

Katherine J. Mack

Department of Astrophysical Sciences
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Education June 2009 (expected) Princeton University, Ph.D., Astrophysical Sciences
 June 2003 California Institute of Technology, B.S., Physics
 Fall 2002 Cambridge University, Physics (study abroad)

Honors and Awards 2005 - 2008 National Science Foundation Graduate Research Fellowship
 1999 - 2002 Caltech Merit Scholarship

Research Interests Cosmology, early universe physics, compact objects, high-energy astrophysics

Current Research Phenomenology of axions in cosmology
 High redshift neutral hydrogen 21cm radiation as a probe of early universe physics
 Cosmological constraints on Big Bang relics

Refereed Publications

1. Ricotti, M., Ostriker, J.P. and Mack, K.J. (2008) Effect of Primordial Black Holes on the Cosmic Microwave Background and Cosmological Parameter Estimates. *The Astrophysical Journal* **680**, 829.
2. Mack, K.J., Wesley, D.H. and King, L.J. (2007) Observing cosmic string loops with gravitational lensing surveys. *Physical Review D* **76**, 123515
3. Mack, K.J., Ostriker, J.P. and Ricotti, M. (2007) Growth of structure seeded by primordial black holes. *The Astrophysical Journal* **665**, 1277.
4. Efstathiou, G. and Mack, K.J. (2005) The Lyth Bound revisited. *Journal of Cosmology and Astroparticle Physics* **05**, 008.
5. Oh, S.P. and Mack, K.J. (2003) Foregrounds for 21cm observations of neutral gas at high redshift. *Monthly Notices of the Royal Astronomical Society* **346**, 871.

Submitted / In Preparation

6. Mack, K.J. and Wesley, D.H. (2008) Primordial black holes in the Dark Ages: Observational prospects for future 21cm surveys. ([arXiv:0805.1531](https://arxiv.org/abs/0805.1531); submitted to *Physical Review D*)
7. Mack, K.J. and Steinhardt, P.J. (2008) Cosmological problems with multiple axion-like fields. (in preparation)
8. Mack, K.J. and Steinhardt, P.J. (2008) Axions, inflation, and the anthropic principle. (in preparation)

Popular Articles

- Mack, K.J. (2008) In the zone: A new method promises to reveal extrasolar planets orbiting in their suns' habitable zones, *American Scientist* (March-April 2008)
- Mack, K.J. (2006) Spotlight on . . . A slice of the solar spectrum, *Sky & Telescope* (June 2006).
- Mack, K.J. (2004) Probing the early universe – quasars and the epoch of reionization. *Griffith Observer* **68** (2), 2–16.

Published Conference Proceedings

- Mack, K.J. and Efstathiou, G. (2004) Phenomenological classification of inflationary potentials. Proceedings of “Phi in the Sky: The Quest for Cosmological Scalar Fields.” Porto, Portugal, July 2004. AIP Conference Proceedings 736.

Seminars & Invited Talks

- Dec. 2007 *Primordial black holes in the Dark Ages.*
ITC Seminar, Harvard-Smithsonian Center for Astrophysics.
- Nov. 2007 *Primordial black holes in the Dark Ages.*
- Cosmology Group Meeting, California Institute of Technology.
- INPA Journal Club, Lawrence Berkeley National Laboratory.
- KIPAC Tea Talk, Stanford University.
- Nov. 2007 *Constraining early universe relics with radio astronomy.*
- KICP Friday Seminar, University of Chicago.
- Friday Astro Lunch, Physics Department, UC Santa Barbara.
- Oct. 2007 *Primordial black holes in the Dark Ages.*
Gravity Group Lunch, Physics Department, Princeton University.
- Sep. 2007 *Primordial black holes in the Dark Ages.*
- CITA Seminar, Canadian Institute for Theoretical Astrophysics, U. Toronto.
- Frontiers of Modern Cosmology workshop, Perimeter Institute.
- Mar. 2007 *Cosmic string loops and gravitational lensing.*
Gravity Group Lunch, Physics Department, Princeton University.
- Mar. 2007 *Massive primordial black holes: observational consequences and constraints.*
Relativity and Cosmology Group, Queen Mary University.
- Feb. 2007 *Massive primordial black holes: observational consequences and constraints.*
General Relativity Group, University of Southampton.
- Jan. 2007 *Gravitational lensing with cosmic strings.*
Bread & Cheese Seminar, IoA, University of Cambridge.
- Nov. 2006 *Massive primordial black holes: observational consequences and constraints.*
Joint Cosmology Lunch, DAMTP, University of Cambridge.
- Jul. 2005 *Tensor modes and the inflaton field.*
Physics Department, University of Rome “La Sapienza.”
- Jan. 2005 *Phenomenological classification of inflationary potentials.*
Department of Physics, Stanford University.

