

# Dr. Ryan M. Lau

Jet Propulsion Laboratory ❖ MS169-237, 4800 Oak Grove Drive  
Pasadena, CA, 91109 ❖ (808) 258-7464 ❖ Ryan.M.Lau@jpl.nasa.gov

## EDUCATION

---

**Cornell University** 2010 - 2014  
Ithaca, NY

- Ph.D. in Astronomy & Space Sciences, Aug 2014
- Thesis Title: “Probing the Extreme Environment of the Galactic Center with Observations from SOFIA/FORCAST” (Advisor: Prof. Terry Herter)

**Reed College** 2006 - 2010  
Portland, OR

- B. A. in Physics, May 2010
- Honors Thesis Title: “Exploration of Extra-Solar Planet Properties” (Advisor: Prof. Johnny Powell)

## RESEARCH INTERESTS

---

Infrared transients, Massive and evolved stars, Interstellar medium and dust formation/destruction, Galactic center, Star formation

## APPOINTMENTS

---

**Caltech Postdoctoral Scholar at JPL** 2015 – Present  
Caltech/JPL Pasadena, CA

**Postdoctoral Associate** 2014 – 2015  
Cornell University Ithaca, NY

**Graduate Research Assistant** 2011 – 2014  
Cornell University Ithaca, NY

**Graduate Teaching Assistant** 2010 – 2011  
Cornell University Ithaca, NY

**Junior-Level Lab Teaching Assistant** 2009 - 2010  
Reed College Portland, OR

**NSF Research Experience for Undergraduates** Summer 2009  
Cornell University Ithaca, NY

## OBSERVING EXPERIENCE

---

- ♦ **W. M. Keck Observatory (Mauna Kea, HI)**
  - 4 nights with MOSFIRE on the Keck-1 Telescope
- ♦ **Palomar Observatory (Palomar Mountain, CA)**
  - 3 nights with WIRC on the 200-inch Hale Telescope
- ♦ **Stratospheric Observatory for Infrared Astronomy (Palmdale, CA)**
  - 17 flights (~ 136 hr) observing with SOFIA/FORCAST as quick-look data analyst
  - 3 flights (~24 hr) as FORCAST Instrument Operator
- ♦ **Caltech Submillimeter Observatory (Mauna Kea, HI)**
  - 4 nights observing with ZEUS 1 at the Caltech Submillimeter Observatory

## **OBSERVING/FUNDING PROPOSALS (\* - Submitted & Under Review)**

---

<b>Date</b>	<b>Observatory</b>	<b>Time</b>	<b>Description</b>
2016*	SOFIA/FORCAST SOFIA/HAWC+	5.5 hr	Mid- to far-IR photometric study of galactic stellar merger candidates ( <b>Written as Co-I</b> )
2016	Spitzer/IRAC	287 hr	Continuation of the Spitzer Infrared Intensive Transients Survey (SPIRITS; PI: M. M. Kasliwal). A systematic search for IR transients and continued monitoring of interesting transients for follow-up with JWST ( <b>Co-I &amp; Technical Contact</b> )
2016	Gattini-IR		A 25 sq-degree IR telescope at Palomar that surveys the entire accessible sky to a depth of 16.4 AB mag (J band) every night ( <b>Science team member</b> ; \$97K)
2016	Keck I/MOSFIRE	3 nights	Follow-up on infrared SPIRITS transients ( <b>Co-I</b> )
2016	JWST	60 hr	JPL JWST Guaranteed Time Observations (GTO; PI: M. Ressler) Funding proposal ( <b>Co-I</b> , \$660K).
2015	VLT/VISIR	9 hr	A Mid-IR Study of the Dust Production and Mass-loss from Evolved, Massive Stars ( <b>PI</b> )
2015	SOFIA/HAWC+	6.6 hr	A Polarimetric Survey of the Cold Dust in the Central Molecular Zone of the Milky Way ( <b>Co-I</b> )
2015	SOFIA/FORCAST	11 hr	Dust Production Rates in the Fomalhaut Disk ( <b>Co-I</b> )
2015	SOFIA/FORCAST	1.6 hr	Constraining the Temperature of an Extremely Massive Pre-stellar Core at the Galactic Center ( <b>Co-I</b> )
2015	SOFIA/FORCAST	<10 hr	A Census of High-Mass Star Formation in the Galactic Center ( <b>Written as Co-I</b> , ~\$3K).
2015	Palomar/TripleSpec	2 nights	Deciphering the Dusty “Helix” Trail from a Massive Evolved Star ( <b>PI</b> ). Published in Lau et al. (2016)

