Shanghuo Li

"Make a star that you like in the sky"

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I am an independent PSF fellow at Max Planck Institute for Astronomy (MPIA). I received my PhD degree from University of Chinese Academy of Sciences (UCAS) and Shanghai Astronomical Observatory (SHAO), China, supervised by Prof. Junzhi Wang (SHAO) and Dr. Qizhou Zhang (CfA), in January 2020. I worked as an CfA-SMA pre-doctoral fellow at Harvard-Smithsonian Center for Astrophysics (CfA), USA, supervised by Dr. Qizhou Zhang (CfA), in 2017-2019. I was also a postdoctoral fellow at Korea Astronomy and Space Science Institute (KASI) in 2020-2022.

RESEARCH INTERESTS

My research interests focus on massive star clusters and low-mass star formation in molecular clouds. I'm also interesting the star formation activities in giant molecular clouds of nearby galaxies. Mostly, I used the infrared, radio, millimeter and sub-millimeter data, e.g., from Spitzer, Herschel, ALMA, SMA, NOEMA, JVLA, IRAM-30m, JCMT, SMT-10m, ARO-12m, CSO, PMO-13.7m, KVN-21m, Tianma-65m and FAST-500m, to probe the molecular gas, ionized gas and dust emission from large scales 100 pc down to small scales ∼0.0001 pc (a few 10 AU). Here some selected research projects, but not limited to:

- The initiation conditions of massive star and cluster formation
- Binary and multiple system formation
- Massive star formation feedback
- Star formation in filamentary structures of molecular cloud
- Outflows/jets/accretions evolution with time in star formation regions
- Radio interferometry/single dish technique

EDUCATION

2015–2019 **Doctor of Philosophiae** in Astrophysics — Shanghai Astronomical Observatory (SHAO) & University of Chinese Academy of Sciences (UCAS)
Investigating the Formation of Massive Stars and Clusters
Advisors: Dr. Qizhou Zhang (CfA) & Prof. Junzhi Wang (SHAO)

2012–2015 **Masters** of Astrophysics — Guangzhou University (GZU)
Line Survey Toward HII Regions
Advisors: Prof. Junzhi Wang (SHAO) & Prof. JunHui Fan (GZU)

2008–2012 **Bachelor** of Physics
Bachelor of Financial Management — Jiaying University

PRESS RELEASES AND MEDIA COVERAGE

42. Technology Org, 2024:
"Why do Weighty Stars Hold Together"

41. Recycling and care of planet, 2024:
"ALMA observations show how double, triple, quadruple and quintuple star systems form simultaneously in a molecular cloud"

40. Innovations report, 2024:
"Zwillinge, Drillinge und mehr (German version)"

39. Science Springs, 2024:
“New images confirm huge stars are born as twins and triplets and more”

38. Raumfahrer, 2024:
“Zwillinge, Drillinge und mehr (German version)”

37. News Beezer, 2024:
“Giant stars are being born as twins, triplets and more, new images confirm”

36. Microsoft MSN, 2024:
“Huge stars are born as twins, triplets and more, new images confirm”

35. yahoo! news, 2024:
“Huge stars are born as twins, triplets and more, new images confirm”

34. SPACE, 2024:
“Huge stars are born as twins, triplets and more, new images confirm”

33. ZAP AEIOU, 2024:
“Gémeas, trigémeas, quadrigémeas, emais: as estrelas massivas nascem em grupos (Portuguese version)”

32. BIG THINK, 2024:
“Star clusters give birth like dogs, not humans, ALMA shows”

31. Knowridge, Aerospace, 2024:
“Astronomers see massive stars forming together in multiple star systems”

30. BioRN, 2024:
“New observations confirm computer models how massive stars are born as multiples”

29. RadioNet, News, 2024:
“Twins, Triplets, Quadruplets and more: Observations show massive stars are indeed born as multiples”

28. News Space, 2024:
“Astrônomos veem estrelas massivas se formando juntas em múltiplos sistemas estelares (Portuguese version)”

27. Infobae, News, 2024:
“Variedad de sistemas estelares pueden surgir de la misma nube molecular (Spanish version)”

26. Lenta, News, 2024:
“A model for the formation of multiple star systems has been proven (Russian version)”

25. Mirage News, 2024:
“Why weighty stars hold together”

24. Kopalnia Wiedzy, 2024:
“Where do multiple star systems come from? We have the first observations of their formation (Polish version)”