Contributed Talks & Posters

- May 2008 *Primordial black holes in the Dark Ages.* Contributed poster, Sackler 21cm Cosmology Conference, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA.
- Jan. 2008 *Primordial black holes in the Dark Ages.* Contributed presentation, American Astronomical Society 211th Meeting, Austin, TX.
- Aug. 2007 *Primordial black holes in the Dark Ages.* Contributed presentation, Cosmo 07, University of Sussex. Brighton, UK.
- Jul. 2007 *Cosmic string loops and gravitational lensing.* Contributed presentation, PASCOS 2007, Imperial College London. London, UK.
- Dec. 2006 *Massive primordial black holes: observational consequences and constraints.* Contributed presentation, UK Cosmo, King’s College London. London, UK.
- Aug. 2005 *Phenomenological classification of inflationary potentials.* Contributed presentation, Cosmo 05, University of Bonn. Bonn, Germany.
- Aug. 2005 *Growth of primordial black holes.* Contributed poster, Open Questions in Cosmology:

- The First Billion Years. Garching, Germany.
- Jun. 2005 *Growth of primordial black holes*. Contributed poster, Reionizing the Universe: The Epoch of Reionization and the Physics of the IGM. Groningen, Netherlands.
- Jan. 2005 *Growth of primordial black holes*. Contributed poster, American Astronomical Society 205th Meeting, San Diego, CA.
- Jul. 2004 *Phenomenological classification of inflationary potentials*. “Phi in the Sky: The Quest for Cosmological Scalar Fields.” Porto, Portugal.
- Jan. 2003 Mack, K.J. and Oh, S.P. (2003) *Foregrounds for future 21cm observations at high redshift*. Bulletin of the American Astronomical Society 34, 1234. Seattle, WA.
- Nov. 2002 *Foregrounds for future 21cm observations of the high redshift universe*. Contributed poster, Institute of Physics Young Physicists’ Conference, Manchester, UK.
- Aug. 2002 *Foregrounds for future 21cm observations of the high redshift universe*. Caltech SURF (Summer) Seminar Day, California Institute of Technology.
- Oct. 2001 *Neutron-antineutron oscillation and annihilation*. Joint presentation with Prof. Kenneth Ganezer. Super-Kamiokande Collaboration Meeting, Maui, Hawaii.
- Nov. 2000 *Laser calibration of K2K water-Cherenkov near detector*. Southern California Conference on Undergraduate Research, Long Beach, CA.
- Oct. 1999 *Helium density measurements*. Caltech SURF Seminar Day, California Institute of Technology.
- Nov. 1998 *Overview of neutrino mass findings of Super-Kamiokande and ongoing studies*. Southern California Conference on Undergraduate Research, Pomona, CA.
- Oct. 1998 *Overview of neutrino mass findings of Super-Kamiokande*. Meeting of the Southern California Section of the American Association of Physics Teachers, Irvine, CA.

Past Research Experience

- Spring 2004 Cosmological inflation models (G. Efstathiou)
Visiting researcher, Institute of Astronomy, Cambridge University
- Summer 2003 Numerical relativity (D. Pollney & J. Thornburg)
Visiting researcher, Max-Planck Inst. Gravitational Physics
- Summer 2002 Semi-analytical modeling of redshifted 21cm observations (S.-P. Oh & E.S. Phinney)
Summer Undergraduate Research Fellow, California Institute of Technology
- Summer 2000 Neutron-antineutron oscillation simulations (K. Ganezer)
Research assistant, California State University, Dominguez Hills
- Summer 2000 Experimental work on neutrino oscillation experiment K2K (H. Sobel & S. Mine)
Research assistant, KEK, Tsukuba, Japan
- Summer 1999 Rubidium absorption resonance experiments (E. Hughes)
Summer Undergraduate Research Fellow, California Institute of Technology
- Summer 1998 Data analysis for Super-Kamiokande neutrino detector (K. Ganezer)
Research Assistant, California State University, Dominguez Hills

Teaching Experience Fall 2005 Assistant in Instruction, AST 105, *Our Place in the Universe*
Instructors: J.P. Ostriker & A.E. Shapley

Professional Activities

- Referee, *Journal of Cosmology and Astroparticle Physics*
- Scientific secretary, *Phi in the Sky: The Quest for Cosmological Scalar Fields* (July 2004)
- Editor, conference proceedings, *Phi in the Sky: The Quest for Cosmological Scalar Fields*
- Established cosmology journal club “Underground Coffee” at Princeton University
- Member: American Astronomical Society; American Institute of Physics; Institute of Physics (UK); Planetary Society