

# Jessica Ryan Lu

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RESEARCH INTERESTS	High-mass star and cluster formation, galactic centers, stellar dynamics, high-angular resolution imaging and spectroscopy, adaptive optics, astrometry, infrared astronomy.	
EDUCATION	<b>University of California, Los Angeles</b> , Ph.D., Astrophysics 2008 <ul style="list-style-type: none"><li>• Adviser: Prof. Andrea Ghez</li><li>• Thesis: <i>Origins of Young Stars in the Central Parsec of the Milky Way</i></li></ul> <b>University of California, Los Angeles</b> , M.S., Astrophysics 2005 <b>Massachusetts Institute of Technology</b> , S.B., Physics 2000 <ul style="list-style-type: none"><li>• Adviser: Prof. Victoria Kaspi</li><li>• Thesis: <i>Monitoring Anomalous X-ray Pulsars with RXTE</i></li></ul>	
HONORS AND AWARDS	2011 NSF Astronomy Postdoctoral Fellowship (IfA, UH Manoa) 2011 Hubble Postdoctoral Fellowship (declined) 2011 NOAO Goldberg (declined) 2011 Dunlap Institute Postdoctoral Fellowship (declined) 2008 Caltech Millikan Postdoctoral Fellowship in Observational Astronomy 2008 Hubble Postdoctoral Fellowship (declined) 2008 NSF Astronomy Postdoctoral Fellowship (declined) 2005 NSF Graduate Research Fellowship 2000 MIT Barrett Award for Excellence in Astrophysics 1997-1999 Spertus Family MIT Research Support Grant	
RESEARCH APPOINTMENTS	<b>NSF Astronomy and Astrophysics Postdoctoral Fellow</b> , IfA 09/2011 - present <b>Millikan Postdoctoral Fellow in Obs. Astronomy</b> , Caltech 10/2008 - 09/2011 <ul style="list-style-type: none"><li>• Measuring the IMF for massive young star clusters in the Milky Way and in the Galactic Center using near-infrared adaptive optics photometry, astrometry, and spectroscopy.</li><li>• Using adaptive optics integral-field unit spectroscopy to measure the kinematics of the nucleus of M31 in an effort to understand the origin of the young nuclear star cluster.</li></ul> <b>Graduate Researcher</b> , UCLA 06/2003 - 09/2005 <b>NSF Graduate Research Fellow</b> , UCLA 09/2005 - 09/2008 <ul style="list-style-type: none"><li>• Dynamical studies of the young stars in the central parsec of the Milky Way in order to understand their origins.</li><li>• Search for infrared counterparts to transient X-ray sources in the Galactic Center</li><li>• Spectroscopic studies of the young stars closest to the supermassive black hole in order to look for extended mass distributions.</li></ul> <b>Undergraduate Researcher</b> , MIT 06/1997 - 06/2000 <ul style="list-style-type: none"><li>• Long-term monitoring of four anomalous X-ray pulsars (AXPs) using phase coherent timing methods to determine the relationship between AXPs and Soft-Gamma repeaters.</li><li>• Used the Compton Gamma-Ray Observatory/EGRET instrument, to observe 2 unidentified gamma-ray sources that were spatially coincident with 2 young energetic radio pulsars. Through timing analysis, we found evidence for gamma-ray emission from PSR B1046-58.</li></ul>	
SERVICE AND OTHER EXPERIENCES	Professional Activities <ul style="list-style-type: none"><li>• 2011 HST TAC Panel Member</li></ul>	

- 2011 Adaptive Optics Astrometry Workshop Organizer
- 2009,2011 TAC Member for Keck and Caltech Optical Observatories
- 2008-present, TMT IRIS Instrument Science Team
- 2009 Keck OSIRIS Workshop Organizer
- 2006-2007, Keck Next Generation Adaptive Optics, Galactic Science Team
- 2006-2007, Keck Next Generation Adaptive Optics, Astrometry Technical Team
- 2007, Keck NIRC2 Distortion Characterization Effort
- Referee for *The Astrophysical Journal* and *Astronomy & Astrophysics*
- Co-Founder of the AstroBetter.com wiki

