Zhaozhou Li

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Work Experience

• MSCA Fellow	Hebrew University of Jerusalem, Israel	2023 –
• Postdoctoral Fellow	Hebrew University of Jerusalem, Israel	2021 – 2023
• Postdoctoral Researcher	Shanghai Jiao Tong University, China	2018 – 2021

Education

• Ph.D. in Astrophysics	Shanghai Astronomical Observatory, China	2011 – 2017
• B.S. in Applied Physics	Beihang University, China	2007 – 2011

Research Projects

Project series that I lead, mostly on the **dynamics and formation of cosmic structures**

- Relaxation of galaxies after mass changes, heating, or tidal stripping 2021 –
- Main-sequence ridgeline of open clusters in color-magnitude diagram (CMD) 2019 – 2020
- Dynamical modeling with non-parametric distribution functions (DFs) 2018 – 2021
- Mass profile and boundary of the Milky Way halo from satellite kinematics 2017 – 2021
- Initial and final orbital distribution of satellite galaxies 2013 – 2018

Professional Expertise

- Cosmological simulation & analysis
  Merger tree, (sub)structure finding, tidal field, two-point correlation function, `GADGET`
- Galactic dynamics
  DF modeling, Jeans equation, violent relaxation, orbit integration, action analysis (`Galpy/Agama`)
- Observational data analysis
  Analysis of survey catalogs (SDSS/BOSS, *Gaia*), modeling stellar populations in CMD
- Statistics and machine learning
  Hierarchical Bayes, mixture model, Gaussian process, Bayes optimization, robust statistics, clustering
- Programming (Expert – `Python`; familiar – `C`, `Fortran`, `SQL`)
  High performance computing (`OpenMP`, parallel `Python`, `Cython`), numerical analysis (`Scipy`, `GSL`)

Open-source Practice

- Ranking by public contribution: top 11% overall on StackOverflow with ∼2.5M people reached
  430 in Israel on GitHub
- Selected open-source software, see more at `https://syrte.github.io/code`
  - `cyper`: running `Cython` codes on the fly for high performance Python
  - `robustgp`: proposed novel Gaussian process regression for contaminated data
  - `ndtest`: multi-dimensional statistical tests (incl. 2D K-S test; >20 citations)
  - `ParsecQuery`: querying isochrones from the PARSEC stellar evolution model
- Code cited by 30 papers of various disciplines (exoplanets, bioinformatics, agriculture, etc.)
- Occasional contributor of infrastructure libraries including `Numpy`, `Scipy`, `Cython`

Honors and Awards

- Marie Skłodowska-Curie Actions Fellowship (score: 99/100), 200,000€, Europe 2023 – 2025

- Rosenblum Award for Excellence in Astrophysics, 2,500$, HUJI 2022
- Second Prize of the Mathematics Competitions for College Students, China 2010
- First Prize of the Physics Experiment Competition for College Students, Beijing 2009
- Outstanding Freshman Scholarship, Second Prize, Beihang Univ. 2007

SERVICES

- Referee for scientific journal: MNRAS 2022 –
- Coordinator of the astrophysics seminar at HUJI 2022 –
- LOC member of the conference *Studying the Universe with Galaxy Surveys*, Shanghai 2018
- Founder and maintainer of the AstroPython wechat discussion groups ($\sim$1000 users) 2016 –
- Maintainer of the computing servers of the cosmology group at SHAO 2014 – 2020
- Organizer of the cosmology journal club at SHAO and SJTU 2014 – 2016, 2018 – 2019

TEACHING

• HUJI	guest lecturer	Advanced Cosmology (graduate course, 4h)	2022S, 2023S
• HUJI	project advisor	Astrophysics Seminar (undergraduate research training, 20h)	2022S
• Shanghai	lecturer	Applied Python in Astronomy (workshop, 4h)	2015

OUTREACH

- Public lecture at a book club "Strolling under the Starry Sky" (2h), Changsha Jul, 2023
- Expositor of the open day of physics and astronomy (20h), SJTU 2017 – 2019
- Lecturer/advisor in scientific practice projects for high school students (100h), Shanghai 2016 – 2018
- Volunteer guide at the Shanghai Natural History Museum 2016
- Lecturer of popular astro/geo courses in primary and middle schools (25h), Shanghai 2015 – 2017
- Member of the Interplanetary Immigration Agency, a near-future science fiction project 2014 –
- (Co-)organizer of sidewalk astronomy nights and stargazing camps (>20), Beijing 2007 – 2011

SOCIAL ACTIVITIES

- Coordinator of the photography exhibition of migrant children, *Voice of Flowing Heart*, Beijing 2010
- Volunteer in a field survey of schools for migrant children, Beijing 2010
- Disaster volunteer of the Sichuan earthquake (1 month), Pengzhou 2008

