy of Science*, being in a different field, has a lower impact factor of 0.818. A\* rated journals in this field typically have impact factors of 0.855 (Synthese) to 1.5 (*British Journal for the Philosophy of Science*).

Papers that indicate my place in the author list "(x/y)" are as a part of observational projects. Papers [24]-[26] are with the SAMI collaboration, where I lead the synthetic pipeline team. Earlier papers are with the zCOSMOS project: a 600hr VIMOS survey of 40,000 galaxies. My contribution to each zCOSMOS paper is as part of the reduction and analysis team. I analysed spectra and solved mismatched spectroscopic and photometric redshifts. My inclusion in the author list marks my significant contribution to these large collaborative projects.

## Authored Books

*A Fortunate Universe: Life in a Finely Tuned Cosmos*, with Geraint Lewis. Cambridge University Press, 2016.

## Book Chapters

2. "The Fine-Tuning of the Universe for Life". Forthcoming in *A Companion to the Philosophy of Physics*, eds. Eleanor Knox and Alastair Wilson, Routledge.
1. "Testing the Multiverse: Bayes, Fine-Tuning and Typicality". Published in "The Philosophy of Cosmology", edited by Khalil Chamcham, Joseph Silk, John D. Barrow, and Simon Saunders. Cambridge University Press, 2017

## Refereed

- [33] “The SAMI Galaxy Survey: understanding observations of large-scale outflows at low redshift with EAGLE simulations.” Tescari, E.; Cortese, L.; Power, C.; Wyithe, J. S. B.; Ho, I.-T.; Crain, R. A.; Bland-Hawthorn, J.; Croom, S. M.; Kewley, L. J.; Schaye, J.; Bower, R. G.; Theuns, T.; Schaller, M.; **Barnes**, L. A. et al. *Monthly Notices of the Royal Astronomical Society*, Volume 473, Issue 1, p.380-397. [Citations: 0. Journal impact factor: 4.9]
- [32] “Galaxy Formation Efficiency and the Cosmological Constant with EAGLE Simulations” **Barnes**, Luke A., Elahi, P. J., Salcido, J., Bower R. G., Lewis, G. F., Theuns, T., Schaller, M., Crain, R. A., Schaye, J. *Monthly Notices of the Royal Astronomical Society* (accepted with minor revisions).
- [31] “The impact of dark energy on galaxy formation. What does the future of our Universe hold?” Salcido, J., Bower R. G., **Barnes**, Luke A., Lewis, G. F., and Elahi, P. J., Theuns, T., Schaller, M., Crain, R. A., Schaye, J. *Monthly Notices of the Royal Astronomical Society* (accepted with minor revisions).
- [30] “Producing the deuteron in stars: anthropic limits on fundamental constants.” **Barnes**, Luke A. and Lewis, Geraint F. *Journal of Cosmology and Astroparticle Physics*, Issue 07, article id. 036 (2017). [Citations: 1. Journal impact factor: 5.81]
- [29] “Fine-tuning in the context of Bayesian theory testing.” **Barnes**, Luke A. *European Journal for Philosophy of Science*, Aug. (2017). [Citations: 0. Journal impact factor: 0.818]
- [28] “Primordial nucleosynthesis in the  $\Lambda$ CDM cosmology: pouring cold water on the simmering Universe.” Lewis, Geraint F, Barnes, Luke A. and Kaushik, Rajesh. *Monthly Notices of the Royal Astronomical Society*, 460, 1, p.291-296 (2016). [Citations: 2. Journal impact factor: 4.9]
- [27] “Binding the diproton in stars: anthropic limits on the strength of gravity.” **Barnes**, Luke A. *Journal of Cosmology and Astroparticle Physics*, Issue 12, article id. 050 (2015). [Citations: 4. Journal impact factor: 5.81]
- [26] “The SAMI Galaxy Survey: instrument specification and target selection.” Bryant, J. J.; Owers, M. S.; Robotham, A. S. G... Barnes, L. A. (16/58), ... & Walcher, C. J. *Monthly Notices of the Royal Astronomical Society*, 447, 3, p.2857-2879 (2015). [Citations: 103. Journal impact factor: 4.9]
- [25] “The SAMI Galaxy Survey: Early Data Release.” Allen, J. T., Croom, S. M., Konstantopoulos, I. S., ... Barnes, L. A. (16/48), ... & Walcher, C. J. *Monthly Notices of the Royal Astronomical Society*, 446, 2, p. 1551-1566 (2015). [Citations: 60. Journal impact factor: 4.9]
- [24] “The SAMI Galaxy Survey: cubism and covariance, putting round pegs into square holes.” Sharp, R.; Allen, J. T.; Fogarty, L. M. R... Barnes, L. A. (11/49), ... & Walcher, C. J. *Monthly Notices of the Royal Astronomical Society*, 446, 2,