23. Naked Science, 2024:
“Astronomers have examined for the first time a molecular cloud where systems of two, three and even five stars are formed (Russian version)”

22. My Science, News, 2024:
“Why weighty stars hold together”
“Warum schwere Sterne zusammenhalten (German version)”

21. UNIVERSE TODAY, 2024:
“Astronomers See Massive Stars Forming Together in Multiple Star Systems”

20. Nature Astronomy, News & Views, 2024:
“Multi-star systems observed in high-mass star forming region”

19. Astronnews, News, 2024:
“Massereiche Sterne entstehen als Vielfachsysteme (German version)”

18. THE NATIONAL TRIBUNE, News, 2024:
“Why weighty stars hold together”

17. Heidelberg Institute for Theoretical Studies, Research News, 2024:
“New observations confirm computer models how massive stars are born as multiples”
“Neue Beobachtungen bestätigen: Massereiche Sterne werden als Mehrlinge geboren (German version)”

16. Tiisys, Physics news, 2024:
“Why weighty stars hold together (Japanese version)”

15. Phys.org, Astronomy news, 2024:
"ALMA observations show how double, triple, quadruple and quintuple star systems form simultaneously in a molecular cloud"

14. University of Duisburg-Essen, Newsroom, 2024:
"Stars Born as Multiples"
"Mehrlingsgeburt bei Sternen (German version)"

13. MAX-PLANCK-GESELLSCHAFT, Newsroom, 2024:
"Massive stars are born as multiples"
"Massereiche Sterne entstehen als Mehrlinge (German version)"

12. Max Planck Institute for Astronomy – Press Release, 2024:
"Twins, Triplets, Quadruplets and more: Observations show massive stars are indeed born as multiples"
"Zwillinge, Drillinge und mehr: Beobachtungen bestätigen, dass massereiche Sterne als Mehrlinge geboren werden (German version)"

11. ScienceNet, 2024:
"Witnessing high-order multiplicity formation in high-mass stellar protocluster (Chinese version)"

10. BNN Breaking, 2024:
"Unraveling the Origins of Multi-Star Systems: Core Fragmentation Holds the Key"
"Astronomers Detect Multiple Protostellar Systems in a Single High Mass Protocluster"

9. idw - Informationsdienst Wissenschaft, 2024:
"Zwillinge, Drillinge und mehr: Beobachtungen bestätigen, dass massereiche Sterne als Mehrlinge geboren werden (German version)"

8. Center for Astrophysics | Harvard & Smithsonian (CfA) science update, 2022:
"The Role of Turbulence in Making Massive Stars"

7. Center for Astrophysics | Harvard & Smithsonian (CfA) science update, 2021:
"The Youngest Stellar Embryos in Massive Clouds"

6. The Academic Times, 2021. ""Astronomers enable search for small soon-to-be stars."

5. I was interviewed by The Academic Times Magazine for the article titled ""Astronomers enable search for small soon-to-be stars."

4. AAS Nova, 2021:
ASHES to ASHES, Dust to. . . Star Formation?

3. NATURE research highlights, 2021:
"Baby stars make it in a tough part of the Galaxy"

2. ALMA press release, 2021:
Stellar Eggs near Galactic Center Hatching into Baby Stars.

1. Center for Astrophysics | Harvard & Smithsonian (CfA) science update, 2020:
"Gas Motions in Interstellar Cores Forming Low-Massive Stars"

WORK EXPERIENCE

2022–Now **MPIA PSF Fellow** MPIA, Germany
working with Prof. Henrik Beuther
- Turbulence in star-formation clouds
- Extreme early stages of massive stars and clusters formation
- Binary and multiple in massive star protocluster-forming regions
- Filament formation and its embedded star formation
- Stellar feedback and star formation feedback

2020–2022 **KASI Postdoctoral Fellow** KASI, Republic of Korea
working with Dr. Kee-Tae Kim
- Extreme early stages of massive stars and clusters formation
- Binary and multiple in massive star protocluster-forming regions
- Star formation and filaments
- The influence of stellar feedback on new star formation

