

# Junhao Liu

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Birth Year: 1993

## Research Interests

- Magnetic fields and dust polarization in star formation regions
- Initial condition of star formation in massive infrared dark clouds (IRDCs) and low-mass starless cores.
- Magneto-hydrodynamic (MHD) turbulence in self-gravitating media
- Jets and outflows associated with star formation activities.

## Employment

2023/09- **Project Researcher**, National Astronomical Observatory of Japan (NAOJ), Mitaka, Tokyo, Japan. Host: Prof. Patricio Sanhueza.

2021/06- **EAO Fellow**, East Asian Observatory (EAO), Hilo, Hawaii, USA.  
2023/09

## Research Experience

2018/08- **SAO pre-doctoral Fellow**, Center for Astrophysics (CfA) | Harvard & Smithsonian, Cambridge, Massachusetts, USA. Supervisor: Dr. Qizhou Zhang.  
2021/05

## Education

2015/09- **Ph.D. in Astronomy**, Nanjing University, Nanjing, Jiangsu, P.R. China. Supervisor: Prof. Keping Qiu.  
2021/03

2011/09- **B.S. in Astronomy**, Nanjing University, Nanjing, Jiangsu, P.R. China.  
2015/06

## Mentoring Experience

2023- Co-mentor of a visiting student (Luo, Qiuyi) at NAOJ.  
2019-2020 Co-mentor of two visiting students (Mo, Shixian and Sun, Li) at CfA.

## Approved PI Proposals

- \* **JCMT**: 104.3 hours allocated and 80.8 hours observed.
- 2022 "Deviation from turbulence cascade in NGC 6334". M23AD001.
- 2018-2022 "Dust polarization survey of massive dense cores in Cygnus-X". M18BP047, M19BP037, M20AP048, M22AP019, and M22BP047.
- 2022 "Dust polarization survey of IRDCs". M22AD003.
- 2021 "Are sub-virial clumps in IRDC G28.34 supported by magnetic fields?". M22AP018.
- 2019 "Does Magnetic Field Suppress Star Formation in Galactic Center?". M20AP023.
- \* **SMA**: 19 tracks allocated and 12 tracks observed; 1 track is about 6-10 hours
- 2019-2023 "Dust polarization survey of massive dense cores in Cygnus-X". 2019B-S028, 2021A-S008, 2022A-S040, and 2023A-S011.

\* **ALMA**: 16 hours allocated and 1.5 hours observed.

2021 “Dust polarization survey of massive dense clumps in IRDCs”. Cycle 8: 2021.1.01083.

## Participated Large Programs

2023-now “Magnetic Fields in Massive Star-Forming Regions (MagMaR)”. ALMA. PI: Patricio Sanhueza.

2016-now “B-Fields in STar-Forming Region Observations (BISTRO)”. JCMT. PI: Derek Ward-Thompson.

## Honors and Grants

2022 Outstanding Young Scholar for the Molecular Clouds and Star Formation Colloquium

2021-2023 EAO Fellowship

2018-2021 SAO pre-doctoral fellowship

## Recent Academic Activities

2023/08 Seminar Talk. NJU-SASS Science Seminar in Nanjing, China

2023/07 Seminar Talk. SHAO Science Seminar in Shanghai, China

2023/07 Seminar Talk. EAO Science Seminar in Hilo, USA

2023/02 Seminar Talk. Young Scholars Forum at Nanjing University (remote), Nanjing, China

2022/11 Seminar Talk. SWIFAR Seminar at Yunnan University (remote), Kunming, China

2022/09 Seminar Talk. KIAA-DoA Seminar at Peking University (remote), Beijing, China

2022/08 Conference Talk. Molecular Clouds and Star Formation Colloquium of China (remote).

2022/02 Seminar Talk. Shanghai Astronomical Observatory in Shanghai (remote), China

## Services

- Reviewer of JCMT and ALMA proposals.

2024 LOC for Bfields-2024 conference in Mitaka, Japan.

2021-2023 EAO fellow's JCMT-related duties (50% of time): technical assessment of submitted proposals, data quality check, monitoring the performance of heterodyne instruments, user support, code maintenance for the large-program prediction model, monitoring JCMT publications, and updating the publication tracking database.

2021-2023 Organizer of EAO science seminars.

2022 Co-organizer of the JCMT 2022 Users Meeting (remote). Chair for one session.

## Observation Experience

2021/12 IRAM-30m remote observation. 1 night.

2018/02 Tianma-65m on-site observation. 5 days. Shanghai, China

2017/09 JCMT on-site observation. 7 nights. Mauna Kea, HI, US

2015/06 CSO remote observation. 5 days.

