

# KATHERINE J. MACK

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## PRIMARY RESEARCH AREAS

Dark matter; astroparticle physics; high-redshift 21-cm astronomy; early-universe cosmology. *Ongoing program: producing a self-consistent model of dark matter particle phenomenology and the formation of the earliest structures in the Universe.*

## EDUCATION AND CAREER

**University of Melbourne**, Astronomy Group, School of Physics 2015 –  
CAASTRO-CoEPP Postdoc Fellowship, Theoretical Cosmology (Level B)  
**University of Melbourne**, Astronomy Group, School of Physics 2012 –  
ARC Discovery Early Career Researcher Award (Postdoctoral Fellowship)  
**Univ of Cambridge**, Kavli Inst. for Cosmology/Inst. of Astronomy 2009 – 2012  
STFC Postdoctoral Fellowship  
**Princeton University**, Ph.D., Astrophysical Sciences Sept 2009  
**California Institute of Technology**, B.S., Physics June 2003

## GRANTS, SCHOLARSHIPS, AND AWARDS

Australian Institute of Physics Women in Physics Lectureship 2017  
Dyason Fellowship (for international collaboration) 2016  
A\$5,000  
Faculty of Science Dean's Award for Excellence in Engagement 2016  
University of Melbourne Excellence in Engagement – Public Value 2016  
A\$10,000  
ARC Discovery Early Career Researcher Award 2012 –  
A\$375,000; University of Melbourne  
STFC Postdoctoral Fellowship 2009 – 2012  
£226,726; University of Cambridge  
National Science Foundation Graduate Research Fellowship 2005 – 2008  
Full stipend, 3 years; Princeton University  
Caltech Merit Scholarship 1999 – 2003  
Full tuition, 4 years; California Institute of Technology

## PUBLICATION SUMMARY

My publications cover many topics, including early universe cosmology, astroparticle theory, dark matter phenomenology, and high-redshift astronomy, and are published in a range of high-impact international journals: *Monthly Notices of the Royal Astronomical Society*, *The Journal of Cosmology and Astroparticle Physics*, *The Astrophysical Journal*, and *Physical Review D*. I also have two refereed publications in Proceedings of Science that comprise chapters of the Square Kilometer Array Science Book. (See full list, page 3.)

### Publication Metrics:

- 473 total citations; average 34 citations per paper
- 213 normalized citations (total of citations/authors)
- 13 refereed publications, 1 preprint. 2 sole-author papers

## LEADERSHIP

- Chair: Australian Supercomputer Time Allocation Committee (2014)
- Executive: Australian Astronomy Decadal Plan Working Group on High-Energy and Fundamental Astrophysics (2013-2014)
- Steering Committee: ASA Inclusion, Diversity, and Equity in Astronomy group (2015-present)
- Collaboration Member: Australian SABRE Dark Matter Detector project (at Stawell Underground Physics Laboratory)
- Research Team Co-Investigator and Media and Outreach Director for SkyHopper Infrared Space Telescope CubeSat project (U Melbourne)

## PROFESSIONAL ACTIVITIES

- Member, SKA Epoch of Reionization Working Group; SKA Cosmology Working Group; Science Case Contributor
- Organization for *CAASTRO/CoEPP Workshop* (2014, 2016), *CAASTRO Dark Theme Workshop "Diving Into the Dark"* (2016), *ASA Diversity in Astronomy workshop* (2016), *Asia-Pacific Symposium on Cosmology and Particle Astrophysics* (2014), *Azores School on Obs. Cosmology* (2011), *Phi in the Sky: The Quest for Cosmological Scalar Fields* (2004)
- Referee, *Journal of Cosmology and Astroparticle Physics*, *Astrophysical Journal*, *Monthly Notices of the Royal Astronomical Society*, *Physics Letters B*, *Marsden Fund*, *Australian Research Council (ARC)*
- Member, *American Astronomical Society*; *Institute of Physics*; *Planetary Society*; *Astronomical Society of Australia*; *Australian National Institute for Theoretical Astrophysics (ANITA)*; *ARC Centre of Excellence for All-Sky Astrophysics (CAASTRO)*; *ARC Centre of Excellence for Particle Physics at the Terascale (CoEPP)*

## KEY BROADER IMPACTS

- Opening liaison initiating Stawell Underground Physics Laboratory project
- Highly influential engagement via Twitter as @AstroKatie (130,000 followers)
  - Worldwide 5<sup>th</sup> most-followed astronomer; 5<sup>th</sup> most-followed physicist
  - Followed by 71% of astronomers on Twitter (ranking 1<sup>st</sup>)
  - Followed by 53% of physicists on Twitter (ranking 2<sup>nd</sup>)
  - Followed by 54% of professional science writers on Twitter
  - Listed on over 1600 public Twitter lists
- 30,000 views on YouTube (via astronomy web series "Pint in the Sky" and "Conversations with an Astrophysicist")
- 35,000 page views on blog "The Universe, In Theory"; 98,000 on Reddit AMA
- Finalist, AAAS Early Career Award, Public Engagement with Science (2014-15)
- Columnist, *Cosmos Magazine* (circulation: 114,000 print; 130,000 web)