## **CONTRIBUTED POSTERS AND TALKS**

---

- ◆ **Lau, R. M.**, Werner, M., Sahai, R., Ressler, M. E., “Evidence from SOFIA Imaging of PAH Formation along a Recent Outflow in NGC 7027.” AAS 228 Poster (Jun 2016)
- ◆ Hankins, M. J., **Lau, R. M.**, Morris, M. R., Herter T. L., “SOFIA/FORCAST Observations of the Arched Filamentary Region in the Galactic Center.” AAS 228 Poster (Jun. 2016)
- ◆ **Lau, R. M.**, Hankins, M. J. Herter, T. L., Morris, M. R., *et al.*, “Unraveling the Nature of Dust Production from Wolf-Rayet Binaries” TMT 2016 Science Forum Talk (May 2016)
- ◆ **Lau, R. M.**, Herter, T. L., Morris, M. R., Li, Z., *et al.*, “Revealing the Galactic Center in the Far-Infrared with SOFIA/FORCAST.” (2 Posters)
  - 50 Years of Infrared Astronomy Poster (Nov 2015)
  - IAU General Assembly XXIX Poster (Aug. 2015)
- ◆ **Lau, R. M.**, Herter, T. L., Morris, M. R., Adams, J. D., “Dusty Cradles in a Turbulent Nursery: The Sgr A East HII Region Complex at the Galactic Center.” IAU General Assembly XXIX Poster (Aug. 2015)
- ◆ **Lau, R. M.**, Herter, T. L., Morris, M. R., Li, Z., Adams, J. D., “Old Supernova Dust Factory Revealed at the Galactic Center with SOFIA/FORCAST.” AAS 225 Poster (Jan. 2015)
- ◆ **Lau, R. M.**, Herter, T. L., Morris, M. R., Becklin, E. E., Adams, J. D., “Probing the Extreme

Environment of the Galactic Center with Observations from SOFIA/FORCAST.” AAS 224  
Dissertation Talk (Jun. 2014)

- ◆ **Lau, R. M.**, Herter, T. L., Morris, M. R., Adams, J. D., “Nature vs. Nurture: Identical ‘Twin’ Luminous Blue Variable Stars with Contrasting Nebulae.” AAS 223 Poster (Jan. 2014)
- ◆ **Lau, R. M.**, Herter, T. L., Morris, M. R., Adams, J. D., “SOFIA/FORCAST Observations of the Luminous Blue Variables located in and near the Quintuplet Cluster.” IAU Symposium 303 Poster (Sept. 2013)
- ◆ Hankins, M. J., **Lau, R. M.**, Herter, T. L., Morris, M. R., Adams, J. D., “SOFIA/FORCAST Observations of the Quintuplet Cluster.” AAS 221 Poster (Jan. 2013)
- ◆ **Lau, R. M.**, Herter, T. L., Morris, M. R., Becklin, E. E., Adams, J. D., “SOFIA/FORCAST Imaging of the Circumnuclear Ring at the Galactic Center.” AAS 221 Poster (Jan. 2013)

## SELECTED TALKS

---

- ◆ Invited speaker and breakout session leader at JWST/Keck Workshop 2016 (Sept 2016)
- ◆ “Evidence of a Dusty Helical Outflow from an Interacting, Massive and Evolved Binary.” (6 talks)
  - UCLA Journal Club, Los Angeles, CA (May 2016)
  - SOFIA Community Task Force Tele-talks (Mar 2016)
  - IPAC Seminar, Pasadena, CA (Feb 2016)
  - Stellar and Extragalactic Astronomy Lunch (SEAL), Goddard Space Flight Center, Greenbelt, MD (Jan 2016)
  - STSci Talk, Space Telescope Science Institute, Baltimore, MD (Jan 2016)
  - Massive Stars Talk, Anton Pannekoek Institute for Astronomy, Amsterdam, Netherlands (Oct. 2015)
- ◆ “Old Supernova Dust Factory Revealed at the Galactic Center.” (8 talks)
  - Institute of Astronomy Colloquium, University of Tokyo, Tokyo, Japan (Apr 2016)
  - Special Seminar, Hokkaido University, Sapporo, Hokkaido, Japan (Mar 2016)
  - Swinburne Caltech Transients Workshop, Pasadena, CA (Oct 2015)
  - IAA-CSIC Seminar, Granada, Spain (Mar 2015)
  - Ringberg Workshop on Spectroscopy with SOFIA, Tegernsee, Germany (Mar 2015)
  - JPL Astrophysics Journal Club, Pasadena, CA (Feb 2015)
  - UCLA Galactic Center Journal Club, Los Angeles, CA (Feb 2015)
  - IfA Visitor Talk, Honolulu, HI (Jan 2015)
- ◆ “Science from the Stratosphere: Infrared Imaging of Our Galactic Center with the SOFIA Telescope.” Astronomy Club Talk, Reed College, Portland, OR (Jan. 2015)
- ◆ “Dusty Cradles in a Turbulent Nursery: The Sgr A East HII Region Complex near the Galactic Center.” SOFIA Community Task Force Tele-talks (Jun. 2014)
- ◆ “Tales from the Galactic Center: The Ring and the Twins.” SOFIA Science Center Colloquium, NASA Ames, Mountain View, CA (May 2014)
- ◆ “Galactic Center Science from SOFIA/FORCAST: Observations of the Circumnuclear Ring and Luminous Blue Variable Nebulae.” JPL Astrophysics Luncheon Seminar, Pasadena, CA (Jan. 2014)
- ◆ “Nature vs. Nurture: Luminous Blue Variable Nebulae in and near Massive Stellar Clusters at the Galactic Center.” UCLA Journal Club, Los Angeles, CA (Jan. 2014)
- ◆ “SOFIA/FORCAST Imaging of the Circumnuclear Ring at the Galactic Center.” (2 talks)
  - UCLA Seminar, Los Angeles, CA (Jul. 2013)
  - IfA Visitor Talk, Honolulu, HI (Jul. 2013)

