

Adrian C. Liu

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EMPLOYMENT **Assistant Professor of Physics**, McGill University, Montreal, QC, Canada **From Aug 2018**
Hubble Fellow, Berkeley, CA, USA **September 2015 to present**
UC Berkeley Department of Astronomy
BCCP Postdoctoral Fellow, Berkeley, CA, USA **September 2012 to August 2015**
Joint appointment between UC Berkeley Department of Astronomy and Berkeley Center for
Cosmological Physics at the Lawrence Berkeley National Laboratory

EDUCATION **Ph.D., Physics, Massachusetts Institute of Technology**, Cambridge, MA, USA **June 2012**
Advisor: Max Tegmark
Completed M.I.T. Graduate Student Teaching Certificate Program
Bachelor of Arts, Physics, Princeton University, Princeton, NJ, USA **June 2006**
Degree conferred *summa cum laude*

HONORS AND AWARDS **Hubble Fellowship**, Space Telescope Science Institute **2015**
Origins Project Postdoctoral Prize Lectureship, Arizona State University **2015**
USD 10,000 cash prize and lecture series awarded annually “to an outstanding junior scholar
chosen from all countries, from any field of study relevant to the Origins Project”
Goodwin Teaching Medal, Massachusetts Institute of Technology **2012**
Citation: “*for performance of teaching duties conspicuously effective over and above ordinary
excellence.*” Awarded annually to a recipient drawn from any discipline.
Henry Kendall Teaching Award, MIT Department of Physics **2011**
Award citation: “*for his excellent contributions over several semesters to teaching quantum
mechanics.*” Awarded annually within the Department of Physics.
Buechner Teaching Prize, MIT Department of Physics **2009**
Award citation: “*for outstandingly effective and engaging teaching as a recitation instructor.*”
Awarded annually to one recipient within the Department of Physics.
Allen G. Shenstone Prize in Physics, Princeton University **2006**
Kusaka Memorial Prize in Physics, Princeton University **2005**
Shapiro Prize for Academic Excellence, Princeton University **2004**
Manfred Pyka Memorial Prize in Physics, Princeton University **2003**

GRANTS AND SUPERCOMPUTING TIME ALLOCATIONS **NASA Astrophysics Data Analysis (ADAP) Grants**
\$212,456, Principal Investigator **Funded for 2016-2018**
Predicting the sky from 30 MHz to 800 GHz: the extended Global Sky Model
University of California Multicampus Research Programs Grant

\$288,477, Co-Investigator, *Cosmic Dawn Initiative*

Funded for 2015-2016

National Energy Research Scientific Computing Center (NERSC) Time Allocations

2,500,000 hours, Principal Investigator **Allocated for 2016**

Complementary Science from 21cm Cosmology and the Cosmic Microwave Background

1,800,000 hours, Principal Investigator **Allocated for 2015**

Data Analysis and Forecasts for Current- and Next-Generation Hydrogen Cosmology Surveys

900,000 hours, Principal Investigator **Allocated for 2014**

Low-frequency Radio Data Analysis for Hydrogen Cosmology

50,000 hours, Principal Investigator **Allocated for 2013**

From theoretical to observations: optimal foreground mitigation in 21cm measurements

PAPERS WRITTEN AS
THE PRIMARY
RESEARCH ADVISOR
OF A STUDENT**

3. Kern, N.S.**, **Liu, A.**, Parsons, A.R., Mesinger, A., Greig, B. (2017), *Emulating Simulations of Cosmic Dawn for 21cm Power Spectrum Constraints on Cosmology, Reionization, and X-ray Heating*, **ApJ submitted**, [arXiv:1705.04688](#)
2. Zheng, H., Tegmark, M., Dillon, J. S., Kim, D. A.**, **Liu, A.**, Nebel, A., Jonas, J., Reich, P., Reich, W. (2017), *An Improved Model of Diffuse Galactic Radio Emission from 10 MHz to 5 THz*, **MNRAS** **464**, 3486
1. Presley, M.E.**, **Liu, A.**, Parsons, A.R. (2015), *Measuring the cosmological 21 cm monopole with an interferometer*, **ApJ** **809**, 18

