

# Alexandra Greenbaum

University of Michigan  
1085 S. University Ave  
Ann Arbor, MI 48109  
☎ +1 (646) 228 6762  
✉ azgreenb@umich.edu

## Education

- 2011–2016 **PhD**, *Johns Hopkins University*, Baltimore, MD.  
Advisor: Dr. Anand Sivaramakrishnan  
Research areas: Planet formation, direct imaging, interferometry, wavefront sensing
- 2011–2013 **M.A. Physics and Astronomy**, *Johns Hopkins University*, Baltimore, MD.
- 2007–2011 **B.S. Physics**, *Rensselaer Polytechnic Institute*, Troy, NY, 3.73.  
Magna Cum Laude
- 2007–2011 **B.S. Mech Engineering**, *Rensselaer Polytechnic Institute*, Troy, NY, 3.73.  
Magna Cum Laude

## Awards

- 2017–2018 **Science Communication Fellow**, *Univ. of Michigan*.  
Museum of Natural history
- 2013–2016 **NSF Graduate Research Fellowship Program**, *JHU*.
- 2014–2015 **NSF Graduate Research Experience Worldwide**, *Sydney University*.  
Host: Peter Tuthill
- 2014 **NASA Group Achievement Award**, *with Phil Stahl*.  
For innovative advancement of deep core mirror technologies required to enable the next generation of Ultraviolet-Optical-Near Infrared monolithic mirror telescopes.
- 2011 **Emily Swomley, PhD Fellowship**, *JHU*.

## Experience

### Research

- 2016–present **Postdoctoral Research Fellow**, *University of Michigan*, Ann Arbor, MI.  
Planning JWST-NIRISS guaranteed time observations, infrared observations of young stars and developing algorithms for PSF subtraction and interferometric analysis.
- 2013–2016 **NSF Graduate Research Fellow**, *Johns Hopkins University*, Baltimore, MD.  
Commissioning non-redundant mask on GPI integral field spectrograph and polarimeter for planet formation studies. Aperture masking data analysis pipeline for JWST.

- 2011–2013 **Graduate Research Assistant**, *Johns Hopkins University*, Baltimore, MD.  
Developed image plane modeling of NIRISS-AMI PSF with intra-pixel sensitivities.  
Analyzed aperture masking data for Gemini Planet Imager integrations and tests.
- Summer 2010 **NSF Research Experience for Undergraduates**, *AMNH*, New York, NY.  
Developed and tested source attenuation method for simulating planetary companions.  
Data analysis and Fourier transform visualization using python packages.

### Laboratory

- 2013–present **Wavefront sensing tests with NRM**, *Makidon Optics Lab, STScI*.  
Lab tests of phase retrieval algorithms using a non-redundant mask.  
Supervised high school and undergraduate student in optics lab set up and analysis.
- Dec 2013 **TBT Tests**, *Ball Aerospace with Scott Acton*, Boulder, CO.  
Coarse phasing tests on the Ball Test Bed Telescope 1-m analog of JWST.
- Jun 2013 **U10B Beamline Tests**, *Brookhaven National Laboratory*.  
Characterizing visible light and near-IR apodizers for space-based coronagraphy.
- Sept 2009 – **Undergraduate Research**, *Rensselaer Polytechnic Institute*, Troy, NY.  
May 2010 Investigated methods of generating terahertz radiation using femtosecond laser pulses.

### Observing

- Feb 2017 **MagAO observing**, *Las Campanas observatory*.
- May 2015 **NRM Commissioning for GPI**, *Gemini South observatory*.  
Designed a commissioning program for GPI's aperture mask.  
Tested NRM polarimetry and characterized vibrations on GPI.
- Sept 2014 **GPI Commissioning**, *Gemini South observatory*.  
Measured focus wavefront error using GPI's aperture mask.
- May 2014 **GPI Commissioning**, *Gemini South observatory*.  
Assisted commissioning for GPI coronagraph and aperture masking modes.

### Awarded Observing Proposals (PI)

- **GS-2016A-Q-30**, 4.5 hrs, GPI

### Selection of Awarded Observing Proposals (Co-I)

- **JWST Cycle 0 (ERS)**, 39 hours (PI: Sasha Hinkley)  
Role: Co-lead of NIRISS-AMI observations
- **GS-2017A-Q-40**, 15 hrs, GPI (PI:Eric Nielsen)
- **GS-2016A-Q-23**, 30.4 hrs, GPI (PI: Adam Kraus)
- **GS-2015A-Q-32**, 10 hrs, GPI (PI: Peter Tuthill)
- **GS-2015A-Q-20**, 20 hrs, GPI (PI: Michael Ireland)

