Zhaozhou Li

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Racah Institute of Physics, The Hebrew University, Jerusalem 91904, Israel

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, Bayesian optimization, robust statistics, clustering
- Programming (Expert in `Python`; familiar with `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 ∼2.3M people reached
  430 in Israel on GitHub
- My public codes were cited by 26 papers from various disciplines (e.g., bioinformatics, exoplanets)
- 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 variant of Gaussian process regression that is robust against outliers
  - `ndtest`: multi-dimensional statistical tests (including the 2D K-S test)
  - `ParsecQuery`: querying isochrones from the website of the PARSEC stellar evolution model
  - Occasional contributor of the infrastructure libraries including `Numpy`, `Scipy`, `Cython`

Honors and Awards

- Marie Skłodowska-Curie Actions Fellowship (200,000€) 2023 – 2025

- Rosenblum Award for Excellence in Astrophysics (2,500$ travel grant), Racah Institute, HUJI 2022
- Merit Student Award ($\times$2), Chinese Academy of Sciences 2015, 2016
- Second Prize of the Chinese Mathematics Competitions for College Students 2010
- First Prize of the Physics Experiment Competition for College Students, Beijing 2009
- Outstanding Freshman Scholarship, Second Prize, Beihang University 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 AstroPython wechat discussion groups (900 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, 2h) Spring 2022
- HUJI project advisor Astrophysics Seminar (undergraduate research training, 20h) Spring 2022
- Shanghai lecturer Applied Python in Astronomy (workshop, 4h) 2015

OUTREACH

- Expositor of the open day of physics and astronomy, SJTU 2017 – 2019
- Advisor in a scientific practice project for high school students, Shanghai 2016 – 2018
- Volunteer guide at the Shanghai Natural History Museum 2016
- Lecturer of popular science courses in primary and middle schools, Shanghai 2015 – 2017
- Member of the Interplanetary Immigration Agency, a near-future science fiction project 2014 –
- Organizer/volunteer of sidewalk astronomy nights, Beijing 2007 – 2011

SEMINAR TALKS

- University of Minnesota, US (*Invited*) Nov 2022
  The Dark-Matter Halo of the Milky Way and Dark-Matter Deficient Cores in Other Galaxies
- 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
  Constrain the Milky Way Mass Profile with Satellite Galaxies in Phase Space
- 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

- 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, Virtual — Apr 2022
  Modeling the response of dark matter haloes to gas ejection
- 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
  Constrain the Milky Way Mass Profile with Satellite Galaxies in Phase Space
- 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
  Measure the Milky Way Mass Profile with Satellite Galaxies in Phase Space
- 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
  Milky Way Halo Mass from Satellite Kinematics
- 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
  Determination of Milky Way Halo Mass from Kinematics of Satellite Galaxies
- 11th Zhang Heng Meeting of the Chinese Astronomical Society, Guiyang — Jun 2017
  Determination of Milky Way Halo Mass from Kinematics of Satellite Galaxies

Publications

Summary: 18 papers (8 as lead author) + 4 proceedings, 219 citations, H-index 8 [ADS, arXiv]

22. 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, arXiv:2206.12121
21. The Response of Dark Matter Haloes to Gas Ejection: CuspCore II
    Li, Z., Dekel, A., Mandelker, N., Freundlich, J., François, T., 2022, arXiv:2206.07069
20. 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

19. 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
18. A machine learning approach to infer the accreted stellar mass fractions of galaxies
Shi, R., Wang, W., **Li, Z.**, Han, J., Shi, J., Rodriguez-Gomez, V., and Peng, Y., 2022, MNRAS, 515, 3938S
17. 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
16. The Outermost Edges of the Milky Way Halo from Galaxy Kinematics
Li, Z.-Z. and Han, J., 2021, ApJL, 915, L18
15. Robust Gaussian process regression based on iterative trimming
Li, Z.-Z., Li, L., and Shao, Z., 2021, Astronomy and Computing, 36, 100483
14. 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
13. 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
12. 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
11. 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
10. 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
9. 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
8. 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
7. 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
6. 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
5. 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

4. Modeling the Response of Dark Matter Halos to Gas Ejection
Li, Z., Dekel, A., Mandelker, N., Freundlich, J., 2022, AAS Division on Dyn. Astro. #53, 201.04
3. The outer edges of the Milky Way halo from the motion of nearby galaxies
Li, Z., 2021, AAS Division on Dyn. Astro. #52, 107.08
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