SEMINAR TALKS

- National Astronomical Observatories, China Jul 2023
  Inferring the Milky Way potential with data-driven distribution function
- National Astronomical Observatories, China Jul 2023
- KIAA, Peking University, China Jul 2023
- Shanghai Astronomical Observatory, China Jun 2023
  Modeling the formation of dark-matter deficient galaxies
- University of Minnesota, US (*Invited*) Nov 2022
- Hebrew University of Jerusalem, Israel Apr 2022
  The Dark-Matter Halo of the Milky Way and Dark-Matter Deficient Cores in Other Galaxies
- Hebrew University of Jerusalem, Israel Mar 2021
  Satellite Kinematics and Milky Way Mass Profile
- Kavli IPMU, University of Tokyo, Japan (*Invited*) Sep 2020
- KIAA, Peking University, China (*Invited*) Jun 2020
  Constrain the Milky Way Mass Profile with Satellite Galaxies in Phase Space

- Shanghai Astronomical Observatory, China — Apl 2020
  Constrain the Milky Way Mass Profile with Phase Space Distribution of Satellite Galaxies
- South-Western Institute for Astronomy Research, Yunnan University, China (*Invited*) — Nov 2019
  Measure the Milky Way Mass Profile with Satellite Galaxies in Phase Space
- ICC, Durham University, UK — Jul 2019
  Measure the Milky Way Mass Profile with Satellite Galaxies in Phase Space
- Kavli IPMU, University of Tokyo, Japan (*Invited*) — Aug 2018
  Satellite Kinematics and Milky Way Halo Mass
- Department of Astronomy, Shanghai Jiao Tong University, China — Nov 2017
  The Kinematics of Dark Matter Halo Substructures and Its Application

Conference Presentations

- Collaboration Workshop on Cosmology and Galaxy Formation, Shanghai (*Invited*) — Jun 2023
- DDA54: Annual Meeting of the Division on Dynamical Astronomy of AAS, Remote — May 2023
- Israeli-Korean Astronomy & Space Science workshop, Ariel — Jan 2023
  Modeling the formation of dark-matter deficient galaxies
- AI for Astronomy, Online/Shenzhen — Nov 2022
  Robust Gaussian process and its application to resolved stellar population
- Santa Cruz Galaxy Workshop — Aug 2022
  Modeling the Response of Halos to Gas Ejection and Tidal Stripping
- DDA53: Annual Meeting of the Division on Dynamical Astronomy of AAS, Remote — Apr 2022
  Modeling the response of dark matter haloes to gas ejection
- EAS: European Astronomical Society Annual Meeting, Online — Jul 2021
  Measuring the Milky Way mass profile from satellite galaxies kinematics
- DDA52: Annual Meeting of the Division on Dynamical Astronomy of AAS, Online — May 2021
  A novel dynamical modeling method based on the data-driven distribution function
- Guoshoujing Meeting on Galaxies and Cosmology, Hangzhou — May 2021
  The outer edges of the Milky Way halo from the motion of nearby galaxies
- Cross-Strait Symposium on Star Cluster Studies, Online — Dec 2020
  Precise determination of the main sequence of open clusters in the CMD
- Chinese Astronomical Society Annual Meeting, Online — Oct 2020
- Shanghai Assembly on Cosmology and Galaxy Formation, Shanghai — Nov 2019
  Constrain the Milky Way Mass Profile with Phase Space Distribution of Satellite Galaxies
- Galaxy Angular Momentum Alignment 2019, Shanghai — Oct 2019
  Satellite Kinematics and Milky Way Halo Mass
- The Milky Way 2019: LAMOST and Other Leading Surveys, Yichang — Oct 2019
  Measure the Milky Way Mass Profile with Satellite Galaxies in Phase Space
- Small Galaxies, Cosmic Questions, Durham (*poster talk*) — Jul 2019
  Milky Way Mass Profile from Satellite Dynamics
- Astrophysical Dynamics, Tsung-Dao Lee Institute, Shanghai — Jul 2019
- Galactic Dynamics in the Era of Large Surveys, Shanghai — Jul 2019
  Measure the Milky Way Mass Profile with Satellite Galaxies in Phase Space
- Halo and Galaxy Assembly Bias — from Theory to Observation, Shanghai — Jun 2019
  Constrain Massive Cluster Formation with SDSS
- The Life and Times of the Milky Way, Shanghai — Nov 2018
- Studying the Universe with Galaxy Surveys Revealing the Unlimited in Shanghai — Jun 2018
  Milky Way Halo Mass from Satellite Kinematics
- SHAO-PKU Bilateral Symposium, Shanghai — Aug 2017
- 11th Zhang Heng Meeting of the Chinese Astronomical Society, Guiyang — Jun 2017
  Determination of Milky Way Halo Mass from Kinematics of Satellite Galaxies

PUBLICATIONS

Since 2017: 23 papers (8 as lead author) + 2 proceedings, 275 citations, H=10 [ADS, arXiv]