## Skills

Software CASA, STARLINK, IDL/MIR, MIRIAD, POLARIS, RADEX, GILDAS

Data reduction&imaging SMA, ALMA, JCMT, IRAM-30m, Tianma-65m, PMO-13.7m

## Publications (ADS link)

8 first-author or corresponding author papers (+1 submitted) with 135 citations, including an invited review. 33 total papers with 677 citations, including 2 second-author papers.

### **First-Author or Corresponding Author Papers** (ADS link)

- \*) **Liu, J.**; Zhang, Q; and 15 coauthors, “Dark Dragon Breaks Magnetic Chain: Dynamical Substructures of IRDC G28.34 Form in Supported Environments”, **2024**, submitted to ApJ, in second revision
- 9) Lu., X.; **Liu, J. (corresponding author)**; and 15 co-authors, “Magnetic Fields in the Central Molecular Zone Influenced by Feedback and Weakly Correlated with Star Formation”, 2024, accepted by ApJ
- 8) **Liu, J.**; Zhang, Q; and 11 coauthors, “Deviation from a Continuous and Universal Turbulence Cascade in NGC 6334 Due to Massive Star Formation Activity”, **2023b**, ApJ, 949, 30
- 7) **Liu, J.**; Zhang, Q; and 12 coauthors, “Multi-scale Physical Properties of NGC 6334 as Revealed by Local Relative Orientations between Magnetic Fields, Density Gradients, Velocity Gradients, and Gravity”, **2023a**, ApJ, 945, 160
- 6) **Liu, J.**; Zhang, Q.; and Qiu, K.; “Magnetic field properties in star formation: a review of their analysis methods and interpretation”, **2022b**, **Invited review** in Frontiers in Astronomy and Space Sciences, vol. 9, id. 943556
- 5) **Liu, J.**; Qiu, K.; and Zhang, Q.; “Magnetic Fields in Star Formation: A Complete Compilation of All the DCF Estimations”, **2022a**, ApJ, 925, 30
- 4) **Liu, J.**; Zhang, Q.; Commercon, B.; Valdivia, V.; Maury, A.; and Qiu, K.; “Calibrating the Davis-Chandrasekhar-Fermi Method with Numerical Simulations: Uncertainties in Estimating the Magnetic Field Strength from Statistics of Field Orientations”, **2021**, ApJ, 919, 79
- 3) **Liu, J.**; Zhang, Q.; Qiu, K.; and 5 coauthors, “Magnetic Fields in the Early Stages of Massive Star Formation as Revealed by ALMA”, **2020**, ApJ, 895, 142, **CfA Science Update**
- 2) **Liu, J.**; Qiu, K.; and 129 coauthors, “The JCMT BISTRO Survey: The Magnetic Field in the Starless Core  $\rho$  Ophiuchus C”, **2019**, ApJ, 877, 43
- 1) **Liu, J.**; Qiu, K.; Wyrowski, F.; Menten, K.; Güsten, R.; Cao, Y.; and Wang, Y.; “An Isothermal Outflow in High-mass Star-forming Region G240.31+0.07”, **2018**, ApJ, 860, 106

### **Co-Author Papers (Second-Author but not corresponding author)**

- 1) Barnes, A. T.; **Liu, J. (2nd-author)**; and 16 co-authors, “Mother of Dragons: A Massive, quiescent core in the dragon cloud (IRDC G028.37+00.07)”, 2023, A&A, 657, 53

### **Co-Author Papers (General)**

- 8) Gu, Q.-L.; Liu, T.; Li, P. S.; Shen, Z.-Q.; Liu, X.; and **Liu, J. (6th-author)**, “The magnetic field in colliding filaments G202.3+2.5”, 2023, ApJ, accepted
- 7) Zeng, L.; Zhang, Q.; Alves, F. O.; Ching, T.-C.; Girart, J. M.; and **Liu, J. (6th-author)**, “Submillimeter Observations of Magnetic Fields in Massive Star-forming Region W75N ”, 2023, ApJ, 954, 99
- 6) Li, C.; Qiu, K.; Li, D.; Wang, H.; Cao, Y.; **Liu, J. (6th-author)**; and 2 co-authors, “H I Self-absorption toward the Cygnus X North: From Atomic Filament to Molecular Filament”, 2023, ApJ, 948, 17
- 5) Wang, Y.; Qiu, K.; Cao, Y.; Cheng, Y.; **Liu, J. (5th-author)**; and Hu B., “Surveys of Clumps, Cores, and Condensations in Cygnus X. II. Radio Properties of Massive Dense Cores”, 2022, ApJ, 927, 185