2017–2019 **CfA-SMA Predoctoral Fellow** Center for Astrophysics | Harvard & Smithsonian (CfA), USA
working with Dr. Qizhou Zhang
- Massive stars and clusters formation in infrared dark filamentary molecular cloud
- Studying the outflow motions and its associated filaments in 70 um dark clumps
- Formation of massive star protostellar clusters — Observations of a sample of massive 70 μm dark clouds
- Investigating the fragmentation at different evolutionary stages of massive star formation regions

2013–2017 **Graduate Student Research** Shanghai Astronomical Observatory (SHAO), China
working with Prof. Junzhi Wang
- SiO multi-transitions survey toward 199 massive star formation regions
- Millimeter line survey toward four HII regions
- Investigating the outflows properties of S255IR with the SMA observations

2012–2013 **Graduate Student Research** Guangzhou University, China
working with Prof. Junhui Fan
- Investigating the galaxy evolution and activity

AWARDS

2017–2019 **The Submillimeter Array (SMA) pre-doctoral fellow** Center for Astrophysics | Harvard & Smithsonian

2017–2019 **China Scholarship Council fellowship** China

2018 **The Zhu-Li Yuehua outstanding doctoral award** Chinese Academy of Sciences

2017 **National Scholarship** China

2016 **Merit Student** Chinese Academy of Science

PROFESSIONAL SERVICE

2021–present **Referee for: Astronomy and Astrophysics (A&A)**

2022–present **Referee for: The Astrophysical Journal (ApJ), The Astrophysical Journal Supplement (ApJS)**

2024 **Local organizing committee of the conference "The Early Phase Of Star formation (EPOS)"**

INVITED TALKS

14. Colloquium, Max Planck Institute for Astronomy (MPIA), Heidelberg, Germany, 19/04/2024.
Title: "Massive Stellar Cluster Formation – From Filament to Binary"

13. Seminar, Guangzhou University, Guangzhou, China, 10/01/2024.
Title: "Multiplicity formation in protocluster"

12. MARTES TALK, Nanjing University, Nanjing, China, 26/12/2023.
Title: “High-order multiplicity formation in high-mass stellar protocluster”

11. Seminar, Xiangtan University, Hunan, China, 21/12/2023.
Title: “High-order multiplicity formation in high-mass stellar protocluster”

10. Seminar, Shanghai Astronomical Observatory, Shanghai, China, 22/02/2023.
Title: “Massive Star Cluster Formation – From Filament to Binary”

9. Seminar, Guangxi University, Guangxi, China, 17/02/2023.
Title: “Shining Heart of the Molecular Cloud: Massive Protostellar Cluster Formation”

8. Seminar, Anhui Normal University, Anhui, China, 13/02/2023.
Title: “Early Stages of Massive Protostellar Cluster Formation”

7. Purple Mountain Observatory Youth Forum, PMO, China, 10/02/2023.
Title: “Massive Protostellar Cluster Formation”

6. Cosmic Origin Seminar, Physical Research Laboratory (PRL), India, 19/01/2023.
Title: “Massive Protostellar Cluster Formation”

5. MPIA Science Day, Max Planck Institute for Astronomy, Germany, 16/12/2022.
Title: “Shining in the Darkness – The ALMA Observations of Infrared Dark High-mass Clumps in Early Stages”

4. KIAA-DoA Seminar, Peking University (PKU) Kavli Institute for Astronomy and Astrophysics (KIAA), China, 11/10/2022.
Title: “Shining in the Darkness — The ALMA Survey of 70 μm Dark High-mass Clumps in Early Stages (ASHES)”

3. Colloquium, Department of Astronomy, Xiamen University, China, 24/02/2022.
Title: “Dancing in Molecular Clouds — Massive Star Formation”

2. ALMA-Japan seminar, National Astronomical Observatory of Japan (NAOJ), Japan, 09/02/2022.
Title: “The Sharp ALMA View of Early Stages of Massive Star Formation”

1. Colloquium, Korea Astronomy and Space Science Institute (KASI), South Korea, 16/03/2022.
Title: “Early Stages of Massive Star Formation”