#### Professional Memberships

- American Astronomical Society
- Center for Adaptive Optics

#### Public Outreach

- Collaborated with Adler Planetarium and University of Chicago Cosmus program in creating a 3D visualization of the stars orbiting the supermassive black hole at the center of the Milky Way.  
*<http://astro.uchicago.edu/cosmus/projects/stararoundblackhole/>*
- Collaborated with National Center for Supercomputing Applications to incorporate above with a simulated animation of the entire Galactic Center region
- Participated in filming and graphic design for the NSF funded NOVA show, *Monster of the Milky Way*, which exhibited research from our UCLA Galactic Center Group.
- Created the UCLA Galactic Center Group website. *<http://www.astro.ucla.edu/research/galcenter>*

#### Departmental Service

- 2008-2011, Caltech Astro-ph Discussion Organizer
- 2003-2006, UCLA Astronomy Webmaster
- 2006-2007, UCLA Faculty Rep. for Grad Students

#### Software Engineer

- 06/2000 - 05/2003, Alphablox Corporation, Mountain View, CA

#### TEACHING EXPERIENCE

*Lesson/Lab Design, CfAO Summer School* 2006-2007  
Part of a team that designed and implemented three interactive labs for the Center for Adaptive Optics Summer School. The labs use facilities and equipment provided by the Moore Lab for Adaptive Optics and attempts to incorporate Inquiry teaching methods for an advanced topic previously taught only in lecture format.

*Teaching Assistant, UCLA* Spring 2006, 2008  
Design and teach weekly recitation sessions for ASTRO 81, an introductory astronomy course for astronomy/physics majors. Received a Teaching Award for 2006.

*Participant, CfAO Professional Development Workshop* Spring 2006  
Training in inquiry (and other) teaching styles.

*Teaching Assistant, UCLA* Fall 2004  
Teach weekly lab sessions for ASTRO 3 introductory astronomy course for non-science majors. Received a Teaching Award for 2004.

#### STUDENTS

Jennifer Greco - Caltech Summer Undergrad 2009  
Hal Cambier\* - UCLA Summer Undergrad 2006  
James Dunn\* - UCLA Undergrad 2006-2008  
Jill Naiman\* - UCLA Undergrad 2005-2006  
Lia Corralles\* - UCLA Summer Undergrad 2005  
Javiera Guedes\* - UCLA Summer Undergrad 2004

*\*Served as a graduate student advisor for undergrads advised by Prof. Andrea Ghez*

PAPERS IN  
PREPARATION

Clarkson, W.; Ghez, A. M.; Morris, M. R.; **Lu, J. R.**; McCrady, N.; Stolte, A.; Yelda, S.; Do, T.; “*Proper motions of the Arches cluster with Keck LGS-Adaptive Optics: The First Kinematic Mass Measurement of the Arches*”, in preparation

PUBLICATIONS

*Note: some publications under maiden name, Jessica Lackey.*

<sup>†</sup> *Unrefereed publications are marked.*

Yelda, S.; **Lu, J. R.**; Ghez, A. M.; Clarkson, W.; Anderson, J.; Do, T.; Matthews, K.; “*Improving Galactic Center Astrometry by Reducing the Effects of Geometric Distortion*”, 2010, ApJ, 725, 331

<sup>†</sup>**Lu, J. R.**; Ghez, A. M.; Yelda, S.; Do, T.; Clarkson, W.; McCrady, N.; Morris, M. R.; “*Recent Results and Perspectives for Precision Astrometry and Photometry with Adaptive Optics*”; 2010, Proceedings of SPIE, 7736, astroph/1008.1293

<sup>†</sup>Barton, E. J.; Larkin, J. E.; Moore, A. M.; Wright, S. A.; Crampton, D.; Simard, L.; Macintosh, B.; Cote, P.; Barth, A. J.; Ghez, A. M.; **Lu, J. R.**; Davidge, T. J.; Law, D. R.; IRIS Science Team; “*The Infrared Imaging Spectrograph (IRIS) for TMT: The Science Case*”, 2010, Proceedings of SPIE, 7736, astroph/1007.1976