23. Unraveling the Complexity of Dwarf Galaxy Dynamics: A study of Binary Orbital Motions
Wang, W., Zhu, L., Jing, Y., Grand, R.J.J., **Li, Z.**, Fu, X., Li, L., Han, J., Li, T.S., Feng, F., and Frenk, C., 2023, arXiv, arXiv:2306.04311
22. Physical evolution of dark matter halo around the depletion boundary
Gao, H., Han, J., Fong, M., Jing, Y.P., and **Li, Z.**, 2023, ApJ, 953, 37
21. Efficient Formation of Massive Galaxies at Cosmic Dawn by Feedback-Free Starbursts
Dekel, A., Sarkar, K.S., Birnboim, Y., Mandelker, N., and **Li, Z.**, 2023, MNRAS, 523, 3201
20. The Response of Dark Matter Haloes to Gas Ejection: CuspCore II
Li, Z., Dekel, A., Mandelker, N., Freundlich, J., François, T., 2023, MNRAS, 518, 5356
19. Is the core-cusp problem a matter of perspective: Jeans Anisotropic Modeling against numerical simulations
Wang, W., Zhu, L., **Li, Z.**, Chen, Y., Han, J., He, F., Yang, X., et al., 2022, ApJ, 941, 108
18. The growth pattern of liver metastases on MRI predicts early recurrence in patients with colorectal cancer: a multicenter study
Cai, Q., Mao, Y., Dai, S. et al. (incl. **Li, Z.**), 2022, European Radiology, 32, 7872
17. The Universal Specific Merger Rate of Dark Matter Halos
Dong, F., Zhao, D., Han, J., **Li, Z.**, Jing, Y., and Yang, X., 2022, ApJ, 929, 120
16. A machine learning approach to infer the accreted stellar mass fractions of galaxies
Shi, R., Wang, W., **Li, Z.**, et al., 2022, MNRAS, 515, 3938S
15. What to expect from dynamical modelling of cluster haloes - I. The information content of different dynamical tracers
Li, Q., Han, J., Wang, W., Cui, W., **Li, Z.**, and Yang, X., 2021, MNRAS, 505, 3907
14. The Outermost Edges of the Milky Way Halo from Galaxy Kinematics
Li, Z.-Z. and Han, J., 2021, ApJL, 915, L18
13. Robust Gaussian process regression based on iterative trimming
Li, Z.-Z., Li, L., and Shao, Z., 2021, Astronomy and Computing, 36, 100483
12. Orbital distribution of infalling satellite halos across cosmic time
Li, Z.-Z., Zhao, D.-H., Jing, Y.P., Han, J., and Dong, F.-Y., 2020, ApJ, 905, 177
11. Weak equivalence principle, swampland and H_0 tension with fast single radio bursts FRB 180924 and FRB 190523
Wang, D., **Li, Z.**, and Zhang, J., 2020, Physics of the Dark Universe, 29, 100571
10. Modeling Unresolved Binaries of Open Clusters in the Color-Magnitude Diagram. I. Method and Application of NGC 3532
Li, L., Shao, Z., **Li, Z.-Z.**, Yu, J., Zhong, J., and Chen, L., 2020, ApJ, 901, 49
9. The mass of our Milky Way (*Invited Review*)
Wang, W., Han, J., Cautun, M., **Li, Z.**, and Ishigaki, M.N., 2020, Science China: Physics, Mechanics & Astronomy, 63, 109801
8. Constraining the Milky Way Mass Profile with Phase-space Distribution of Satellite Galaxies
Li, Z.-Z., Qian, Y.-Z., Han, J., Li, T.S., Wang, W., and Jing, Y.P., 2020, ApJ, 894, 10
7. A Versatile and Accurate Method for Halo Mass Determination from Phase-space Distribution of Satellite Galaxies
Li, Z.-Z., Qian, Y.-Z., Han, J., Wang, W., and Jing, Y.P., 2019, ApJ, 886, 69
6. The first constraint from SDSS galaxy-galaxy weak lensing measurements on interacting dark energy models
Zhang, J., An, R., Luo, W., **Li, Z.**, Liao, S., and Wang, B., 2019, ApJL, 875, L11
5. Fully self-consistent cosmological simulation pipeline for interacting dark energy models
Zhang, J., An, R., Liao, S., Luo, W., **Li, Z.**, and Wang, B., 2018, Phy. Rev. D, 98, 103530
4. The Structure Finders and the Subhalo Population in Cosmological Simulations (*Review in Chinese*)
Li, Z.-Z., Han, J.-X., 2018, Progress in Astronomy, 36-3, 306
3. Determination of Dark Matter Halo Mass from Dynamics of Satellite Galaxies

Li, Z.-Z., Jing, Y.P., Qian, Y.-Z., Yuan, Z., and Zhao, D.-H., 2017, ApJ, 850, 116

Conference proceedings

2. Dynamical interaction in the stellar cluster – Evidence from binaries of NGC3532
   Li, L., Shao, Z., **Li, Z.-Z.**, 2021, JSM proceedings, 2021.317202
1. Satellite galaxies as better tracers of the Milky Way halo mass
   Han, J., Wang, W., and **Li, Z.**, 2020, Galactic Dynamics in the Era of Large Surveys, IAU Symposium, 353, 109