# Lulu Liu

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## AREAS OF INTEREST

Optics, physics, early-stage design & prototyping, telescopes, satellites, imaging, photography.

## EDUCATION

**Ph.D. Applied Physics - Optics** *Aug 2011 - Dec 2016*
*Harvard University*, Cambridge MA

**B.S. Physics - GPA 3.8/4.0** *Aug 2005 - Jun 2009*
*Massachusetts Institute of Technology*, Cambridge MA

## RESEARCH

I'm currently a scientist at MIT Lincoln Laboratory in the Space Systems Division. My group is focused on advanced technology development and prototyping specifically in the imaging and remote sensing space.

**MIT Lincoln Laboratory** May 2017 - present
*Member of Technical Staff* *Lexington, MA*

- Active distributed aperture optical phased arrays ($600k internal funding awarded / Principle Investigator / 2017-present)
- Laser acceleration of neutral particles for high velocity impacts ($400k internal funding awarded / Principle Investigator / 2018-present)
- 3D-printed coded apertures for one-shot volumetric imaging ($17k internal seed funding / Principle Investigator / 2018-present)
- Long-baseline interferometry design/build ($25M IARPA program / Technical Advisor / 2017-2018)
- Space-based laser-radar system ($2M internally funded program / Performance Engineer / 2018)

**Harvard University** Aug 2011 - Dec 2016
*Graduate Student Researcher* *Cambridge, MA*

- Dissertation on micro- nanoscale optics in Federico Capasso's group. Designed and built instrument for optical trapping/sensing of micron-size particles in optical fields. Broke the femtonewton sensitivity barrier in measurement of optical forces in fluid. Observed and quantified novel phenomena involving more exotic states of light. Mentored undergraduate and graduate students as the lead on the project.

**Stanford University - Astrophysics/Cosmology Center (KIPAC)** Sept 2009 - Oct 2010
*Research Assistant* *Palo Alto, CA*

- Developed statistical ensemble approach to investigation of deep-space objects with inadequate redshift information. Used this approach to determine the abundance of large satellites around Milky-Way sized galaxies and confirm its statistical agreement with numerical simulations running cold dark matter cosmological models.

**NASA - Transiting Exoplanet Survey Satellite (TESS)** May 2007 - Jun 2009
*Intern* *Mountain View, CA*

- Designed a concept of operations. Tested the reaction wheel assembly. Performed communications systems analysis. Characterized and improved the sensitivity of the main CCD array for the spacecraft. Mission launched in 2018.

## GRANTS, AWARDS, AND HONORS

**Paper Selected for Editor's Suggestion,** Physical Review Letters 2016
**Bok Center Certificate of Distinction in Teaching Award,** Harvard University 2016
**Kao Fellowship,** Harvard University 2013 - present

**Graduate Research Fellowship,** NSF 2011 - present

**2010 Mass Media Fellowship for Science Writing,** AAAS May 2010

## SELECTED PUBLICATIONS AND PRESENTATIONS

I have published first-author papers in the Proceedings of the National Academy of Sciences, Physical Review Letters, and Astrophysical Journal, including a paper which was highlighted as an "Editor's Suggestion" in PRL and the subject of a Physics Focus article. I have given talks at conferences in optics, physics, and metamaterials and have been an invited speaker on two occasions. Additionally, in the capacity of a science journalist, I have published news stories and essays in Sacramento Bee, APS News, and Technology Review.

**Three-Dimensional Measurement of the Helicity-Dependent Forces on a Mie Particle** May 2018
*L. Liu, A. DiDonato, V. Ginis, S. Kheifets, A. Amirzhan, and F. Capasso* *Physical Review Letters*

**Elliptical Orbits of Microspheres in an Evanescent Field** Oct 2017
*L. Liu, S. Kheifets, V. Ginis, A. DiDonato, F. Capasso* *PNAS*

**Sub-femtonewton Force Spectroscopy at the Thermal Limit in Liquids** Jun 2016
*L. Liu, S. Kheifets, V. Ginis, F. Capasso* *Physical Review Letters*

**Absolute position total internal reflection microscopy with an optical tweezer** Dec 2014
*L. Liu, A. Woolf, A. Rodriguez, F. Capasso* *PNAS*

**How Common are the Magellanic Clouds?** May 2011
*L. Liu, B. Gerke, R. Wechsler, P. Behroozi, M. Busha* *The Astrophysical Journal*

**CCD Photometric Precision for the Transiting Exoplanet Survey Satellite** May 2009
*Senior thesis on TESS -launched 2018* *MIT / NASA*

## NON-ACADEMIC EMPLOYMENT AND EXPERIENCE

I have industry experience in solar metrology, image recognition, classification and processing, consulting experience in the design and optimization of modern microscopes, and an substantial teaching, writing, and photography background.

**Leaf Labs** Jan 2017 - present
*Optics Consultant* *Cambridge, MA*

- Calculated trade-offs for the design of a modern light-field microscope for the high speed video imaging of a 3D brain volume. Made design recommendations based on optical constraints and target requirements. Ran 3D reconstruction algorithms on test data.

**Harvard GSAS** Mar 2012 - present
*Photographer* *Cambridge, MA*

- Professional part-time photographer for the Harvard Graduate School of Arts and Sciences, covering events, outings, and faculty and student studio-style portraits.
- Author portrait featured in the New Yorker accompanying short story.

**Alta Devices** Sept 2010 - Aug 2011
*Metrology Engineer* *Santa Clara, CA*

- Worked directly under chief technologist to design and build complete metrology solutions for characterizing solar film quality at the thin film solar start-up.

## TECHNICAL STRENGTHS

**Languages** MATLAB, Python, Javascript [D3], HTML/CSS, Unix
**Skills** Communication, Mentoring/Leadership, Design, Physics, Cleanroom Nanofabrication, Photoshop, Lumerical, CAD, LaTeX