PROFESSIONAL SKILLS

languages

English (fluency), Chinese & Cantonese & Hakka (mother tongue)

programming

♥ Python, IDL & C++

- To involve in the design OTF observing System of TianMa 65m telescope
- Familiar with radio data (cm/mm/submm) reduction and analysis using CASA, GILDAS, MIR, Miriad, CARMA, Python, IDL and XCLASS
- Experience with Chandra data using CIAO
- Developed several Python codes for analyzing observational data:
  - Friend-of-Friend (FOF) algorithm Python code to identify filaments using the molecular line emission (see in GitHub)
  - Automatic multiple velocity components fitting code for molecular line cube
  - Interactive tool to calculate the molecular outflow parameters (see in GitHub)
- Skilled in TOPCAT, DS9, Glue, Pyspeckit, Astrodendro, Linux, Mac OS and Latex

TEACHING EXPERIENCE

09/2024–12/2024 **MPIA Summer intership.**
Student's topic is "On the properties of Class 0/I protostellar cores in the Lambda Orionis molecular complex" MPIA, German

2023–present **Assisting in supervision of a visiting PhD student (Peiking University) in MPIA.**
Student's thesis topic is "Investigating Magnetic Field in Massive Star-forming Regions" MPIA, German

2022–present **Assisting in supervision of a PhD student (Guangxi University).**
Student's thesis topic is "Investigating Massive Star Formation in Infrared Dark Clumps" Guangxi University, China

2018 **Teaching data reduction to a CfA-SMA pre-doctoral for doing the project of "SMA observations toward CMZ"** Center for Astrophysics | Harvard & Smithsonian, USA

2016–2017 **Teaching data reduction and data analysis to a PhD student at SHAO for doing the project of "Millimetre line observations towards four local galaxies"** Shanghai Astronomical Observatory, China

2015 **Teaching radio data reduction in "Summer School in Radio Astronomy"** Shanghai, China

2014 **Teaching radio data reduction in "Summer School in Radio Astronomy"** Guizhou province, China

ACCEPTED OBSERVATION PROPOSALS

PI proposal: 1441.8 hours

Interferometer:

- ALMA ———————— 12.0 (12m) hours, Cycle-10 (Co-PI, grade A)
- ALMA ———————— 16.1 (12m) + 44.9 (ACA) + 84.2 (TP) hours, Cycle-9 (grade A)
- ALMA ———————— 12.1 (12m) hours, Cycle-9
- ALMA ———————— 4.8 (12m) + 26 (ACA) + 50 (TP) hours, Cycle-8
- ALMA ———————— 9.5 (12m) hours, Cycle-8
- ALMA ———————— 4.6 (12m) + 27 (ACA) + 50 (TP) hours, Cycle-7 (Co-PI)
- NOEMA ———————— 50.5 hours + 25.8 hours (IRAM-30m), Sep. 2023
- NOEMA ———————— 10 hours, Mar. 2023
- NOEMA ———————— 12 hours, Sep. 2018
- NOEMA ———————— 12 hours, Mar. 2018
- JVLA ———————— 14 hours, Aug. 2020
- JVLA ———————— 9 hours, Aug. 2020
- JVLA ———————— 14 hours, Aug. 2018
- JVLA ———————— 10 hours, Aug. 2018
- SMA ———————— 2 tracks, Mar. 2018
- SMA ———————— 2 tracks, Mar. 2018
- SMA ———————— 2 tracks, Mar. 2018

Single dish:

- IRAM-30m ———————— 24.5 hours, Mar. 2023
- TRAO ———————— 100+ hours, Oct. 2021
- JCMT ———————— 5.6 hours, Nov. 2020
- JCMT ———————— 52 hours, Nov. 2020
- TRAO ———————— 300+ hours, Oct. 2020
- SMT ———————— 78 hours, Jan. 2017
- KVN ———————— 104 hours, Nov. 2017

- SMT ———————— 35 hours, Aug. 2016
- JCMT ———————— 15 hours, Sep. 2016
- SMT ———————— 140 hours, Sep. 2015
- ARO-12m ———————— 30 hours, Sep. 2015
- CSO ———————— 20 hours, Feb. 2015
- PMO ———————— 60 hours, May. 2014

Selected some Co-I proposals: 2000+ hours

Interferometer:

- ALMA large program ———————— 81.2 (12m) + 313.8 (ACA) + 647.6 (TP) hours, Cycle-10
- ALMA ———————— 39.7 (12m) hours, Cycle-9
- ALMA ———————— 26.8 (12m) + 24.9(ACA) hours, Cycle-9
- ALMA ———————— 12.5 (12m) + 35.5 (ACA) hours, Cycle-9
- ALMA ———————— 9.4 (12m) + 26.3 (ACA) hours, Cycle-8
- ALMA ———————— 8.8 (12m) + 10.3 (ACA) hours, Cycle-8
- ALMA ———————— 26 (12m) hours, Cycle-8
- NOEMA ———————— 12 hours, Sep. 2020
- NOEMA ———————— 8 hours, Sep. 2020
- NOEMA ———————— 4 hours, Sep. 20q8
- ALMA ———————— 5.4 (12m) + 37.9 (ACA) hours, Cycle-6
- ALMA ———————— 7.9 (12m) + 14 (ACA) hours, Cycle-6
- ALMA ———————— 19.6 (12m) hours, Cycle-5
- SMA ———————— 4 tracks, Sep. 2017
- SMA ———————— 2 tracks, Sep. 2017

Single dish:

- IRAM-30m ———————— 22 hours, Mar. 2023
- IRAM-30m ———————— 9 hours, Mar. 2023
- IRAM-30m ———————— 52.5 hours, Mar. 2021
- IRAM-30m ———————— 50 hours, Sep. 2019
- IRAM-30m ———————— 49 hours, Mar. 2019
- IRAM-30m ———————— 50 hours, Mar. 2019
- IRAM-30m ———————— 65 hours, Mar. 2019
- IRAM-30m ———————— 46 hours, Mar. 2019
- IRAM-30m ———————— 37 hours, Sep. 2018
- SMT ———————— 250 hours, 2016-2017
- KVN ———————— 151 hours, May. 2017

OBSERVING EXPERIENCE

- TRAO - remote+on-site, 2020-2021 (>300 hours)
- Tianma 65m Telescope (TianMa) - - - - - - - - - - on-site, 2014 — 2019 (>200 hours)
- IRAM 30m - on-site, 2019 (5 days)
- Submillimeter Array (SMA) - on-site, 2017 (5 nights)
- Submillimeter Telescope (SMT) - - - - - - - - - - - - remote, 2015 — 2017 (>300 hours)
- Kitt Peak 12m Radio Telescope (KP 12m) - - - - - remote, 2015 — 2016 (>50 hours)

- Caltech Submillimeter Telescope (CSO) - - - - - - - - - - - - - remote, 2015 (20 hours)
- Purple Mountain Observatory Telescope (PMO) - - - - - - - - on-site, 2014 (60 hours)

REFERENCES

Dr. Qizhou Zhang
Center for Astrophysics | Harvard & Smithsonian
Email: qzhang@cfa.harvard.edu

Prof. Junzhi Wang
GuangXi University
Email: junzhiwang@gxu.edu.cn

Prof. Henrik Beuther
Max Planck Institute for Astronomy
Email: beuther@mpia.de

Dr. Howard A. Smith
Center for Astrophysics | Harvard & Smithsonian
Email: hsmith@cfa.harvard.edu

Dr. Kee-Tae Kim
Korea Astronomy and Space Science Institute
Email: ktkim@kasi.re.kr

PUBLICATIONS

13 first and second authored publications, 72 co-authored publications

Publication list on ADS ORCID: 0000-0003-1275-5251

First and Second authored Publications

13. **Li, Shanghuo**; Sanhueza, Patricio; Henrik Beuther, Huei-Ru Vivien Chen, Rolf Kuiper, Fernando A. Olguin, Ralph E. Pudritz, Ian W. Stephens, Qizhou Zhang, Fumitaka Nakamura, Xing Lu, Rajika L. Kuruwita, Takeshi Sakai, Thomas Henning, Kotomi Taniguchi; Li, Fei; *"Observations of high-order multiplicity in a high-mass stellar protocluster", 2023, Nature Astronomy, ISSN 2397-3366 (online).*
(1). MPIA Press Release: Twins, Triplets, Quadruplets and more: Observations show massive stars are indeed born as multiples.
(2). MAX-PLANCK-GESELLSCHAFT: Massive stars are born as multiples.
(3). University of Duisburg-Essen: Stars Born as Multiples.
(4). Heidelberg Institute for Theoretical Studies: New observations confirm computer models how massive stars are born as multiples.
(5). Nature Astronomy: Multi-star systems observed in high-mass star forming region.
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*12. **Li, Shanghuo**; Sanhueza, Patricio; Zhang, Qizhou; Guido, Garay; Sabatini, Giovanni; Morii, Kaho; Lu, Xing; Tafoya, Daniel; Nakamura, Fumitaka, Izumi, Natsuko; Tatematsu, Ken'ichi; Li, Fei; "The ALMA Survey of 70 μm Dark High-mass Clumps in Early Stages (ASHES). VIII: Dynamics of Embedded Dense Cores", 2023, ApJ, 949, 109.*