## TEACHING AND SUPERVISING

Cosmology (master's level), African Inst. for Mathematical Sciences, Rwanda (2016)

PHYC90009: *Physical Cosmology*, Melbourne (2016)

PHYC10008: *From the Solar System to the Cosmos*, Melbourne (2013, 2014)

E2C3 *Dark Side of the Universe*, Catalunya Caixa Youth in Science Program (2012)

TA: AST 203/105, *The Universe/Our Place in the Universe*, Princeton (2005/2009)

Co-Supervising: U Melbourne Master's student Cassandra Avram (2014-2015)

Co-Supervising: U Melbourne PhD candidate Sarah Schon (2013-)

Co-Supervising: U Cambridge Master's student Matthew Burgess (2011-2012)

## REFEREED PUBLICATIONS

- Holwerda, B.W., Keel, W.C., Kenworthy, M.A & **Mack, K.J.** (2015) The dependence of the AV prior for SN Ia on host mass and disc inclination. *Monthly Notices of the Royal Astronomical Society*, **451**, 2390. [arxiv:1505.03949]
- Koopmans, L.V.E. & 43 authors including **Mack, K.J.** (2014) The Cosmic Dawn and Epoch of Reionization with the Square Kilometre Array. *Proceedings of Science*, **AASKA14**, 001. [arXiv: 1505.07568]
- Schon, S., **Mack, K.J.**, Avram, C., Wyithe, J.S.B., & Barberio, E. (2014) Dark Matter Annihilation in the First Galaxy Halos. *Monthly Notices of the Royal Astronomical Society*, **451**, 2840. [arxiv:1411.3783]
- Ciardi, B., Inoue, S., **Mack, K.J.**, Xu, Y. & Bernardi, G. (2014) 21cm Forest with the SKA. *Proceedings of Science*, **AASKA14**, 006. [arXiv:1501.04425]
- **Mack, K.J.** (2014) Known Unknowns of Dark Matter Annihilation Over Cosmic Time. *Monthly Notices of the Royal Astronomical Society*, **439**, 2728. [arXiv:1309.7783]
- **Mack, K.J.** & Wyithe, J.S.B. (2012) Detecting the redshifted 21cm forest during reionization. *Monthly Notices of the Royal Astronomical Society* **425**, 2988. [arXiv:1101.5431]
- **Mack, K.J.** (2011) Axions, inflation, and the anthropic principle. *The Journal of Cosmology and Astroparticle Physics* **1107**, 021. [arXiv:0911.0421]
- **Mack, K.J.** & Steinhardt, P.J. (2011) Cosmological problems with multiple axion-like fields. *The Journal of Cosmology and Astroparticle Physics* **1105**, 001. [arXiv:0911.0418]
- Ricotti, M., Ostriker, J.P. & **Mack, K.J.** (2008) Effect of primordial black holes on the cosmic microwave background and cosmological parameter estimates. *The Astrophysical Journal* **680**, 829. [arXiv:0709.0524]
- **Mack, K.J.**, Wesley, D.H. & King, L.J. (2007) Observing cosmic string loops with gravitational lensing surveys. *Physical Review D* **76**, 123515. [arXiv:astro-ph/0702648]
- **Mack, K.J.**, Ostriker, J.P. & Ricotti, M. (2007) Growth of structure seeded by primordial black holes. *The Astrophysical Journal* **665**, 1277. [arXiv:astro-ph/0608642]
- Efstathiou, G. & **Mack, K.J.** (2005) The Lyth Bound revisited. *Journal of Cosmology and Astroparticle Physics* **0505**, 008. [arXiv:astro-ph/0503360]
- Oh, S.P. & **Mack, K.J.** (2003) Foregrounds for 21cm observations of neutral gas at high redshift. *Monthly Notices of the Royal Astronomical Society* **346**, 871. [arXiv:astro-ph/0302099]

## PREPRINTS

- **Mack, K.J.** & Wesley, D.H. (2008) Primordial black holes in the Dark Ages: Observational prospects for future 21cm surveys. [arXiv:0805.1531]

