Xing "Walker" Lu

ALMA Project Research Fellow

Chile Observatory, National Astronomical Observatory of Japan

9 2-21-1 Osawa, Mitaka, Tokyo 181-8588, Japan

☑ xinglv.nju@gmail.com, xing.lu@nao.ac.jp

★ https://xinglunju.github.io
♠ https://github.com/xinglunju

Research Interests

- Star formation in the Central Molecular Zone of the Galaxy.
- Gas accretion in high-mass star forming filamentary clouds.

Education

Sep. 2010–Jun. 2016	Ph.D. in Astronomy, School of Astronomy & Space Science, Nanjing University.
Advisors	Drs. Qizhou Zhang and Qiusheng Gu
Thesis	Interferometric Observations of Dense Cores in High-mass Star Forming Regions
Sep. 2006–Jun. 2010	B.S. in Physics, Kuang Yaming Honor School, Nanjing University.

Professional Experience

Sep. 2018–Present	Referee of the journal Research in Astronomy and Astrophysics.
Mar. 2018–Present	One of the two founders and organisers of the Star Formation Weekly Meeting at NAOJ.
Nov. 2017	Astronomer on Duty at the ALMA Operations Support Facility, Chile. Operated ALMA, scheduled projects, and conducted various tests during two shifts (two weeks).
Jun. 2017	Technical secretary for the ALMA Cycle 5 proposal review meeting. Helped the panel chair coordinating the discussion, and answered technical questions on ALMA from reviewers.
Aug. 2016–Present	ALMA project research fellow at NAOJ, with duties related to ALMA operations, including data quality assurance, user support (Phase 2 Generation, helpdesk), and support of workshops.
Mar. 2012–Aug. 2015	The Submillimeter Array (SMA) pre-doctoral fellow at Harvard-Smithsonian Center for Astrophysics (advisor: Dr. Qizhou Zhang).
May 2011–Present	Administrator and contributor of <i>Astroleaks</i> , an on-line platform for professional discussion and experience-sharing. Contributed 12 articles covering topics including solar physics and data visualization.
Mar. 2010–Jun. 2010	Undergraduate research intern at Nanjing University (advisor: Prof. Yang Chen), data reduction and analysis of CO (1–0) observations taken with the KOSMA telescope towards the supernova remnant W41.

Sep. 2009–Feb. 2010

Associate editor of *College Natural Science*, a nation-wide student-managed undergraduate science journal.

▼ Teaching/Mentoring and Outreach

Aug. 2018	Volunteer of the Nobeyama Radio Observatory Public Open Day.
Oct. 2016/2017/2018	Volunteer of the National Astronomical Observatory of Japan Public Open Day.
Aug. 2017–Oct. 2017	Host of visiting student Mengyuan Xiao (first-year PhD student from Nanjing University) at NAOJ. Taught basics of interferometry and worked together to calibrate and image ALMA data of a high-redshift proto-galaxy-cluster.
Jun. 2013–Aug. 2015	Mentors of summer interns at Harvard-Smithsonian Center for Astrophysics. Worked with 4 interns from colleges and high schools to develop short-term research projects from interferometric imaging to Python programming.
Sep. 2011–Jan. 2012	Teaching assistant for undergraduate course <i>Observational Astronomy</i> at Nanjing University (lecturer: Dr. Junzhi Wang).

♥ Professional Skills

- · Mastered in Python and IDL.
- Text editing with LTEX, web design with HTML/CSS/Javascript.

☑ Successful PI Observation Proposals

ALMA (45 hours completed & \sim 35 hours allocated)

- 2018 "Evidence of accretion disks during the formation of high-mass stars in the Central Molecular Zone" (Grade A; 10 hours allocated).
- 2018 "Are they low-mass protostars? A census of hundreds of compact sources in the Central Molecular Zone" (Grade A; 21 hours allocated).
- "Gas accretion into dense cores from early to late evolutionary phases of massive filamentary clouds" (re-submission; 21 hours allocated but partially completed).
- 2017 "Where and when do low-mass stars form in high-mass protoclusters?" (8.5 hours).
- "Gas accretion into dense cores from early to late evolutionary phases of massive filamentary clouds" (36 hours).
- 2017 "Confirming Deeply Embedded Protostellar Population in the Central Molecular Zone" (re-submission; 6 hours).

VLA (3 hours completed & 30 hours allocated as filler)

- 2018 "Is Active Star Formation Emerging in the Central Molecular Zone?" (30 hours allocated).
- 2016 | "Progressive Star Formation of the Orbit in the Central Molecular Zone" (3 hours).