## MENTORING & TEACHING

---

### Undergraduate Mentoring:

<b>Stephanie Kwan</b> (Caltech, SURF student) Characterizing unusual infrared transients and variables in NGC 6822 with time-domain observations from the Spitzer Space Telescope and follow-up with Palomar 200-in	<b>Summer 2016</b>
<b>Jeremy Turner</b> (Cornell University, Undergraduate Research Assistant) Dust modeling of mid-IR point sources in the FORCAST Galactic Center fields (Co-mentoring with M. Hankins)	<b>Spring 2016 - Present</b>
<b>Ariel Donlin</b> (Cornell University, Undergraduate Research Assistant) Examining the variability of the dust and ionized gas emission from the nebula surrounding the Pistol Star, a luminous blue variable-type star. (Co-mentored with M. Hankins)	<b>Summer 2015 – Spring 2016</b>
<b>Sahitya Mantravadi</b> (Cornell University, Undergraduate Research Assistant) Mapping out the PAH emission strength around the Circumnuclear Disk at the Galactic center with images from FORCAST and Spitzer (Co-mentoring with M. Hankins)	<b>Fall 2014 - Present</b>
<b>Jose Covarrubias Ameca</b> (Cornell University, Undergraduate Research Assistant) Characterization of mid-IR point sources in the Arches region of the Galactic center. (Co-mentored with M. Hankins)	<b>Fall 2014 – Spring 2016</b>
<b>Matthew Hankins</b> (University of Central Arkansas, NSF REU at Cornell) Dust emission modeling of massive, evolved stars imaged by SOFIA/FORCAST. Currently a NSF Graduate Research Fellow at Cornell University on the FORCAST science team	<b>Summer 2012</b>

### Teaching:

<b>Cornell University Astro 7671</b> (Guest Lectured) Seminar: Micron to Millimeter Astronomy	<b>Spring 2015</b>
<b>Cornell University Astro 1102/1104</b> (Teaching Assistant) The Nature of the Universe - Introductory astronomy course for non-science majors	<b>Spring 2011</b>
<b>Cornell University Astro 1101/1103</b> (Teaching Assistant) Our Solar System - Introductory astronomy course for non-science majors	<b>Fall 2010</b>

## OUTREACH

---

- ♦ Thirty Meter Telescope Outreach Volunteer (2015 - Present)
  - TMT Lead Volunteer, Cleveland Elementary STEAM Festival, Pasadena, CA (Jan. 2016)
  - TMT Lead Volunteer, UCLA Exploring Your Universe 2015, UCLA, Los Angeles, CA (Nov. 2015)
- ♦ FORCAST Science Liaison for the SOFIA Airborne Astronomy Ambassadors (2013 - 2015)
  - Interacted in flight and on base in Palmdale, CA with ~30+ K-12 educators selected to participate in AAA program
  - Collaborated with Vivian Hoette, Director of Education and Outreach at Yerkes Observatory, to produce unique “tactile” graphics that allowed blind and visually impaired students to see IR images taken by SOFIA/FORCAST
  - Developing the *Stratos Scholars Program* (SSP), an 8-week program designed to high school students of AAA educators with hands-on research experience by reducing FORCAST imaging data [delayed due to substantial changes within the AAA program]
- ♦ Cornell University Astronomy Outreach Volunteer and Coordinator (2011 – 2015):
  - Coordinated the “Museum in the Dark” event at the Museum of the Earth (2011 - 2014)
    - o Arranged free admission for low-income families part of the Southside Community Center

- Coordinated the 3-day Focus For Teens Workshop “Astronomy: Exploring the Solar System and the Universe,” (Summer 2012 and 2014)
- Volunteer/speaker at over 5 additional events on campus and throughout the community