FIRST OR SECOND
AUTHOR
PUBLICATIONS

18. Schutz, K., **Liu, A.** (2016), *Pulsar timing can constrain primordial black holes in the LIGO mass window*, **Phys. Rev. D** **95**, 023002
17. **Liu, A.**, Zhang, Y., Parsons, A.R. (2016), *Spherical Harmonic Analyses of Intensity Mapping Power Spectra*, **ApJ** **833**, 242
16. Parsons, A.R., **Liu, A.**, Ali, Z.S., Cheng, C. (2016), *Optimized Beam Sculpting with Generalized Fringe-Rate Filters*, **ApJ** **820**, 51
15. **Liu, A.**, Pritchard, J.R., Allison et al. (2016), *Eliminating the optical depth nuisance from the CMB with 21 cm cosmology*, **Phys. Rev. D** **93**, 043013
14. **Liu, A.**, Parsons, A.R. (2016), *Constraining cosmology and ionization history with combined 21 cm power spectrum and global signal measurements*, **MNRAS** **457**, 1864
13. Switzer, E.R., **Liu, A.** (2014), *Erasing the variable: Empirical foreground discovery for global 21 cm spectrum experiments*, **ApJ** **793**, 102
12. **Liu, A.**, Parsons, A.R., Trott, C.M. (2014), *The Epoch of Reionization Window: II. Statistical Methods for Foreground Wedge Reduction*, **Phys. Rev. D** **90**, 023019
11. **Liu, A.**, Parsons, A.R., Trott, C.M. (2014), *The Epoch of Reionization Window: I. Mathematical Formalism*, **Phys. Rev. D** **90**, 023018
[Selected as **Phys. Rev. D** Editors' Suggestion Paper]
10. Parsons, A.R., **Liu, A.**, et al. (2014), *New Limits on 21cm EoR from PAPER-32 Consistent with an X-ray Heated IGM at $z = 7.7$* , **ApJ** **788**, 106
9. Pober, J.C., **Liu, A.**, Dillon, J.S., et al. (2014), *What Next-Generation 21 cm Power Spectrum Measurements Can Teach Us About the Epoch of Reionization*, **ApJ** **782**, 66
8. Dillon, J.S., **Liu, A.**, Williams, C.L., et al. (2014), *Overcoming Real-World Obstacles in 21 cm Power Spectrum Estimation: A Method Demonstration and Results from Early Murchison Widefield Array Data*, **Phys. Rev. D** **89**, 023002
[Co-first author]
7. **Liu, A.**, Pritchard, J., Tegmark, M., Loeb, A. (2013), *Global 21 cm signal experiments: a designer's guide*, **Phys. Rev. D** **87**, 043002

6. Dillon, J.S., **Liu, A.**, Tegmark, M. (2013), *A Fast Method for Power Spectrum and Foreground Analysis for 21 cm Cosmology*, *Phys. Rev. D* **87**, 043005
5. **Liu, A.**, Tegmark, M. (2011), *How well can we measure and understand foregrounds with 21 cm experiments?*, *MNRAS* **419**, 3491
4. **Liu, A.**, Tegmark, M. (2011), *A method for 21 cm power spectrum estimation in the presence of foregrounds*, *Phys. Rev. D* **83**, 103006
3. **Liu, A.**, Tegmark, M., Morrison, S., Lutomirski, A., Zaldarriaga, M. (2010), *Precision calibration of radio interferometers using redundant baselines*, *MNRAS* **408**, 1029
2. **Liu, A.**, Tegmark, M., Bowman, J., Hewitt, J., Zaldarriaga, M. (2009), *An improved method for 21 cm foreground removal*, *MNRAS* **398**, 401
1. **Liu, A.**, Tegmark, M., Zaldarriaga, M. (2009), *Will point sources spoil 21 cm tomography?*, *MNRAS* **394**, 1575

OTHER
PUBLICATIONS AS A
PRIMARY
CONTRIBUTOR

5. Ewall-Wice, A., Dillon, J.S., **Liu, A.**, Hewitt, J. (2017), *The Impact of Modeling Errors on Interferometer Calibration for 21 cm Power Spectra*, *MNRAS submitted*, [arXiv: 1610.02689](https://arxiv.org/abs/1610.02689)
4. Zheng, H., Tegmark, M., Dillon, J., **Liu, A.**, et al. [27 authors] (2017), *Brute-Force Mapmaking with Compact Interferometers: A MITEoR Northern Sky Map from 128 MHz to 175 MHz*, *MNRAS* **465**, 2901
3. Ewall-Wice, A., Hewitt, J., Mesinger, A., Dillon, J.S., **Liu, A.**, Pober, J. (2015), *Constraining High Redshift X-ray Sources with Next Generation 21 cm Power Spectrum Measurements*, *MNRAS* **458**, 2710
2. Ali, Z. S., Parsons, A.R., Zheng, H., Pober, J.C., **Liu, A.**, et al. (2015), *PAPER-64 Constraints on Reionization: The 21 cm Power Spectrum at $z = 8.4$* , *ApJ* **809**, 61
1. Dillon, J.S., Tegmark, M., **Liu, A.**, Ewall-Wice, A., Hewitt, J.N., et al. (2014), *Mapmaking for Precision 21 cm Cosmology*, *Phys. Rev. D* **91**, 023002