SMA (20 tracks completed & 4 tracks allocated; 1 track is 6–10 hours)

- 2018 "Gas Accretion toward Dense Cores in High-mass Star Forming Filaments" (4 tracks allocated).
- "Understanding Formation of Low-mass Stars in Clusters with Observations of Hubs" (3 tracks).
- 2015 "High-mass Star Formation in Dense Cores Embedded in Filaments" (2 tracks).
- 2015 "Deeply Embedded Protostars in the Central Molecular Zone" (1 track).
- 2014 "Massive Star Formation in Progress in Filamentary Clouds" (3 tracks).
- 2014 | "Star Formation in Progress in Filamentary Clouds" (filler; 2 tracks).
- 2013 "Star Formation in the Central Molecular Zone" (filler; 1 track).
- 2013 "Sgr B2: A Star-forming Cloud in the Central Molecular Zone" (2 tracks).
- 2013 "Gas Kinematics in Filamentary Infrared Dark Clouds" (1 track).
- 2013 | "High-mass Clouds in the Central Molecular Zone" (3 tracks).
- 2012 "Gas Kinematics and Condensations in Filamentary Infrared Dark Clouds" (filler; 1 track).
- 2012 "Gas Kinematics and Condensations in Filamentary Infrared Dark Clouds" (1 track).

JCMT (24 hours completed & 32 hours allocated)

- 2018 "Are supercritical filaments supported by magnetic fields?" (32 hours allocated).
- 2017 "A Rigorous Survey of Gas Accretion in High-mass Star Forming Filamentary Clouds" (24 hours).

ASTE (10 hours completed)

"Densities of Massive Molecular Clouds in the Central Molecular Zone with N_2H^+ Lines" (10 hours).

IRAM 30m (9 hours completed)

2014 "Filamentary Structure, Infall Convergent Flow and Massive Star Formation" (9 hours).

Participated Large Scale Projects

- 2017–2018 ALMA, PI: F. Motte, "ALMA-IMF: ALMA transforms our view of the origin of stellar masses".
- 2014–2017 SMA, PIs: C. Battersby & E. Keto, "CMZoom: The SMA Legacy Survey of the Central Molecular Zone".
- 2015–2017 The Submillimeter Telescope (SMT), PI: K. Wang, "ESO-ARO Public Survey on Planck All-Sky Cold Clumps".

† Observing Experience

Nov. 2017 | ALMA, on-site observing, 14 nights, San Pedro, Chile.

Jul. 2017 | ASTE, remote observing, 10 nights, Mitaka, Japan.

SMT, remote observing, 3 nights, Nanjing, China. Jan. 2016 SMT, remote observing, 2 nights, Nanjing, China. Nov. 2015 SMA, on-site observing, 5 nights, Mauna Kea, HI, USA. Sep. 2014 Caltech Submillimeter Obervatory (CSO), remote observing, 3 nights, Cambridge, Apr. 2014 MA, USA. Combined Array for Research in Millimeter-wave Astronomy (CARMA), on-site Jun. 2012 observing during CARMA summer school, 2 nights, Big Pine, CA, USA. SMA, on-site observing, 5 nights, Mauna Kea, HI, USA. May 2012 DLH 13.7m telescope, on-site observing, 5 nights, Delingha, Qinghai, China. Jan. 2012

P Honors and Grants

- JSPS Grant-in-Aid for Early-Career Scientists (KAKENHI), 910,000 JPY (\sim 8,200 USD) for two years.
- 2017 Outstanding Doctoral Thesis Prize of Jiangsu Province, China.
- 2016 NAOJ ALMA project research fellowship.
- Excellent Projects of Program A for outstanding PhD candidates of Nanjing University, 10,000 CNY (~1,500 USD).
- 2016 | IAU Travel Grants, 700 EUR (∼800 USD).
- Program A for outstanding PhD candidates of Nanjing University, 80,000 CNY (~12,000 USD).
- Nanjing University outstanding graduate students scholarship, 1,000 CNY (\sim 150 USD).
- The SMA pre-doctoral fellowship, \sim 30,000 USD per year for three years.
- 2011 Nanjing University Zhengzhiwei enterprise scholarship.
- 2009 Nanjing University social activity scholarship, second prize.
- 2008 Nanjing University people's scholarship, second prize.
- 2007 | Nanjing University people's scholarship, second prize.

List of Publications

Submitted Work

"Star Formation Rates of Massive Molecular Clouds in the Central Molecular Zone",
 Lu, X., Zhang, Q., Kauffmann, J., Pillai, T., Ginsburg, A., Mills, E. A. C., Kruijssen,
 J. M. D., Longmore, S. N., Battersby, C., Liu, H. B & Gu, Q., submitted to ApJ.