Stolte, A.; Morris, M. R.; Ghez, A. M.; Do, T.; **Lu, J. R.**; Ballard, C.; Mills, E.; Matthews, K.; “*Disks in the Arches Cluster - Survival in a Starburst Environment*”, 2010, ApJ, 718, 810

Smith, N.; Miller, A. A.; Weidong, L.; Filippenko, A. V.; Silverman, J. M.; Howard, A. W.; Nugent, P.; Marcy, G. W.; Bloom, J. S.; Ghez, A. M.; **Lu, J. R.**; Yelda, S.; Bernstein, R. A.; Colucci, J. E.; “*Discovery of Precursor LBV Outbursts in Two Recent Optical Transients: The Fitfully Variable Missing Links UGC 2773-OT and SN 2009ip*”, 2010, AJ, 139, 1451

Do, T.; Ghez, A. M.; Morris, M. R.; **Lu, J. R.**; Matthews, K.; Yelda, S.; Larkin, J.; “*High Angular Resolution Integral-Field Spectroscopy of the Galaxy’s Nuclear Cluster: A Missing Stellar Cusp?*”, 2009, ApJ, 703, 1323

Do, T.; Ghez, A. M.; Morris, M. R.; Yelda, S.; Meyer, L.; **Lu, J. R.**; Hornstein, S. D.; and Matthews, K.; “*A Near-IR Variability Study of the Galactic Black Hole: A Red Noise Source with No Detected Periodicity*”, 2009, ApJ, 691, 1021

<sup>†</sup>**Lu, J. R.**; “*Exploring the Origins of Young Stars in the Central Parsec of our Galaxy with Stellar Dynamics*”, 2008, UCLA Ph.D. Thesis

**Lu, J. R.**; Ghez, A. M.; Hornstein, S. D.; Morris, M. R.; Becklin, E. E.; Matthews, K.; “*A Disk of Young Stars at the Galactic Center as Determined by Individual Stellar Orbits*”, 2009, ApJ, 690, 1463

Ghez, A. M.; Salim, S.; Weinberg, N. N.; **Lu, J. R.**; Do, T.; Dunn, J. K.; Matthews, K.; Morris, M.; Yelda, S.; Becklin, E. E.; Kremenek, T.; Milosavljevic, M.; and Naiman, J.; “*Measuring the Distance and Properties of the Milky Way’s Central Supermassive Black Hole with Stellar Orbits*”, 2008, ApJ, 689, 1044

Stolte, A.; Ghez, A. M.; Morris, M. R.; **Lu, J. R.**; Brandner, W.; Matthews, K.; “*The Proper Motion of the Arches Cluster with Keck Laser-Guide Star Adaptive Optics*”, 2007, ApJ, 675, 1278

Hornstein, S. D.; Matthews, K.; Ghez, A. M.; **Lu, J. R.**; Morris, M. R.; Becklin, E. E.; Rafel-

ski, M.; Baganoff, F. K.; "A Constant Spectral Index for Sagittarius A\* during Infrared/X-Ray Intensity Variations", 2007, ApJ, 667, 900

**Lu, J. R.**; Ghez, A. M.; Hornstein, S. D.; Morris, M. R.; Matthews, K.; Thompson, D. J.; Becklin, E. E.; "Orbits and Origins of the Young Stars in the Central Parsec", 2006, Galactic Center Newsletter, 25, invited article

**Lu, J. R.**; Ghez, A. M.; Hornstein, S. D.; Morris, M. R.; Matthews, K.; Thompson, D. J.; Becklin, E. E.; "Galactic Center Youth: Orbits and Origins of the Young Stars in the Central Parsec", 2006, Journal of Physics: Conference Series, 54, 279

Rafelski, M.; Ghez, A. M.; Hornstein, S. D.; **Lu, J. R.**; Morris, M.; "Photometric Stellar Variability in the Galactic Center", 2007, ApJ, 659, 1241

**Lu, J. R.**; Ghez, A. M.; Hornstein, S. D.; Morris, M.; Becklin, E. E.; "IRS 16 SW - A New Comoving Group of Young Stars in the Central Parsec of the Milky Way", 2005, ApJ, 625, L51