## SERVICE & PROFESSIONAL ACTIVITIES

---

- ◆ **2016 – Present:** Member of the TMT/MICHI Instrument Science Team
- ◆ **2015 – Present:** Member of the TMT International Science Development Team for Stars, Stellar Physics, and the ISM
- ◆ **2015 – Present:** Member of the SOFIA/HAWC+ Instrument Science Team
- ◆ **2015 – Present:** Member of JWST/MIRI Instrument Science Team
- ◆ **2015 – Present:** Moderator of Caltech Cahill Astro-ph Discussions
- ◆ **2015:** AAS Chambliss Poster Judge
- ◆ **2011 – Present:** Member of the SOFIA/FORCAST Instrument Science Team
- ◆ Referee for *ApJ*

## SELECTED PRESS AND MEDIA

---

- ◆ New York Times (and 100+ other media outlets including Washington Post, Huffington Post, Space.com, and Universe Today), “Scientists Solve a Puzzle: Cosmic Dust Comes from Supernovae,” March 2015
  - Honolulu Star Advertiser, “Fiery Forge,” March 23, 2015
- ◆ UChicago News, “Yerkes Observatory educators prepare to fly with airborne infrared telescope,” May 5, 2014
- ◆ Honolulu Star Advertiser, “Isle teacher, ‘Iolani grad find common ground in NASA flight,” September 23, 2013
- ◆ Hawaii Tribune-Herald, “Astronomer to talk about Galactic core,” July 3, 2013
- ◆ CBS This Morning News Interview, “New NASA Observatory is Changing Astronomy,” June 22, 2013
- ◆ NASA Press Release, “SOFIA Spots Recent Starbursts in the Milky Way Galaxy’s Center,” January 8, 2013

## REFEREED PUBLICATIONS (\* - Submitted)

---

1. **Lau, R. M.**, Kasliwal, M. M., Bond, H. E., Smith, N. *et al.*, “Rising from the Ashes: Mid-Infrared Re-Brightening of the Impostor SN 2010da in NGC 300.” Accepted to *ApJ* (2016).  
arXiv:1605.06750
2. **Lau, R. M.**, Werner, M., Sahai, R., Ressler, M. E., “Evidence from SOFIA Imaging of Polycyclic Aromatic Hydrocarbon Formation along a Recent Outflow in NGC 7027.” Accepted to *ApJ* (2016).
3. \*Kasliwal, M. M. *et al.*, “SPIRITS: Uncovering Unusual Infrared Transients with *Spitzer*.” Submitted to *ApJ* (2016)
4. **Lau, R. M.**, Hankins, M. J., Herter, T. L., Morris, M. R., Mills, E. A. C., Ressler, M. E., “An Apparent Precessing Helical Outflow from a Massive Evolved Star: Evidence for Binary Interaction.” *ApJ*, **818**, 117 (Feb. 2016)

5. \*Tinyanont, S., Kasliwal, M. M., Fox, O. D., **Lau, R. M.**, *et al.*, “A Systematic Study of Mid-Infrared Emission from Core-Collapse Supernovae with SPIRITS.” Submitted to *ApJ* (Jan. 2016). arXiv160103440
6. Adams, J. D., Herter, T. L., Hora, J. L., Schneider, N., **Lau, R. M.**, *et al.*, “SOFIA/FORCAST Observations of Warm Dust in S106: A Fragmented Environment.” *ApJ*, **814**, 54 (Nov. 2015)
7. Hankins, M. J., **Lau, R. M.**, Morris, M. R., Sanchez-Bermudez, *et al.*, “Mid and Far Infrared Observations of the Quintuplet Proper Members using SOFIA/FORCAST and Gemini/TReCS.” Accepted to *ApJ*
8. **Lau, R. M.**, Herter, T. L., Morris, M. R., Li, Z., Adams, J. D., “Old Supernova Dust Factory Revealed at the Galactic Center.” *Science*, **348**, 413 (Apr. 2015)
9. **Lau, R. M.**, Herter, T. L., Morris, M. R., Adams, J. D., “Dusty Cradles in a Turbulent Nursery: The Sgr A East HII Region Complex at the Galactic Center” *ApJ*, **794**, 108 (Sept. 2014)
10. **Lau, R. M.**, Herter, T. L., Morris, M. R., Adams, J. D., “Nature vs. Nurture: Luminous Blue Variable Nebulae in and near Massive Stellar Cluster at the Galactic Center.” *ApJ*, **785**, 120 (Apr. 2014)
11. **Lau, R. M.**, Herter, T. L., Morris, M. R., Becklin, E.E., Adams, J. D., “SOFIA/FORCAST Imaging of the Circumnuclear Ring at the Galactic Center.” *ApJ*, **775**, 37 (Sept. 2013)