■ First-authored Publications

- 5. "Filamentary Fragmentation and Accretion in High-mass Star-forming Molecular Clouds", **Lu, X.**, Zhang, Q., Liu, H. B., Sanhueza, P., Tatematsu, K., Feng, S., Smith, H. A., Myers, P. C., Sridharan, T. K., & Gu, Q. 2018, ApJ, 855, 9.
- 4. "The Molecular Gas Environment in the 20 km s⁻¹ Cloud in the Central Molecular Zone", **Lu, X.**, Zhang, Q., Kauffmann, J., Pillai, T., Longmore, S. N., Kruijssen, J. M. D., Battersby, C., Liu, H. B., Ginsburg, A., Mills, E. A. C., Zhang, Z.-Y., & Gu, Q. 2017, ApJ, 839, 1.
- 3. "Deeply Embedded Protostellar Population in the 20 km $\rm s^{-1}$ Cloud of the Central Molecular Zone",
 - Lu, X., Zhang, Q., Kauffmann, J., Pillai, T., Longmore, S. N., Kruijssen, J. M. D., Battersby, C., & Gu, Q. 2015, ApJL, 814, L18.
- 2. "Initial Fragmentation in the Infrared Dark Cloud G28.53-0.25", Lu, X., Zhang, Q., Wang, K., & Gu, Q. 2015, ApJ, 805, 171.
- 1. "VLA Observations of Ammonia in High-mass Star Formation Regions", Lu, X., Zhang, Q., Liu, H. B., Wang, J., & Gu, Q. 2014, ApJ, 790, 84.

@ Co-authored Publications

- 9. "SMA Observations of Extended CO (J=2-1) Emission in Interacting Galaxy NGC 3627", Law, C. J., Zhang, Q., Ricci, L., Petitpas, G., Jiménez-Donaire, M. J., Ueda, J., Lu, X., & Dunham, M. M. 2018, ApJ, 865, 1.
- 8. "Distributed Star Formation throughout the Galactic Center Cloud Sgr B2", Ginsburg, A., Bally, J., Barnes, A., Bastian, N., Battersby, C., Beuther, H., Brogan, C., Contreras, Y., Corby, J., Darling, J., & 17 co-authors including **Lu**, **X**. 2018, ApJ, 853, 171.
- 7. "First Data Release of the ESO-ARO Public Survey SAMPLING—SMT All-sky Mapping of Planck Interstellar Nebulae in the Galaxy", Wang, K., Zahorecz, S., Cunningham, M. R., Tóth, L. V., Liu, T., Lu, X., Wang, Y., Cosentino, G., Sung, R.-S., Sokolov, V., & 10 co-authors 2018, RNAAS, 2, 2.
- 6. "Star formation in a high-pressure environment: an SMA view of the Galactic Centre dust ridge", Walker, D. L., Longmore, S. N., Zhang, Q., Battersby, C., Keto, E., Kruijssen, J. M. D., Ginsburg, A., **Lu**, **X**., Henshaw, J. D., Kauffmann, J., & 7 co-authors 2018, MNRAS, 474, 2373.
- 5. "SMA Observations of the Hot Molecular Core IRAS 18566+0408", Silva, A., Zhang, Q., Sanhueza, P., **Lu, X.**, Beltran, M. T., Fallscheer, C., Beuther, H., Sridharan, T. K., & Cesaroni, R. 2017, ApJ, 847, 87.

- 4. "The Galactic Center Molecular Cloud Survey. I. A steep linewidth-size relation and suppression of star formation",
 - Kauffmann, J., Pillai, T., Zhang, Q., Menten, K. M., Goldsmith, P. F., **Lu**, **X**., & Guzmán, A. E. 2017, A&A, 603, A89.
- 3. "The Galactic Center Molecular Cloud Survey. II. A lack of dense gas and cloud evolution along Galactic center orbits",
 - Kauffmann, J., Pillai, T., Zhang, Q., Menten, K. M., Goldsmith, P. F., Lu, X., Guzmán, A. E., & Schmiedeke, A. 2017, A&A, 603, A90.
- "A Massive Prestellar Clump Hosting No High-mass Cores", Sanhueza, P., Jackson, J. M., Zhang, Q., Guzmán, A. E., Lu, X., Stephens, I. W., Wang, K., & Tatematsu, K. 2017, ApJ, 841, 97.
- 1. "Fragmentation of Molecular Clumps and Formation of Protocluster", Zhang, Q., Wang, K., Lu, X., & Jiménez-Serra, I. 2015, ApJ, 804, 141.

