

Shangjia Zhang

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EDUCATION

University of Nevada, Las Vegas, Nevada, USA

- Ph.D in Astronomy
- Advisor: Prof. Zhaohuan Zhu

Aug 2018 – May 2024

University of Michigan, Ann Arbor, Michigan, USA

- B.S. in Astronomy
- B.S. in Physics
 - GPA: 4.0, with Highest Distinction
- Advisor: Prof. Lee Hartmann

2018 – 20

Nanjing University, Nanjing, Jiangsu, China

- B.S. in Astronomy

Aug 2014 – Jul 2016

RESEARCH INTERESTS

I study *planet formation* by bridging observations and numerical simulations. I constrain *young planet populations* using statistical and *machine learning* techniques applied to observed substructures among hundreds of protoplanetary disks. I also explore critical roles of *self-consistent dust and thermal structures* in shaping disk morphology and kinematics using state-of-the-art *radiation-hydrodynamical* simulations.

PUBLICATIONS

First-author paper citations: 365, h-index: 6; **all paper citations:** 2622, h-index: 17.
Please view my updated publications [here](#) on ADS.

As leading author:

- [1] **Zhang S.**, Zhu, Z., Jiang, Y.-F., “Vertical Shear Instability with Stellar Irradiation in Protoplanetary Disks” 2023, *MNRAS*, in prep
- [2] **Zhang S.**, Zhu, Z. et al. “Porous Particles in Protoplanetary Disks: Application to the HL Tau Disk” 2023, *ApJ*, 953, 96
- [3] **Zhang S.**, Kalscheur, M. et al. “Substructures in Compact Disks of the Taurus Star-forming Region” 2023, *ApJ*, 952, 108
- [4] **Zhang S.**, Zhu, Z. and Kang, M. “PGNets: Planet mass prediction using convolutional neural networks for radio continuum observations of protoplanetary disks” 2022, *MNRAS*, 510, 4473
- [5] **Zhang S.**, Hu, X., Zhu, Z., and Bae, J. “Self-consistent ring model in protoplanetary disks: temperature dips and substructure formation” 2021, *ApJ*, 923, 70
- [6] **Zhang S.** and Zhu, Z. “The effects of disk self-gravity and radiative cooling on the formation of gaps and spirals by young planets” 2020, *MNRAS*, 493, 2287
- [7] Zhu, Z., **Zhang S.**, et al. “One Solution to the Mass Budget Problem for Planet Formation: Optically Thick Disks with Dust Scattering” 2019, *ApJL*, 877, L18
- [8] **Zhang S.** and Zhu, Z. et al. “The Disk Substructures at High Angular Resolution Project (DSHARP). VII. The Planet–Disk Interactions Interpretation” 2018, *ApJL*, 869, L47

- [9] **Zhang S.**, and Hartmann, L. and Zamora-Avilés, M. and Kuznetsova, A. “On estimating angular momenta of infalling protostellar cores from observations” 2018, *MNRAS*, 480, 5495

As contributing author:

- [1] Wallack, N. et al., including **Zhang S.** “Survey of Protoplanetary Disks Using the Keck/NIRC2 Vortex Coronagraph” 2023, *ApJ*, in press
- [2] Long, F., Andrews, S., **Zhang S.** et al. “ALMA Detection of Dust Trapping around Lagrangian Points in the LkCa 15 Disk” 2022, *ApJL*, 937, 1L
- [3] Burrill, Benjamin P. et al., including **Zhang S.** “Investigating the Future Potential of an Upgraded ALMA to Image Planet-forming Disks at Sub-astronomical-unit Scales” 2022, *ApJ*, 928, 40
- [4] Andrews, S., Elder, W., **Zhang S.**, et al. “Limits on Millimeter Continuum Emission from Circumplanetary Material in the DSHARP Disks” 2021, *ApJ*, 916, 51
- [5] Ueda, T., Kataoka, A., **Zhang S.**, et al. “Impact of Differential Dust Settling on the SED and Polarization: Application to the Inner Region of the HL Tau Disk” 2021, *ApJ*, 913, 117
- [6] Jorquera, S. et al., including **Zhang S.** “A search for companions via direct imaging in the DSHARP planet-forming disks” 2021, *AJ*, 161, 146
- [7] Harter, S., Ricci, L., **Zhang S.**, Zhu, Z. “Imaging the Dusty Substructures due to Terrestrial Planets in Planet-forming Disks with ALMA and the Next-generation Very Large Array” 2020, *ApJ*, 891, 48
- [8] Huang, J. et al., including **Zhang S.** “A Multifrequency ALMA Characterization of Substructures in the GM Aur Protoplanetary Disk” 2020, *ApJ*, 891, 48
- [9] Andrews, S. M. et al., including **Zhang S.** “The Disk Substructures at High Angular Resolution Project (DSHARP). I. Motivation, Sample, Calibration, and Overview” 2018, *ApJL*, 869, L41
- [10] Huang, J. et al., including **Zhang S.** “The Disk Substructures at High Angular Resolution Project (DSHARP). II. Characteristics of Annular Substructures” 2018, *ApJL*, 869, L42
- [11] Huang, J. et al., including **Zhang S.** “The Disk Substructures at High Angular Resolution Project (DSHARP). III. Spiral Structures in the Millimeter Continuum of the Elias 27, IM Lup, and WaOph 6 Disks” 2018, *ApJL*, 869, L43
- [12] Kurtovic, N. and Pérez, L. M. et al., including **Zhang S.** “The Disk Substructures at High Angular Resolution Project (DSHARP). IV. Characterizing Substructures and Interactions in Disks around Multiple Star Systems” 2018, *ApJL*, 869, L44
- [13] Birnstiel, T. et al. including **Zhang S.** “The Disk Substructures at High Angular Resolution Project (DSHARP). V. Interpreting ALMA Maps of Protoplanetary Disks in Terms of a Dust Model” 2018, *ApJL*, 869, L45
- [14] Dullemond, C. P. et al. including **Zhang S.** “The Disk Substructures at High Angular Resolution Project (DSHARP). VI. Dust Trapping in Thin-ringed Protoplanetary Disks” 2018, *ApJL*, 869, L46
- [15] Guzmán et al., V. V. et al., including **Zhang S.** “The Disk Substructures at High Angular Resolution Program (DSHARP). VIII. The Rich Ringed Substructures in the AS 209 Disk” 2018, *ApJL*, 869, L48