## Leadership and Outreach

- 2017-Present **Astro Diversity Equity and Inclusion Committee**, *U. Michigan*.  
Postdoctoral representative, organizing monthly discussion of DEI topics
- Current **Science Communication Fellowship**, *U. Michigan*.  
Hosted by the Museum of Natural History
- 2017-Present **Astro Women Postdoc Lunch Coordinator**, *U. Michigan*.
- 2012–2016 **Graduate Outreach**, *JHU*.  
Founder, president 2012-2014, volunteer, website contributor.
- 2013–2014 **Ignition Grant for innovative community projects**, *Ignite Baltimore*.  
"Bringing the Skies to Baltimore" portable planetarium project  
One planetarium for the Southwest Baltimore Charter School, one for our local shows.
- 2010-2011 **RPI Women's Club Water Polo Captain**
- 2008-2010 **American Society of Mechanical Engineers Vice President**, *RPI*.  
Drafted plan for construction and implementation of on-campus green roof.

---

## Teaching

### Johns Hopkins University

- Mar 2015 **Fourier Optics Graduate Course Guest Lecture**.  
Building kernel phase formalism from simple aperture masking examples.
- Jan 2014, **Imaging in Astronomy**.  
2016 A two-week undergraduate course in imaging for astronomy.  
Basic Fourier principles and detector technologies.

### Rensselaer Polytechnic Institute

- 2008–2009 **Teaching Assistant - General Physics I**.

### Mentoring

- UMich Graduate Student Felicity B. Hills (2016– Present)  
UMich Undergraduate Veenu Suri (Summer 2017)  
UMD Undergraduate Noah Gamper (2014-2015)  
UTK Undergraduate Chima McGruder (2015)  
STScl Intern Kathryn St.Laurent (2015)

---

## Talks and Presentations

### Invited Talks

- Nov 2017 University of Toledo Physics and Astronomy Colloquium  
July 2016 Oxford University Astronomy Seminar

Oct 2015 Goddard Space Flight Center Exoplanets Group  
Apr 2015 American Museum of Natural History Astrophysics Dept.

### Conferences

Jan 2017 American Astronomical Society Meeting – *Thesis talk*  
Oct 2016 High Contrast Imaging in Space (STScl) –*1 talk*  
Jul 2016 SPIE Edinburgh – *1 poster*  
Jan 2016 American Astronomical Society Meeting – *1 talk*  
Jul 2015 Sagan Exoplanets Workshop – *1 pop, 1 poster*  
Jun 2015 Spirit of Lyot Conference – *1 talk, poster contributions*  
Nov 2014 4th Australian Exoplanets conference USQ – *1 talk*  
Jun 2014 SPIE Montreal – *2 posters*  
Jan 2014 AAS, National Harbor – *1 poster*  
Aug 2013 SPIE San Diego – *2 posters*  
2013, 2015 2 NASA SR&T Meetings – *2 talks*

---

### Professional Affiliations

JWST NIRISS Aperture Masking Interferometry Working Group  
Gemini Planet Imager Team  
American Astronomical Society Junior Member  
SPIE Junior Member  
Tau Beta Pi Engineering Honors Society  
Sigma Pi Sigma Physics Honors Society  
Pi Tau Sigma Mechanical Engineering Honors Society

---

### Service

Oct 2017 MIRA Volatiles Local Organizing Committee  
2017–2018 Astronomy Diversity Equity & Inclusion Postdoc Representative  
2017 Reviewer for Astrophysical Journal Supplement  
Oct 2016 STScl High Contrast Imaging in Space Local Organizing Committee