■ Conference Contributions

- 18. Poster, "Star Formation Rates of Massive Molecular Clouds in the Central Molecular Zone", Lu, X., Zhang, Q., Kauffmann, J., Pillai, T., Ginsburg, A., Mills, E. A. C., Kruijssen, J. M. D., Longmore, S. N., Battersby, C., Liu, H. B. 2018, 2018 Autumn Annual Meeting of the Astronomical Society of Japan.
- 17. Talk, "Deeply Embedded Star Formation in Massive Clouds in the Central Molecular Zone", **Lu, X.**, Zhang, Q., Kauffmann, J., Pillai, T., Longmore, S. N., Kruijssen, J. M. D., Battersby, C., Mills, E. A. C., Ginsburg, A., Liu, H. B. 2018, Tracing the Flow: Galactic Environments and the Formation of Massive Stars.
- Poster, "Gas Accretion in High-mass Star Forming Filaments",
 Lu, X., Zhang, Q., Sanhueza, P., Liu, H. B., Feng, S., Wang, K., Tatematsu, K. 2018,
 Tracing the Flow: Galactic Environments and the Formation of Massive Stars.
- 15. Poster, "Gas Accretion in High-mass Star Forming Filaments", **Lu, X.**, Zhang, Q., Sanhueza, P., Liu, H. B., Feng, S., Wang, K., Tatematsu, K. 2018, NAOJ NOEMA/30m Workshop.
- 14. Invited talk, "From Filaments to the Central Molecular Zone: Understanding Star Formation in the Galaxy",
 - Lu, X. 2018, School of Astronomy and Space Science, Nanjing University.
- 13. Colloquium talk, "Deeply Embedded Star Formation in Massive Clouds in the Central Molecular Zone",
 - Lu, X. 2018, Weekly Colloquium at the Shanghai Astronomical Observatory.
- 12. Colloquium talk, "Deeply Embedded Star Formation in Massive Clouds in the Central Molecular Zone",
 - Lu, X. 2018, Weekly Colloquium at the National Astronomical Observatory of China.
- 11. Colloquium talk, "The molecular environment of star formation in the Central Molecular Zone",
 - Lu, X. 2017, Weekly Colloquium at the China-Chile Joint Center for Astronomy.
- 10. Talk, "The molecular environment of star formation in the CMZ", Lu, X., Zhang, Q., Kauffmann, J., Pillai, T., Longmore, S. N., Kruijssen, J. M. D., Bat-

- tersby, C. 2017, Star Formation in Different Environments 2017 (SFDE17): From Local Clouds to Distant Galaxies.
- 9. Colloquium talk, "Fragmentation and Accretion in High-mass Star Forming Filamentary Clouds",
 - Lu, X. 2017, Weekly Colloquium at the Purple Mountain Observatory.
- 8. Talk, "Deeply Embedded Star Formation in the Central Molecular Zone", Lu, X., Zhang, Q., Kauffmann, J., Pillai, T., Longmore, S. N., Kruijssen, J. M. D., Battersby, C. 2017, East-Asian ALMA Science Workshop 2016.
- 7. Talk, "Deeply Embedded Protostellar Population in the Central Molecular Zone Suggested by H₂O Masers and Dense Cores",
 - Lu, X., Zhang, Q., Kauffmann, J., Pillai, T., Longmore, S. N., Kruijssen, J. M. D., Battersby, C. 2016, International Astronomical Union Symposium 322: The Multi-Messenger Astrophysics of the Galactic Centre.
- 6. Intro talk & poster, "An SMA/VLA Mini-survey of Six Massive CMZ Clouds: Searching for 'Hidden' Protostellar Population",

 July Thang O. Kauffmann, J. & Pillai, T. 2015, Harvard-Heidelberg Star Formation
 - Lu, X., Zhang, Q., Kauffmann, J., & Pillai, T. 2015, Harvard-Heidelberg Star Formation Workshops.
- 5. Talk, "SMA and VLA Observations of Dense Cores at Different Evolutionary Phases in Filamentary IRDCs",
 - Lu, X. & Zhang, Q. 2014, Workshop on Dense Cores: Origin, Evolution, and Collapse, AAS Topical Conference Series.
- 4. Talk, "Molecular Spectral Lines in Filamentary Infrared Dark Clouds", Lu, X., Zhang, Q., & Liu, H. B. 2014, 69th International Symposium on Molecular Spectroscopy.
- 3. Poster, "Revealing Initial Conditions of High-mass Star Formation in IRDCs with the SMA",
 - Lu, X., Zhang, Q., & Liu, H. B. 2014, The Submillimeter Array: First Decade of Discovery.
- 2. Talk, "Gas Kinematics in Filamentary Infrared Dark Clouds", Lu, X., Zhang, Q., & Liu, H. B. 2014, American Astronomical Society Meeting #224.
- 1. Poster, "SMA Observations towards Massive Clouds in the Central Molecular Zone", **Lu, X.**, Zhang, Q., Kauffmann, J., & Pillai, T. 2013, International Astronomical Union Symposium 303: The Galactic Center: Feeding and feedback in a normal galactic nucleus.