- [16] Isella et al., A., et al., including **Zhang S.** “The Disk Substructures at High Angular Resolution Project (DSHARP). IX. A High-definition Study of the HD 163296 Planet-forming Disk” 2018, *ApJL*, 869, L49
- [17] Pérez et al., L. et al., including **Zhang S.** “The Disk Substructures at High Angular Resolution Project (DSHARP). X. Multiple Rings, a Misaligned Inner Disk, and a Bright Arc in the Disk around the T Tauri star HD 143006” 2018, *ApJL*, 869, L50
- [18] Li J.-T., Bregman J. N., Wang Q. D., Crain R. A., Anderson M. E. & **Zhang S.** “The Circum-Galactic Medium of MASSive Spirals II: Probing the Nature of Hot Gaseous Halo around the Most Massive Isolated Spiral Galaxies.” 2017, *ApJS*, 233, 20

**SELECTED
TALKS**

- [1] *Princeton Thunch*, Princeton, NJ, Oct 2023.
- [2] *U. of Hawaii SPLAT Talk*, Honolulu, HI, Sep 2023.
- [3] *CfA SMA Seminars*, Cambridge, MA, Sep 2023.
- [4] *Harvard ITC Luncheon*, Cambridge, MA, Sep 2023.
- [5] *Origin Seminars at University of Arizona*, Tuscon, AZ, Sep 2023.
- [6] *Emerging Researchers in Exoplanet Science (ERES)*, New Haven, CT, Jun 2023.
- [7] *Athena++ workshop*, New York, NY, May 2023.
- [8] *Planet Formation Group Meeting*, Flatiron Institute (online) Jan 2023.
- [9] *Planet Formation Group Meeting*, U. Victoria, (online) Feb 2022.
- [10] *Planet Formation Group Meeting*, Flatiron Institute, (online) Feb 2022.
- [11] *Star and Planet Formation Seminar*, UMich, Ann Arbor, MI (online) Jan 2022.
- [12] *Caltech Direct Imaging Group*, Pasadena, CA (online) Dec 2021.
- [13] *New paradigms for radiatively efficient accretion disks*, New York, NY, Dec 2021.
- [14] *STAR FORMATION: FROM CLOUDS TO DISCS - A Tribute to the Career of Lee Hartmann*, Malahide, Ireland, Oct 2021.
- [15] *Five years after HL Tau: a new era in planet formation*, (online), Dec 2020.
- [16] *New Horizons in Planetary Systems*, Victoria, BC, Canada, May 2019.
- [17] *233st AAS Meeting Circumstellar Disks Session I*, Seattle, WA, Jan 2019.
- [18] *SPF Group Meeting*, , KIAA, Peking University, Beijing, Dec 2018.

**SELECTED
POSTERS**

- [1] *GRC and GRS Origins of Solar Systems*, South Hadley, MA, Jun 2023.
- [2] *Protostars and Planets VII*, Kyoto, Japan, Apr 2023.
- [3] *Exoplanet IV*, Las Vegas, NV, May 2022.
- [4] *Kepler and K2 Science Conference V*, Glendale, CA, Mar 2019.
- [5] *231st AAS Meeting Poster Session*, Washington, DC, Jan 2018.
- [6] *Astronomy Undergraduate Poster Session*, Ann Arbor, MI, Apr 2017.