---

## Publications

### Journals

- [A. Z. Greenbaum](#), A. Sivaramakrishnan, "In-focus wavefront sensing using non-redundant mask-induced pupil diversity," *Optics Express*, vol. 24, Jul 2016.
- [A. Z. Greenbaum](#), L. Pueyo, A. Sivaramakrishnan, and S. Lacour, "An image plane algorithm for JWST's non-redundant aperture mask data," *Astrophysical Journal*, vol. 798, Jan 2015.
- S. Lacour, B. Biller, A. Cheetham, [A. Greenbaum](#), et al., "An M-dwarf star in the transition disk of Herbig HD142527; Physical parameters and orbital elements," *Astronomy & Astrophysics*, vol 590, May 2016.
- B. Pope, P. G. Tuthill, S. Hinkley, ... [A. Greenbaum](#), et al., "The Palomar Kernel Phase Experiment: Testing Kernel Phase Interferometry for Ground-based Astronomical Observations," *MNRAS*, vol. 455, Jan 2015
- L. Poyneer, D. W. Palmer, B. Macintosh, ... [A. Z. Greenbaum](#), et al., "Performance of the Gemini Planet Imager's adaptive optics system," *Applied Optics*, vol. 55, Jan 2016.
- E. Nielsen, R. J. De Rosa, J. Rameau ... [A. Z. Greenbaum](#), et al., "Evidence That the Directly Imaged Planet HD 131399 Ab Is a Background Star," *Astronomical Journal*, vol. 154, Dec 2017.
- A. Rajan, J. Rameau, R. J. De Rosa, ... [A. Z. Greenbaum](#), et al., "Characterizing 51 Eri b from 1 to 5  $\mu\text{m}$ : A Partly Cloudy Exoplanet," *Astronomical Journal*, vol. 154, July 2017.
- J. B. Ruffio, B. Macintosh, J. J. Wang, ... [A. Z. Greenbaum](#), et al., "Improving and Assessing Planet Sensitivity of the GPI Exoplanet Survey with a Forward Model Matched Filter," *Astrophysical Journal*, vol. 842, Jun 2017.
- K. B. Follette, J. Rameau, R. Dong, ... [A. Z. Greenbaum](#), et al., "Complex Spiral Structure in the HD 100546 Transitional Disk as Revealed by GPI and MagAO", *Astronomical Journal*, vol. 153, Jun 2017
- J. Rameau, K. B. Follette, L. Pueyo, ... [A. Z. Greenbaum](#), et al., "An Optical/Near-infrared Investigation of HD 100546 b with the Gemini Planet Imager and MagAO", *Astronomical Journal*, vol. 153, Jun 2017
- M. Johnson-Groh, C. Marois, R. J. De Rosa, ... [A. Z. Greenbaum](#), et al., "Integral Field Spectroscopy of the Low-mass Companion HD 984 B with the Gemini Planet Imager", *Astronomical Journal*, vol. 153, Apr 2017
- J. Chilcote, L. Pueyo, R. J. De Rosa... [A. Z. Greenbaum](#), et al., "1-2.4 m Near-IR Spectrum of the Giant Planet Pictoris b Obtained with the Gemini Planet Imager," *Astronomical Journal*, vol. 153, Apr 2017.

- E. Nielsen, R. J. De Rosa, J. J. Wang ... [A. Z. Greenbaum](#), et al., "Dynamical Mass Measurement of the Young Spectroscopic Binary V343 Normae AaAb Resolved With the Gemini Planet Imager," *Astronomical Journal*, vol. 152, Dec 2016.
- M. A. Millar-Blanchaer, J. J. Wang, P. Kalas, ... [A. Z. Greenbaum](#), et al., "Imaging an 80 au Radius Dust Ring around the F5V Star HD 157587," *Astronomical Journal*, vol. 152, Nov 2016.
- J. J. Wang, J. R. Graham, L. Pueyo, ... [A. Z. Greenbaum](#), et al., "The Orbit and Transit Prospects for Pictoris b Constrained with One Milliarcsecond Astrometry," *Astronomical Journal*, vol. 152, Oct 2016.
- E. L. Nielsen, R. J. De Rosa, J. Wang, ... [A. Z. Greenbaum](#), et al., "Dynamical Mass Measurement of the Young Spectroscopic Binary V343 Normae AaAb Resolved With the Gemini Planet Imager," *Astronomical Journal*, *Accepted*.
- Q. M. Konopacky, J. Rameau, G. Duchêne, ... [A. Z. Greenbaum](#), et al., "Discovery of a Substellar Companion to the Nearby Debris Disk Host HR 2562," *Astrophysical Journal Letters*, vol. 829, Sept 2016.
- Z. H. Draper, G. Duchêne, M. A. Millar-Blanchaer, ... [A. Z. Greenbaum](#), et al., "The Peculiar Debris Disk of HD 111520 as Resolved by the Gemini Planet Imager," *Astrophysical Journal*, vol. 826, Aug 2016.
- S. G. Wolff, M. D. Perrin, M. A. Millar-Blanchaer, ... [A. Z. Greenbaum](#), et al., "The PDS 66 Circumstellar Disk as Seen in Polarized Light with the Gemini Planet Imager," *Astrophysical Journal Letters*, vol. 818, Feb 2016.
- L. Keszthelyi, W. Grundy, J. Stansbury, ... [A. Greenbaum](#), et al., "Observing Outer Planet Satellites (except Titan) with JWST: Science Justification and Observational Requirements," *PASP*, vol. 128, Jan 2016.
- L.-W. Hung, G. Duchêne, P. Arriaga, ... [A. Greenbaum](#), et al., "First Scattered-light Image of the Debris Disk around HD 131835 with the Gemini Planet Imager," *Astrophysical Journal Letters*, vol. 815L, Dec 2015
- R. J. De Rosa, E. L. Nielsen, S. C. Blunt, ... [A. Z. Greenbaum](#), et al., "Astrometric Confirmation and Preliminary Orbital Parameters of the Young Exoplanet 51 Eridani b with the Gemini Planet Imager," *Astrophysical Journal Letters*, vol. 814, Nov 2015.
- P. G. Kalas, A. Rajan, J. Wang, ... [A. Greenbaum](#), et al., "Direct Imaging of an Asymmetric Debris Disk in the HD 106906 Planetary System," *Astrophysical Journal Letters*, vol. 814, Nov 2015.
- B. Macintosh, J. R. Graham, T. Barman, ... [A. Z. Greenbaum](#), et al., "Discovery and spectroscopy of the young jovian planet 51 Eri b with the Gemini Planet Imager," *Science*, vol. 350, Oct 2015.