## SELECTED RECENT COLLOQUIA & INVITED CONFERENCE TALKS\*

- \*Cosmological Quests for the Next Decade, Daejeon, Korea (April 2017)
- \*Physics of Cosmic Dawn and Reionization in the SKA Era, Sexten, Italy (Jan 2016)
- ICRAR Colloquium, University of Western Australia (December 2015)
- UNSW School of Physics Colloquium (October 2015)
- Swinburne CAS Colloquium (August 2015)
- \*Astronomical Society of Australia Meeting (July 2015)
- Aspen Center for Physics Colloquium (June 2015)
- \*Cospa Cosmology Conference, University of Auckland (December 2014)
- RSAA Colloquium, Australian National University, Australia (November 2014)
- \*CAASTRO/CoEPP Joint Workshop, Great Western, Australia (September 2014)
- CASS Colloquium, CSIRO Sydney (June 2014)
- Physics Colloquium, University of Melbourne (April 2014)
- Physics Colloquium, Occidental College (March 2014)
- \*CoEPP Annual Workshop, Wollongong (February 2014)
- Physics Colloquium, University of Adelaide (November 2013)
- Physics Colloquium, University of Auckland (August 2013)
- Astrophysics Science Division Colloquium, Goddard Space Flight Center (July 2013)
- \*SKA1-Low Science Assessment Workshop (March 2013)

## SELECTED POPULAR ARTICLES AND PUBLIC TALKS

- “Dispatches from a Dark Universe,” Final Frontier Festival, Melb (June 2016)
- “Everything You Wanted to Know About Dark Matter but Were Afraid to Ask,” Juilliard School, New York (March 2016)
- “Astrophysicist Katie Mack Explains the Universe”, Seattle (Jan 2015)
- “A Tour of the Universe (and Selected Cosmic Mysteries)”, Imperial College London (August 2014); Swinburne University of Technology (December 2014)
- “The Dark Matter Poltergeist,” Slate (February 2014)
- “Our Place in the Universe,” A Life in Science Lecture Series, University of Auckland (August 2013)
- “Space Station’s Detector Has Not Found Dark Matter, Despite What Some Media Reports Say,” Physics Focus Blog (April 2013)
- “Are We Alone? - Science at the Edge” Exobiology panel discussion sponsored by The Age, Melbourne, Australia (April 2013)
- “Becoming an Astronaut,” *Economist* Tech Blog, *Babbage* (Sept 2012)
- “Losing Neil Armstrong,” Foundational Questions Institute Blog (Sept 2012)
- “Drawn to the Dark Side: The Enigma of Dark Matter in the Universe,” Institute of Physics Lecture Series, Royal Society of *Edinburgh* (Jan 2011)
- “AstroKatie” Column, *Cosmos* Magazine, ongoing

## RECENT PUBLIC OUTREACH/EDUCATION INVOLVEMENT

- South By Southwest Festival, “We Are All Scientists” panel (2017)
- National Geographic Live, “Mars: The Live Experience” (2016)
- Comic-Con, “The Science of Star Wars” panel (2016)
- WonderCon, “The Science of Star Wars” panel (2016)
- Pause Festival, “How Tech is Changing Our View of the Universe” (2015)
- Nat. Science Week “Space Oddity” show, coordinated by ScienceAlert (2014)
- World Science Fiction Convention (London 2014)
- University of Melbourne Science Discovery Day 2014
- Reddit Science “Ask Me Anything” (AMA) event (April 2014)
- Online Video series: “Pint in the Sky” & “Conversations with an Astrophysicist”
- Frequent podcasts, radio, and online appearances

## REFERENCES

- **Professor Joss Bland-Hawthorn**, Director and ARC Laureate Fellow, Sydney Institute for Astrophysics, University of Sydney, [jbh@physics.usyd.edu.au](mailto:jbh@physics.usyd.edu.au)
- **Professor Richard Easther**, Professor and Head of Department, Department of Physics, University of Auckland, [r.easther@auckland.ac.nz](mailto:r.easther@auckland.ac.nz)
- **Professor George Efstathiou** F.R.S., Director, Kavli Institute for Cosmology, Institute of Astronomy, University of Cambridge, [gpe@ast.cam.ac.uk](mailto:gpe@ast.cam.ac.uk)
- **Assistant Professor Tracy Slatyer**, Department of Physics, Massachusetts Institute of Technology, [tslatyer@mit.edu](mailto:tslatyer@mit.edu)
- **Professor David Spergel**, Chair, Department of Astrophysical Sciences, Princeton University, [dns@astro.princeton.edu](mailto:dns@astro.princeton.edu)
- **Professor Paul Steinhardt**, Director, Center for Theoretical Science, Princeton University, [steinh@princeton.edu](mailto:steinh@princeton.edu)
- **Professor Raymond Volkas**, Head of School of Physics, University of Melbourne, [raymondv@unimelb.edu.au](mailto:raymondv@unimelb.edu.au)
- **Professor Rachel Webster**, Head of Astrophysics, School of Physics, University of Melbourne, [r.webster@unimelb.edu.au](mailto:r.webster@unimelb.edu.au)
- **Professor Stuart Wyithe**, ARC Laureate Fellow, School of Physics, University of Melbourne, [swyithe@physics.unimelb.edu.au](mailto:swyithe@physics.unimelb.edu.au)