- p.1567-1583 (2015). [Citations: 38. Journal impact factor: 4.9]
- [23] “Ly- $\alpha$  and Mg II as Probes of Galaxies and Their Environment” (Invited Review). **Barnes**, Luke A., Garel, T., Kacprzak, G.G. Publications of the Astronomical Society of the Pacific, 126, 945, 969-1009 (2014). [Citations: 20. Journal impact factor: 3.2]
- [22] “The bias of DLAs at  $z \sim 2.3$ : Evidence for very strong stellar feedback in shallow potential wells.” **Barnes**, Luke A., Haehnelt, Martin G. Monthly Notices of the Royal Astronomical Society, 440, 3, p.2313-2321. [Citations: 20. Journal impact factor: 4.9]
- [21] “Spot the difference. Impact of different selection criteria on observed properties of passive galaxies in zCOSMOS-20k sample.” Moresco, M., Pozzetti, L., Cimatti, A., ... Barnes, L. (41/53), ... & Welikala, N. Astronomy and Astrophysics, 558, A61, 18pp. (2013). [Citations: 38. Journal impact factor: 5.1]
- [20] “Investigating the relationship between AGN activity and stellar mass in zCOSMOS galaxies at  $0 < z < 1$  using emission-line diagnostic diagrams.” Vitale, M., Mignoli, M., Cimatti, A., ... Barnes, L. (14/52), ... & Zucca, E. Astronomy and Astrophysics, 556, A11, 20pp. (2013). [Citations: 11. Journal impact factor: 5.1]
- [19] “The Colors of Central and Satellite Galaxies in zCOSMOS Out to  $z \sim 0.8$  and Implications for Quenching.” Knobel, C., Lilly, S. J., Kovac;, K., ... Barnes, L. (39/50), ... & Welikala, N. The Astrophysical Journal, 769, 24, 10pp. (2013). [Citations: 43. Journal impact factor: 6.7]
- [18] “The Fine Tuning of the Universe for Intelligent Life.” **Barnes**, Luke A.; Publications of the Astronomical Society of Australia, 29, 4, 529-564 (2012). [Citations: 34. Journal impact factor: 3.1]
- [17] “The dominant role of mergers in the size evolution of massive early-type galaxies since  $z \sim 1$ .” Lopez-Sanjuan, C., Le Fevre, O., Ilbert, O., ... Barnes, L. (52/63), ... & Welikala, N. Astronomy and Astrophysics, 548, A7, 18pp. (2012). [Citations: 85. Journal impact factor: 5.1]
- [16] “Improved constraints on the expansion rate of the Universe up to  $z \sim 1.1$  from the spectroscopic evolution of cosmic chronometers.” Moresco, M., Cimatti, A., Jimenez, R., ... Barnes, L. (51/68), ... & Welikala, N. Journal of Cosmology and Astroparticle Physics, 8, 6, 15pp. (2012). [Citations: 219. Journal impact factor: 6.0]
- [15] “A Group-galaxy Cross-correlation Function Analysis in zCOSMOS.” Knobel, C., Lilly, S. J., Carollo, C. M., ... Barnes, L. (38/49), ... & Welikala, N. The Astrophysical Journal, 755, 48, 12pp. (2012). [Citations: 11. Journal impact factor: 6.7]
- [14] “The COSMOS density field: a reconstruction using both weak lensing and galaxy distributions.” Amara, A., Lilly, S., Kovac;, K., ... Barnes, L. (41/52), ...