*11. Zhou, Jian-Wen; **Li, Shanghuo**; Liu, Hong-Li; Peng, Yaping; Zhang, Siju; Xu, Feng-Wei; Zhang, Chao; Liu, Tie; Li, Jin-Zeng; "Formation of hub-filament structure triggered by a cloud-cloud collision in the W33 complex", 2023, MNRAS, 519, 2391.*

*10. **Li, Shanghuo**; Sanhueza, Patricio; Lu, Xing; Lee, Chang Won; Zhang, Qizhou; Bovino, Stefano; Sabatini, Giovanni; Liu, Tie; Kim, Kee-Tae; Morii, Kaho; Tafoya, Daniel; Tatematsu, Ken'ichi; Sakai, Takeshi; Wang, Junzhi; Li, Fei; Silva, Andrea; Izumi, Natsuko; Allingham, David; "The ALMA Survey of 70 μm Dark High-mass Clumps in Early Stages (ASHES). VII: Chemistry of Embedded Dense Cores", 2022, ApJ, 939, 102.*

*9. **Li, Shanghuo**; Sanhueza, Patricio; Lee, Chang-Won; Zhang, Qizhou; Beuther, Henrik; Palau, Aina; Liu, Hong-Li; Hauyu Baobab; Feng, Siyi; Liu, Tie; Kim, Kee-Tae; Wang, Junzhi; Li, Di; Smith, Howard A.; Izaskun; Jiménez-Serra; Miquel. Girart, Josep; Qiu, Keping; Wang, Ke; Lu, Xing; Li, Fei; Li, Juan; Cao, Yue; Kim, Shinyoung; Strom, Shaye; "ALMA observations of NGC 6334S. II. Subsonic and Transonic Narrow Filaments in a High-mass Star Formation Cloud ", 2022, ApJ, 926, 165.*

(1). Center for Astrophysics | Harvard & Smithsonian (CfA) science update (11.26.2021): The Role of Turbulence in Making Massive Stars.

8. ***Li, Shanghuo**; Lu, Xing; Zhang, Qizhou; Lee, Chang-Won; Sanhueza, Patricio; Beuther, Henrik; Izaskun; Jiménez-Serra; Qiu, Keping; Palau, Aina; Feng, Siyi; Pillai, Thushara; Kim, Kee-Tae; Liu, Hong-Li; Miquel. Girart, Josep; Liu, Tie; Wang, Junzhi; Wang, Ke; Liu, Hauyu Baobab; Smith, Howard A.; Li, Di; Lee, Jeong-Eun; Li, Fei; Li, Juan; Kim, Shinyoung; Yue, Nannan; Strom, Shaye; "A Low-mass Cold and Quiescent Core Population in a Massive Star Protocluster ", 2021, ApJL, 912L, 7.*
(1). Center for Astrophysics | Harvard & Smithsonian (CfA) science update (04.16.2021): The Youngest Stellar Embryos in Massive Clouds.
(2). The Academic Times: Astronomers enable search for small soon-to-be stars.

7. Lu, Xing; ***Li, Shanghuo**; Zhang, Qizhou; Feng, Siyi; Cheng, Yu; Ginsburg, Adam; Dan, Walker; Battersby, Cara; Kauffmann, Jens; Pillai, Thushara; Longmore, Steven; Diederik, Kruijssen; Natsuko, Izumi; Pan, Xing; Callahan, Daniel; "ALMA Observations of Massive Clouds in the Central Molecular Zone: Protostellar Outflows", 2021, ApJ, 909, 177.*
(1). NATURE research highlights: Baby stars make it in a tough part of the Galaxy.