**SELECTED
PRESS RELEASE**

- [1] “New Evidence Of A Baby Planet In The Making”, SpaceRef
- [2] “It’s a Planet: New Evidence of Baby Planet in the Making”, CfA News
- [3] “The Birth of Worlds Stunning new images of young planetary systems create a profound cosmic perspective”, Scientific American
- [4] “Stunning high-resolution images of disks swirling around 20 young stars outside of our solar system reveal new clues on planet formation”, Daily Mail
- [5] The Epoch of Planet Formation, Times Twenty, NRAO News
- [6] “UNLV Study Unlocks Clues to How Planets Form”, UNLV News

OUTREACH & SERVICES

- **Referee of ApJL, ApJ, MNRAS, PASJ** Jan 2019 – present (5 in total)
 - **ApJL** (The Astrophysical Journal Letters)
 - **ApJ** (The Astrophysical Journal)
 - **MNRAS** (Monthly Notices of the Royal Astronomical Society)
 - **PASJ** (Publications of the Astronomical Society of Japan)
- **Co-founder, Speaker and Webmaster**, Astronomy on Tap, Las Vegas (~1/season) Oct 2018 – present
- **Judge of Beal Bank Science Fair**, UNLV Mar 2022, Mar 2023
- **Visualization Specialist**, Helping render grid-based simulations to planetarium shows, Beijing Planetarium Sep 2020- Mar 2021
- **Speaker at Public Outreach Science Seminar**, “Mars exploration and planet formation” (in Chinese ~200 general public audience), Beijing Planetarium Feb 2021
- **Author for Amateur Astronomer Magazine (in Chinese)**, “GW Ori: ALMA observation of an interesting three-body system” Oct 2020
- **Sole Organizer of Astro Coffee and Astro Journal Club**, UNLV Aug 2019 – Aug 2020
- **Presenter at Art in Science Exhibition**, UNLV Jan 2020
- **AAS Astronomy Ambassador Program** Class of 2019
- **Sole Organizer of Lunar Eclipse on the Strip**, Las Vegas Jan 2019
- **Member**, Student Astronomical Society, University of Michigan Sep 2016 – Apr 2018
- **Student Instructor**, International Astronomy Olympiad National Team Intense Training, Beijing Jul 2016

SELECTED AWARDS & GRANTS

- Future Investigators in NASA Earth and Space Science and Technology (FINESST, 135,000 USD + 75,000 SBU supercomputer hours / year) 2021 – 2024
- Russell L. and Brenda Frank Scholarship, UNLV (7,000 USD) 2022 – 2024
- UNLV GPSA Travel Fund (2,500 USD) 2023
- UNLV OISS Distinguished Contribution Award (1,000 USD) 2023
- AAS International Travel Grant (1,700 USD) 2023
- Barrick Graduate Fellowship, University of Nevada, Las Vegas (30,000 USD) 2020 – 2021
- University Honors, University of Michigan 2016 – 2018
- Outstanding Student Leader, Nanjing University 2015 – 2016
- Renmin Scholarship, First Prize, Nanjing University (3,000 RMB) Mar 2016
- NAOC Scholarship, National Astronomical Observatory, CAS (3,000 RMB) Mar 2015
- Bronze Medal, 7th International Olympiad on Astronomy and Astrophysics, Volos, Greece Jul 2013
- Gold Medal, VII Asian-Pacific Astronomy Olympiad, Aktobe, Kazakhstan Nov 2011

TEACHING	<ul style="list-style-type: none"> ▪ Physics 151 L General Physics I (Mechanics and Thermal Physics), Lecturer and Grader Spring 2019 ▪ Astro 105 Introductory Astronomy Laboratory, Lecturer, Grader and Proctor Spring 2020 	
SKILLS	(Astrophysical) Computational (Radiation) Fluid Dynamics, Monte Carlo Radiative Transfer, Deep Neural Networks C, C++ Python, Tensorflow, IDL \LaTeX , Linux/Unix MPI, OpenMP, CUDA	
SIMULATIONS	Athena++, FARGO, FLASH, LIME, RADMC3D.	
STUDENT ADVISING	<ul style="list-style-type: none"> ▪ Sarah Harter Undergraduate student at CSUN (now graduate student at U. Rochester) Project: <i>Imaging the Dusty Substructures due to Terrestrial Planets in Planet-forming Disks with ALMA and the Next-generation Very Large Array</i>. Co-advised with Prof. Luca Ricci, led to a publication in ApJ. ▪ Fiona Han Undergraduate student at University of Michigan Project: <i>Producing synthetic observations of protostellar cores using global simulations</i>. Co-advised with Prof. Lee Hartmann and resulted in a poster presentation at the Astronomy Undergraduate Poster Session at the University of Michigan. ▪ Stanley Baronett PhD student at UNLV Project: <i>On multi-band radiation-hydrodynamics in protoplanetary disks</i>. Starting from the frequency-integrated radiation transport I worked on and exploring the multi-frequency nature of protoplanetary disk thermodynamics. Co-advised with Prof. Zhaohuan Zhu and Dr. Yan-Fei Jiang. An ongoing project. 	
REFERENCES	<p>Prof. Zhaohuan Zhu (PhD Advisor) University of Nevada, Las Vegas Nevada, USA zhaohuan.zhu@unlv.edu</p> <p>Prof. Lee Hartmann University of Michigan, Ann Arbor Michigan, USA lhartm@umich.edu</p>	<p>Prof. Akimasa Kataoka National Observatory of Japan Mitaka, Tokyo, Japan akimasa.kataoka@nao.ac.jp</p>