COLLABORATION
PUBLICATIONS

5. DeBoer, D.R., Parsons, A.R., Aguirre, J.E., ... **Liu, A.**, et al. [54 authors] (2017), *Hydrogen Epoch of Reionization Array (HERA)*, *PASA* **129**, 045001
4. Moore, D., Aguirre, J.A., ... **Liu, A.**, et al. [17 authors] (2017), *New Limits on Polarized Power Spectra at 126 and 164 MHz: Relevance to Epoch of Reionization Measurements*, *ApJ* **836**, 154
3. Pober, J.C., Ali, Z.S., ... **Liu, A.**, et al. [27 authors] (2015), *PAPER-64 Constraints On Reionization II: The Temperature Of The $z=8.4$ Intergalactic Medium*, *ApJ* **809**, 62
2. Jacobs, D.C., Pober, J.C., ... **Liu, A.**, et al. [18 authors] (2014), *Multi-redshift limits on the 21cm power spectrum from PAPER*, *ApJ* **801**, 51
1. Zheng, H., Tegmark, M., ... **Liu, A.**, et al. [37 authors] (2014), *MITEoR: A Scalable Interferometer for Precision 21 cm Cosmology*, *MNRAS* **445**, 1084

TEACHING
EXPERIENCE

MIT, Department of Physics

Quantum I (Recitation Instructor: Fall 2010-11, Spring 2012; Teaching Assistant: Spring 2010)
 Physics II: Honors Electromagnetism (Recitation Instructor: Spring 2009)
 Graduate Astrophysics II: Galaxies and Cosmology (Teaching Assistant: Fall 2009)
 Physics II: Electromagnetism (Teaching Assistant: Spring 2008)

STUDENTS MENTORED	Graduate students		
		Morgan Presley, UC Berkeley	Fall 2015 to present
		Nicholas Kern, UC Berkeley	Fall 2015 to present
	“Post-bac” student		
		Doyeon Kim, UC Berkeley	Spring 2016 to present
	Undergraduate researchers		
	Annie Lin, UC Berkeley	Summer 2015 to Summer 2016	
	Morgan Presley, Princeton/UC Berkeley summer researcher	Summer 2014	
	Michael Valdez, MIT	Spring 2011 to Winter 2011	
PROFESSIONAL ACTIVITIES	Scientific organizing committees		
		<i>Future cosmic surveys</i> workshop	September 2016
		<i>CMB spectral distortions from cosmic baryon evolution</i> workshop	July 2016
		<i>Preparing for the 21 cm cosmology revolution</i> workshop	September 2015
		<i>Wide-field imaging and power spectrum measurements session, National Radio Science Meeting</i> conference	January 2014
	Journal referee		
	Physical Review Letters, Physical Review D, The Astrophysical Journal, Monthly Notices of the Royal Astronomical Society, Journal of Cosmology and Astroparticle Physics, Progress in Electromagnetic Research/Journal of Electromagnetic Waves and Applications		
	Grant review panels , National Science Foundation, NASA		
INVITED PROFESSIONAL TALKS	McGill University, Special physics seminar	March 2017	
	University of Virginia, Astronomy colloquium	Feb 2017	
	University of Virginia, Physics colloquium	Feb 2017	
	Notre Dame University, Astrophysics seminar	Feb 2017	
	Columbia University, Astronomy colloquium	Feb 2017	
	Stony Brook University, Astronomy and astrophysics seminar	Feb 2017	
	Center for Computational Astrophysics, Seminar	Feb 2017	
	Cornell University, Astronomy colloquium	Feb 2017	
	Cornell University, Astronomy seminar	Feb 2017	
	Franklin & Marshall College, Physics colloquium	Jan 2017	
	Brandeis University, Chalk talk	Jan 2017	
	Brandeis University, Physics colloquium	Jan 2017	
	Carleton College, Physics colloquium	Jan 2017	
	Harvey Mudd College, Physics colloquium	Jan 2017	
	Indiana University, Physics colloquium	Jan 2017	
	NYU Center for Cosmology and Particle Physics, Astrophysics seminar	Nov 2016	
	Perimeter Institute for Theoretical Physics, Cosmology seminar	Sept 2016	
	National Radio Astronomy Observatory, Radio Futures II meeting	Aug 2016	
	Raman Research Institute, CMB spectral distortions workshop	July 2016	
	Cambridge University, 21 cm workshop parameter estimation session talk	June 2016	
	Cambridge University, 21 cm workshop main session talk	June 2016	
	Stanford University, Cosmology seminar	April 2016	
	UC Santa Cruz, Astrophysics seminar	Feb 2016	
	UC Davis, Astrophysics seminar	Feb 2016	
	UC Davis, Physics colloquium	Feb 2016	
	Caltech Astronomy, Tea talk	Feb 2016	
	Carnegie Mellon University, Astrophysics seminar	Jan 2016	