6. ***Li, Shanghuo**; Sanhueza, Patricio; Zhang, Qizhou; Fumitaka Nakamura, Lu, Xing; Wang, Junzhi; Liu, Tie; Ken'ichi Tatematsu, Jackson, James M; Andrea Silva, Andre's E. Guzma'n, Takeshi Sakai, Natsuko Izumi, Daniel Tafoya, Fei Li, Contreras, Yanett, Morii, Kaho and Kim, Kee-Tae; "The ALMA Survey of 70 μm Dark High-mass Clumps in Early Stages (ASHES). II: Molecular Outflows in the Extreme Early Stages of Protocluster Formation", 2020, ApJ, 903,119.*

5. ***Li, Shanghuo**; Zhang, Qizhou; Liu, Hauyu Baobab; Beuther, Henrik; Palau, Aina; Girart, Josep; Storm, Shaye; Qiu, Keping; Smith, Howard; Hora, Joseph; Wang, junzhi; Li, Fei; Yue, Nannan; "ALMA observations of NGC 6334S – I. Forming massive stars and cluster in subsonic-to-transonic filamentary clouds", 2020, ApJ, 896, 110.*
(1). Center for Astrophysics | Harvard & Smithsonian (CfA) science update (03.20.2020): Gas Motions in Interstellar Cores Forming Low-Massive Stars.

4. ***Li, Shanghuo**; Zhang, Qizhou; Pillai ,Thushara; Wang, Junzhi; Stephens, Ian W; Li, Fei; "Formation of Massive Protostellar Clusters – Observations of Massive 70 μm Dark Molecular Clouds", 2019, ApJ, 886, 130.*

3. ***Li, Shanghuo**; Wang, Junzhi; Fang, Min; Zhang, Qizhou; Li, Fei; Zhang, Zhi-Yu; Li, Juan; Zhu, Qingfeng; "A SiO J=5-4 Survey Toward Massive Star Formation Regions", 2019, ApJ, 878, 29.*

2. ***Li, Shanghuo**; Wang, Junzhi; Zhang, Zhi-Yu; Fang, Min; Li, Juan; Zhang, Jiangshui; Fan, Junhui; Zhu, Qingfeng; Li, Fei; "Millimetre spectral line mapping observations towards four massive star-forming H II regions", 2017, MNRAS, 466, 248.*

1. ***Li, Shanghuo**; Fan, Junhui, Wu, D. X; "Core Dominance Parameter for Gamma-Ray Loud Blazars", 2014, JApA, 35, 467.*

Co-authored Publications

*72. Mai, Xiaofeng; Liu, Tie; ... **Li, Shanghuo**; et al., "The ALMA-QUARKS survey: Detection of two extremely dense substructures in a massive prestellar core", 2024, ApJL, in press.*

*71. Xu, Fengwei; Wang, Ke; ... **Li, Shanghuo**; et al., "The ALMA Survey of Star Formation and Evolution in Massive Protoclusters with Blue Profiles (ASSEMBLE): Core Growth, Cluster Contraction, and Primordial Mass Segregation", 2024, ApJS, 270, 9.*

*70. Izumi, Natsuko; Sanhueza, Patricio; ... **Li, Shanghuo**; et al., "The ALMA Survey of 70 μm Dark High-mass Clumps in Early Stages (ASHES). X: Hot Gas Reveals Deeply Embedded Star Formation", 2023, ApJ, in press.*

*69. Zhou, J. W; Dib, S; ... **Li, Shanghuo**; et al., "Feedback from protoclusters does not significantly change the kinematic properties of the embedded dense gas structures", 2023, A&A, in press.*

*68. Olguin, Fernando; Sanhueza, Patricio; ... **Li, Shanghuo**; et al., "Digging into the Interior of Hot Cores with ALMA: Spiral Accretion into the High-mass Protostellar Core G336.01-0.82", 2023, ApJL, in press.*

*67. Liu, Xunchuan; ... **Li, Shanghuo**; et al., "The ALMA-QUARKS survey: – I. Survey description and data reduction", 2023, RAA, in press.*

*66. Hirano, Naomi; Sahu, Dipen; ... **Li, Shanghuo**; et al., "ALMA Survey of Orion Planck Galactic Cold Clumps (ALMASOP): Discovery of an extremely dense and compact object embedded in the prestellar core G208.68-19.92-N2", 2023, ApJ, in press.*

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PERSONAL INTERESTS

Badminton (very good), Hiking (frequently), Tennis (frequently), Fishing (sometimes), Skiing (newbie), Swimming (very good)