- J. J. Wang, J. R. Graham, L. Pueyo, ... A. Z. Greenbaum, et al., "Gemini Planet Imager Observations of the AU Microscopii Debris Disk: Asymmetries within One Arcsecond," *Astrophysical Journal Letters*, vol. 811, Oct 2015.
- M. A. Millar-Blanchaer, J. R. Graham, L. Pueyo, ... A. Z. Greenbaum, et al. "Beta Pictoris' Inner Disk in Polarized Light and New Orbital Parameters for Beta Pictoris b," *Astrophysical Journal*, vol. 811, Sept 2015.

## Conference Proceedings

- A. Z. Greenbaum, N. Gamper, A. Sivaramakrishnan,; "In-focus phase retrieval using JWST-NIRISS's non-redundant mask," in *Proc. SPIE 9904*, Jul 2016.
- A. Z. Greenbaum, A. Cheetham, A. Sivaramakrishnan, P. G. Tuthill, B. Norris, L. Pueyo, et al.; "Gemini planet imager observational calibrations X: non-redundant masking on GPI," in *Proc. SPIE 9147*, Aug 2014.
- A. Z. Greenbaum, A. Martel, A. Sivaramakrishnan, K. Volk, L. Pueyo, et al., "Analyzing the first JWST-NIRISS NRM test data," in *Proc. SPIE 9143*, Aug 2014.
- A. Z. Greenbaum, A. Sivaramakrishnan, L. Pueyo, et al., "Wavelength Calibration and Closure Phases with the Gemini Planet Imager IFS Using its Non-Redundant Mask," in *Proc. SPIE 8864*, Aug 2013.
- A. Z. Greenbaum, A. Sivaramakrishnan, and L. Pueyo, "Flat Field Errors and Intra-Pixel Sensitivities for Non-Redundant Aperture Masking Interferometry on JWST NIRISS," in *Proc. SPIE 8864*, Aug 2013.
- D. Thatte, A. Greenbaum, A. Martel, A. Sivaramakrishnan, and E. Artigau, "Astrometric accuracy of aperture making interferometry with JWST-NIRISS," in *Proc. SPIE*, Aug 2015
- A. Sivaramakrishnan, A. Cheetham, A. Z. Greenbaum, et al., "Non-redundant masking ideas on JWST", in *Proc. SPIE 9143*, Aug 2014.
- E. Artigau, A. Sivaramakrishnan, A. Z. Greenbaum, et al. "NIRISS aperture masking interferometry: an overview of science opportunities," in *Proc. SPIE 9143*, Aug 2014.
- A. Sivaramakrishnan, A. Z. Greenbaum, et al., "Calibrating apodizer fabrication techniques for high-contrast coronagraphs on segmented and monolithic space telescopes," in *Proc. SPIE 8860*, Aug 2013.
- B. A. Macintosh, A. Anthony, J. Atwood, ... A. Z. Greenbaum, et al., "The Gemini planet imager: first light and commissioning," in *Proc. SPIE 9148*, Aug 2014.
- A. Sivaramakrishnan, D. Lafrenière, K. E. S. Ford, ... A. Z. Greenbaum, et al., "Non-redundant Aperture Masking Interferometry (AMI) and segment phasing with JWST-NIRISS," in *Proc. SPIE 8442*, Jun 2012.

- M. D. Perrin, J. Maire, P. Ingraham, ... [A. Z. Greenbaum](#), et al., "Gemini Planet Imager observational calibrations I: Overview of the GPI data reduction pipeline", in *Proc. SPIE 9147*, Jul 2014.
- J. Maire, P. J. Ingraham, R. J. De Rosa, ... [A. Z. Greenbaum](#), et al., "Gemini planet imager observational calibrations VI: photometric and spectroscopic calibration for the integral field spectrograph, " in *Proc. SPIE 9147*, Jul 2014
- J. J. Wang, A. Rajan, J. Graham, ... [A. Z. Greenbaum](#), et al., "Gemini planet imager observational calibrations VIII: characterization and role of satellite spots", in *Proc. SPIE 9147*, Jul 2014.