- & Welikala, N. *Monthly Notices of the Royal Astronomical Society*, 424, 553-563 (2012). [Citations: 16. Journal impact factor: 4.9]
- [13] “The zCOSMOS 20k Group Catalog.” Knobel, C., Lilly, S. J., Iovino, A., ... Barnes, L. (40/51), ... & Welikala, N. *The Astrophysical Journal*, 753, 121, 24pp. (2012). [Citations: 60. Journal impact factor: 6.7]
- [12] “X-Ray Groups of Galaxies at  $0.5 < z < 1$  in zCOSMOS: Increased AGN Activities in High Redshift Groups.” Tanaka, M., Finoguenov, A., Lilly, S. J., ... Barnes, L. (40/51), ... & Welikala, N. *Publications of the Astronomical Society of Japan*, 64, 22-32 (2012). [Citations: 22. Journal impact factor: 2.4]
- [11] “A journey from the outskirts to the cores of groups. I. Color- and mass-segregation in 20K-zCOSMOS groups.” Presotto, V., Iovino, A., Scodreggio, M., ... Barnes, L. (43/52), ... & Welikala, N. *Astronomy and Astrophysics*, 539, A55, 19pp. (2012). [Citations: 27. Journal impact factor: 5.1]
- [10] “Galactic winds and extended Ly $\alpha$  emission from the host galaxies of high column density quasistellar object absorption systems.” Barnes, Luke A., et al. *Monthly Notices of the Royal Astronomical Society* 416, 3, 1723-1738 (2011). [Citations: 53. Journal impact factor: 4.9]
- [9] “The Radial and Azimuthal Profiles of Mg II Absorption around  $0.5 < z < 0.9$  zCOSMOS Galaxies of Different Colors, Masses, and Environments.” Bordoloi, R., Lilly, S. J., Knobel, C., ... Barnes, L. (40/53), ... & Welikala, N. *The Astrophysical Journal*, 743, 10-20 (2011). [Citations: 147. Journal impact factor: 6.7]
- [8] “Faint extended Ly $\alpha$  emission due to star formation at the centre of high column density QSO absorption systems.” Barnes, Luke A., Haehnelt, Martin G. *Monthly Notices of the Royal Astronomical Society*, 403, 870-885 (2010). [Citations: 44. Journal impact factor: 4.9]
- [7] “Mass and Environment as Drivers of Galaxy Evolution in SDSS and zCOSMOS and the Origin of the Schechter Function.” Peng, Y., Lilly, S. J., Kovac, K., ... Barnes, L. (46/64), ... & Scaramella, R. *The Astrophysical Journal*, 721, 193-221 (2010). [Citations: 822. Journal impact factor: 6.7]
- [6] “A joint model for the emission and absorption properties of damped Lyman Alpha systems.” Barnes, Luke A., Haehnelt, Martin G. *Monthly Notices of the Royal Astronomical Society* 397, 511-519 (2008). [Citations: 35. Journal impact factor: 4.9]
- [5] “Cosmological Radar Ranging in an Expanding Universe.” Lewis, Geraint F., Francis, Matthew J., Barnes, Luke A., Kwan, Juliana, James, J. Berian. *Monthly Notices of the Royal Astronomical Society*, 388, 960-964 (2008). [Citations: 6. Journal impact factor: 4.9]
- [4] “Coordinate confusion in conformal cosmology.” Lewis, Geraint F., Francis, Matthew J., Barnes, Luke A., James, J. Berian. *Monthly Notices of the Royal*

- Astronomical Society, 381, L50-L54 (2007). [Citations: 11. Journal impact factor: 4.9]
- [3] “Expanding Space: the Root of all Evil?” Francis, Matthew J.; Barnes, Luke A.; James, J. Berian; Lewis, Geraint F. *Publications of the Astronomical Society of Australia*, 24, 95-102 (2007). [Citations: 39. Journal impact factor: 3.1]
- [2] “Joining the Hubble flow: implications for expanding space.” **Barnes**, Luke A.; Francis, Matthew J.; James, J. Berian; Lewis, Geraint F. *Monthly Notices of the Royal Astronomical Society*, 373, 382 -390 (2006). [Citations: 28. Journal impact factor: 4.9]
- [1] “The Influence of Evolving Dark Energy on Cosmology.” **Barnes**, Luke A.; Francis, Matthew J.; Lewis, Geraint F.; Linder, Eric V. *Publications of the Astronomical Society of Australia*, 22, 315-325 (2005). [Citations: 18. Journal impact factor: 3.1]

### **Other publication outputs**

6. Can Dark Energy Kill Galaxies? *Nautilus* (nautil.us), March 23, 2017.
5. *Review: The Big Picture by Sean Carroll*. *Inference: International Review of Science*. December 31, 2016.
4. *The Fine-Tuning of Nature's Laws*, Luke A. Barnes. *The New Atlantis*, No. 47 (Fall 2015), pp. 87-97
3. *Have cosmologists lost their minds in the multiverse?* *The Conversation*, 13 May 2014.
2. *Cosmology Q&A*. *Australian Physics*, 51, 2, 42 (March 2014).
1. *A universe from nothing? Putting the Krauss-Craig debate into perspective*. ABC Online Opinion, August 2013 (ab.co/1gc0WGz)