Ghez, A. M.; Hornstein, S. D.; **Lu, J. R.**; Bouchez, A.; LeMignant, D.; Wizinowich, P.; Matthews, K.; Morris, M.; Becklin, E. E.; Campbell, R. D.; Chin, J. C. Y.; van Dam, M. A.; Hartman, S. K.; Johansson, E. M.; Lafon, R. E.; Stomski, P. J.; Summers, D. M.; "The First Laser Guide Star Adaptive Optics Observations of the Galactic Center: Sgr A\*'s Infrared Color and the Discovery of Extended Red Emission in its Vicinity", 2005, ApJ, 635, 1087

Muno, M. P.; **Lu, J. R.**; Baganoff, F. K.; Brandt, W. N.; Garmire, G. P.; Ghez, A. M.; Hornstein, S. D.; Morris, M. R.; "A Remarkable Low-Mass X-Ray Binary within 0.1 Parsecs of the Galactic Center", 2005, ApJ, 633, 228

Muno, M. P.; Pfahl, E.; Baganoff, F. K.; Brandt, W. N.; Ghez, A.; **Lu, J. R.**; Morris, M. R.; "An Overabundance of Transient X-Ray Binaries within 1 Parsec of the Galactic Center", 2005, ApJ, 622, L113

Ghez, A. M.; Salim, S.; Hornstein, S. D.; Tanner, A.; **Lu, J. R.**; Morris, M.; Becklin, E. E.; Duchêne, G.; "Stellar Orbits around the Galactic Center Black Hole", 2005, ApJ, 620, 744

Kaspi, V. M.; Gavriil, F. P.; Chakrabarty, D.; **Lackey, J. R.**; Muno, M. P.; "Long-Term Rossi X-ray Timing Explorer Monitoring of the Anomalous X-ray Pulsar 1E 1048.1-5937", 2001, ApJ, 558, 253

†**Lackey, J. R.**; "Monitoring Anomalous X-ray Pulsars with RXTE", 2000, MIT Undergraduate Thesis

Kaspi, V. M.; **Lackey, J. R.**; Chakrabarty, D., "A Glitch in an Anomalous X-ray Pulsar", 2000, ApJ, 537, L31

Kaspi, V. M.; **Lackey, J. R.**; Mattox, J.; Manchester, R. N.; Bailes, M.; Pace, R.; "High-Energy Gamma-Ray Observations of Two Young, Energetic Radio Pulsars", 2000, ApJ, 528, 445

#### TALKS AND POSTERS

Invited Talk: **TMT Workshop**, Victoria, BC, 3/2011, *Astrometry with ELTs*

Invited Talk: **Univ. of Texas** Astronomy Colloquium, Austin, TX, 2/2011, *Clarifying our View of Milky Way Massive Young Star Clusters with Adaptive Optics*

Invited Talk: **Drexel University** Physics Colloquium, Philadelphia, PA, 1/2011, *Star Formation in Extreme Environments, Including Around the Milky Way's Supermassive Black Hole*

Invited Talk: **Institute for Astronomy, UHawaii** Astronomy Colloquium, Honolulu, HI, 1/2011, *Clarifying our View of Milky Way Massive Young Star Clusters with Adaptive Optics*

Talk: **AAS Meeting**, Seattle, WA 1/2011, *Clarifying our View of Milky Way Massive Young Star Clusters with Adaptive Optics*

Invited Talk: **Caltech** Astronomy Colloquium, Pasadena, CA, 12/2010, *Clarifying our View of Star Formation in Massive Young Clusters with Adaptive Optics*

Invited Talk: **Carnegie Observatories** Astronomy Colloquium, Pasadena, CA, 11/2010, *Clarifying our View of Star Formation in Massive Young Clusters with Adaptive Optics*

Invited Talk: **SPIE Conference**, San Deigo, CA, 6/2010, *Recent Results and Perspectives for Precision Astrometry and Photometry with Adaptive Optics*

Invited Talk: **UP 2010 Conference**, Sedona, AZ, 6/2010, *Clarifying our View of Star Formation in Massive Young Clusters and the Galactic Center with Adaptive Optics*