	Carnegie Mellon University, Physics colloquium	Jan 2016
	Canadian Institute for Theoretical Astrophysics, Seminar	Nov 2015
	UC Santa Cruz, Cosmology seminar	Nov 2015
	Department of Energy Cosmic Visions Dark Energy Panel West Coast Meeting	Nov 2015
	UC Davis, Cosmology seminar	Oct 2015
	International Center for Theoretical Physics Workshop	May 2015
	ASU, Origins Prize seminars (three talks)	April 2015
	MIT, Astrophysics colloquium	Feb 2015
	University of Chicago Astronomy & Astrophysics, Colloquium	Jan 2015
	UC Santa Barbara, Astrophysics seminar	Oct 2014
	UC Santa Cruz, Cosmology seminar	March 2014
	Carnegie Mellon University, Astrophysics Seminar	Oct 2013
	UC Davis, Astrophysics Seminar	Oct 2013
	ARC Centre of Excellence, Global Signal Workshop, Opening theory talk	Nov 2012
	Canadian Institute for Theoretical Astrophysics, Seminar	Jan 2012
	McGill University, Astroparticle Seminar	Jan 2012
	Canadian Institute for Theoretical Astrophysics, Advanced Data Analysis Meeting	June 2011
CONTRIBUTED PROFESSIONAL TALKS	National Radio Science Meeting	Jan 2017
	Space Telescope Science Institute, Hubble Fellows Symposium	March 2016
	Aspen Center for Physics, The Reionization Epoch Conference	March 2016
	American Astronomical Society Meeting	Jan 2016
	National Radio Astronomy Observatory, Radio Futures I meeting	Dec 2015
	Science at Low Frequencies II Conference	Dec 2015
	Olympian Symposium Conference	May 2015
	American Astronomical Society Meeting	Jan 2015
	Science at Low Frequencies I Conference	Dec 2014
	Imperial College London, Astrophysics seminar	July 2014
	UC Berkeley, MWA Epoch of Reionization Workshop	June 2014
	American Astronomical Society, Exascale Radio Astronomy Conference	April 2014
	Harvard-Smithsonian Institute for Theory and Computation Lunch talk	Sept 2013
	Reionization in the Red Center Conference	July 2013
	Ohio State 21 cm Workshop	April 2013
	American Astronomical Society Meeting	Jan 2013
	ARC Centre of Excellence, Global Signal Workshop, Global signal session	Nov 2012
	Melbourne MWA Project Meeting (two talks)	Dec 2012
	Berkeley Cosmology Group Seminar	Aug 2011
	American Astronomical Society Meeting	Jan 2011
	Harvard-Smithsonian Center for Astrophysics, Hydrogen Cosmology Workshop	May 2011
	Fermilab, Science with Fast Radio Telescopes Workshop	Oct 2010
	Canberra MWA Project Meeting (two talks)	Jan 2009
POPULAR TALKS	East Bay Science Cafe	Sept 2016
	East Bay Astronomical Society	July 2016
	City College of San Francisco	April 2016
	Scarlet City Grounds for Science	Feb 2016
	Arizona State University Marston Theater	May 2015
	"Discover Physics!", MIT Freshman Pre-Orientation Program (two talks)	Aug 2011
	"Discover Physics!", MIT Freshman Pre-Orientation Program (two talks)	Aug 2010
	MIT Office of Undergraduate Advising	Sept 2009
	Choate Rosemary Hall	May 2009
SERVICE TO THE COMMUNITY	Co-organizer	July 2015 to present
	AstroJustice discussion group for social issues	

Postdoc representative UC Berkeley Astronomy Department	2013 to present
Graduate student representative “Discover Physics!” Freshman Pre-orientation Program	2010, 2011
Astrophysics graduate student liaison MIT Physics department admitted graduate student open house	2010
Astrophysics graduate student representative MIT Physics Graduate Student Council	September 2008 to August 2010
Co-organizer Astrophysics graduate student weekly lunch	October 2006 to September 2008