- 4) Palau, A.; Zhang, Q.; Girart, J.; **Liu, J. (4th-author)**; and 14 co-authors, "Does the Magnetic Field Suppress Fragmentation in Massive Dense Cores?", 2021, ApJ, 912, 159
- 3) Hu, B.; Qiu, K.; Cao, Y.; **Liu, J. (4th-author)**; and 7 co-authors, "DR 21 South Filament: A Parsec-sized Dense Gas Accretion Flow onto the DR 21 Massive Young Cluster", 2021, ApJ, 908, 70
- 2) Soam, A.; Liu, T.; Andersson, B.; Lee, C.; **Liu, J. (5th-author)**; and 9 co-authors, "Magnetic fields in the infrared dark cloud G34.43+0.24", 2019, ApJ, 883, 1
- 1) Cao, Y.; Qiu, K.; Zhang, Q.; Wang, Y.; Hu, B.; and **Liu, J. (6th-author)**, "Surveys of Clumps, Cores, and Condensations in Cygnus X. I. A New Catalog of  $\sim 0.1$  pc Massive Dense Cores", 2019, ApJS, 241, 1

#### **Co-Author Papers (Large-Program)**

- 15) Karoly, J.; and 157 co-authors including **Liu, J.**, "The JCMT BISTRO Survey: Studying the Complex Magnetic Field of L43", 2023, ApJ, 952, 29
- 14) Ward-Thompson, D.; and 157 co-authors including **Liu, J.**, "First BISTRO Observations of the Dark Cloud Taurus L1495A-B10: The Role of the Magnetic Field in the Earliest Stages of Low-mass Star Formation", 2023, ApJ, 946, 62
- 13) Tahani, M.; and 144 co-authors including **Liu, J.**, "JCMT BISTRO Observations: Magnetic Field Morphology of Bubbles Associated with NGC 6334", 2023, ApJ, 944, 139
- 12) Ching, T.-C.; and 156 co-authors including **Liu, J.**, "The JCMT BISTRO-2 Survey: Magnetic Fields of the Massive DR21 Filament", 2022, ApJ, 941, 122
- 11) Hwang, J.; and 159 co-authors including **Liu, J.**, "The JCMT BISTRO Survey: A Spiral Magnetic Field in a Hub-filament Structure, Monoceros R2", 2022, ApJ, 941, 51
- 10) Kwon, W.; and 151 co-authors including **Liu, J.**, "B-fields in Star-forming Region Observations (BISTRO): Magnetic Fields in the Filamentary Structures of Serpens Main", 2022, ApJ, 926, 123
- 9) Lyo, A.; and 149 co-authors including **Liu, J.**, "The JCMT BISTRO Survey: An 850/450  $\mu\text{m}$  Polarization Study of NGC 2071IR in Orion B", 2021, ApJ, 918, 85
- 8) Eswaraiah, C.; and 144 co-authors including **Liu, J.**, "The JCMT BISTRO Survey: Revealing the Diverse Magnetic Field Morphologies in Taurus Dense Cores with Sensitive Submillimeter Polarimetry", 2021, ApJ, 912, L27
- 7) Ngoc, N., and 148 co-authors including **Liu, J.**, "Observations of Magnetic Fields Surrounding LkH $\alpha$  101 Taken by the BISTRO Survey with JCMT-POL-2", 2021, ApJ, 908, 10
- 6) Doi, Y., and 137 co-authors including **Liu, J.**, "The JCMT BISTRO Survey: Magnetic Fields Associated with a Network of Filaments in NGC 1333", 2020, ApJ, 899, 28
- 5) Coude, S., and 121 coauthors including **Liu, J.**, "The JCMT BISTRO Survey: The Magnetic Field of the Barnard 1 Star-forming Region", 2019, ApJ, 877, 88
- 4) Wang, J., and 132 coauthors including **Liu, J.**, "JCMT BISTRO Survey: Magnetic Fields within the Hub-filament Structure in IC 5146", 2019, ApJ, 876, 42
- 3) Soam, A., and 123 coauthors including **Liu, J.**, "Magnetic Fields toward Ophiuchus-B Derived from SCUBA-2 Polarization Measurements", 2018, ApJ, 861, 65
- 2) Kwon, J., and 121 coauthors including **Liu, J.**, "A First Look at BISTRO Observations of the  $\rho$  Oph-A core", 2018, ApJ, 859, 4
- 1) Ward-Thompson, D., and 113 coauthors including **Liu, J.**, "First Results from BISTRO: A SCUBA-2 Polarimeter Survey of the Gould Belt", 2017, ApJ, 842, 66