Invited Talk: **From Stars To Galaxies Conference**, U. of Florida, 4/2010, *Massive Young Star Clusters in Different Milky Way Environments*

Invited Talk: **Lawrence Livermore National Labs** Colloquium, 3/2010, *Clarifying our View of Star Formation in Massive Young Clusters with Adaptive Optics*

Invited Talk: **AAS Science with Adaptive Optics on Large Telescopes**, 6/2009, *Origin of Young Stars in the Galactic Center and M31*

Invited Talk: **AAS 2010-2020: The Decade of Astrometry**, 6/2009, *Relative Astrometry with Ground-Based Adaptive Optics Imaging*

Invited Talk: **UC Irvine** Astrophysics Seminar, 6/2009, *Origins of Young Stars Around the Two Closest Supermassive Black Holes*

Poster: **Intermediate-Mass Black Holes Conference**, UC Irvine, 4/2009, *Observational Constraints on Fueling the Starburst in the Central Parsec of M31*

Invited Talk: **Cal Poly Pomona** Physics Colloquium, 1/2009, *Star Formation Around the Supermassive Black Hole at the Center of our Galaxy*

Invited Talk: **U. of Florida, Gainseville** Astronomy Colloquium, 11/2008, *Young Stars in the Central Parsec of Our Galaxy*

Invited Talk: **Center for Adaptive Optics Fall Retreat**, 10/2008, *Characterizing and Improving Ground Based Astrometry from Keck*, joint talk with Sylvana Yelda

Invited Talk: **Tarzana Medical Center** Astronomy Symposium, 08/2008, *Forming Stars Around the Supermassive Black Hole in Our Galaxy*

Invited Talk: **The Universe Under the Microscope Conference**, 04/2008, *Dynamics of the Stars Around Our Galaxy's Supermassive Black Hole*

Talk: **AAS Meeting**, 01/2008, *Orbits and Origins of Young Stars in the Central Parsec of the Milky Way*

Invited Talk: **Keck Science Meeting**, 09/2007, *Astrometry with the Next Generation Adaptive Optics System at Keck*, joint talk with Brian Cameron

Poster: **Science in the Era of TMT Conference**, 07/2007, *A Magnified View of the Nucleus of M31 with TMT*

Invited Talk: **Galactic Center Workshop**, Ringberg, 06/2007, *Young Stellar Disks in the Galactic Center*

Invited Talk: **Center for Adaptive Optics Spring Retreat**, 03/2007, *Astrometry with Adaptive Optics Imaging*

Invited Talk: **UC Berkeley**, Theoretical Astrophysics Center Seminar, 10/2006, *The Galactic Center: Star Formation Near a Supermassive Black Hole?*

Talk: **Keck Science Meeting**, 09/2006, *Orbits and Origins of the Young Stars at the Center of Our Milky Way Galaxy*

Talk: **Galactic Center Workshop**, 04/2006, *Galactic Center Youth: Orbits and Origins of the Young Stars in the Central Parsec*

Invited Talk: **USC Viterbi School of Engineering** Undergraduate Honors Colloquium, 04/2006, *The Supermassive Black Hole at the Center of the Milky Way*

Talk: **AAS Meeting**, 01/2006, *Orbits and Origins of the Young Stars at the Center of Our Milky Way Galaxy*

Talk: **Center for Adaptive Optics NSF Site Visit**, 11/2005, *Overview of UCLA Galactic Center Research with Keck*

Talk: **Center for Adaptive Optics Fall Retreat**, 10/2005, *Overview of UCLA Galactic Center Research with Keck*

Poster: **KITP Galactic Center Conference**, 04/2005, *IRS 16 SW - A New Comoving Group of Young Stars in the Central Parsec of Our Galaxy*

Poster: **AAS Meeting**, 01/2005, *IRS 16 SW - A New Cluster of Young Stars in the Central Parsec of Our Galaxy*

Poster: **Center for Adaptive Optics Fall Retreat**, 10/2004, *IRS 16 SW - A New Comoving Group of Young Stars in the Central Parsec of Our Galaxy*