Jiaxuan Li

Personal Information

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Research Interests

I am enthusiastic about almost all aspects of astrophysics and cosmology. Some of them are listed below.

- Low surface brightness astrophysics: galaxy outskirts, intracluster/intragroup lights, ultra-diffuse galaxies.
- Galaxy evolution: quenching of galaxies, formation of massive galaxies, galaxy-halo connection, SMBHs.
- Cosmology: weak lensing, cosmological simulations, CMB, large-scale structure.
- Statistical methods and machine learning in astrophysics.
- Instrumentation, deep sky surveys, astronomical data reduction.

Education

Undergraduate Student, Department of Astronomy, Peking University, China   Sept 2016 - July 2020 (expected)

- Major: Astrophysics   GPA: 3.83/4.00   Rank: 1 / 28 | Detailed Transcript

  Physical Cosmology (3.98, Top 1), Astrophysics Seminar (3.96, Top 1), Astronomical Spectroscopy (3.97, Top 3), Atomic Physics (3.97), Physics Lab II (3.98, Top 3), Methods of Mathematical Physics (3.93)
- TOEFL iBT: 109. Reading: 29, Listening: 28, Speaking: 24, Writing: 28.
- GRE General: Verbal 153/170, Quantitative 170/170, Analytical Writing 3.5
- GRE Physics: 990/990, Percentile 94%

Research Experience

Multi-resolution filtering: an empirical method for isolating faint, extended emission in Dragonfly data and other low resolution images

Advisor: Pieter van Dokkum   Research Intern, Yale University, USA. June 2019 – Sept 2019

- Helped develop an empirical, self-contained method "Multi-resolution filtering" (MRF) to isolate and study faint, large-scale emission in imaging data of low spatial resolution (such as the Dragonfly Telephoto Array). This method is crucial for sciences using Dragonfly and has already been used in van Dokkum et al. (2019), Gilhuly et al. (2019) and Danieli et al. (2019).
- Implemented and packaged MRF algorithm into an open-source Python package `mrf` and built the documentation website. Helped complete a paper submitted to PASP (arXiv:1910.12867) as the fourth author.
- Proposed and implemented two variations of MRF (self-MRF and cross-MRF) when no intrinsically low-resolution image is available to be used. Tested the idea of surface brightness contrast and incorporate it into the `mrf` package.
- Currently working on applying MRF to the Dragonfly Wide Field Survey data (Danieli et al. 2019).

Reaching for the Edge I: Probing the Outskirts of Massive Galaxies with HSC, DECaLS, SDSS and Dragonfly

Advisors: Alexie Leauthaud, Song Huang   Research Fellow, UC Santa Cruz, USA. Sept 2018 – Jan 2019

- Explored the ability of different sky surveys (HSC, DECaLS, Dragonfly and SDSS) to extract the stellar halo light profiles of massive galaxies.
- Revealed that the sky background of HSC data release S18A (PDR2) is under-subtracted for galaxies at intermediate redshift and is still over-subtracted around bright galaxies. Also proposed an efficient method to characterize and correct the sky residual based on mock galaxy tests.
- Concluded that Dragonfly shows the best ability ($\mu_r > 30$ mag/arcsec^2) in detecting low surface brightness feature for low-z galaxies. DECaLS with customized pipeline still suffers from over-subtraction but could recover the stellar mass within 100 kpc from HSC by only 0.05 dex.
- Currently working on a first-authored MNRAS paper manuscript.

SDSS IV MaNGA: Inside-out quenching galaxies with Hα ring-like structures

Advisor: Yingjie Peng   Research Assistant, Peking University, China. July 2017 – Now

- Helped discover galaxies with Hα ring-like emission structures in the MaNGA survey using MaNGA Pipe3D data. Most of them are located in the "green valley" and experiencing the inside-out quenching process.
- Characterized Hα rings by measuring their radii and found a good correlation between the ring radii and the bar lengths for barred disk galaxies.
- Examined multiple properties of this population and found high bar fraction, AGN (Seyfert & LINER) fraction and bulge-to-total ratio. This supports that the joint effects of bar, bulge and AGN could quench the massive disk galaxies efficiently by the inside-out quenching mode and form the Hα ring-like structure.
- Currently working on a first-authored paper manuscript.

PUBLICATIONS

1. **Li J.**, Huang S., Leauthaud A., Moustakas J., Danieli S., Ardila F., van Dokkum P., Greene J., Abraham R., Kado-Fong E., Lupton R., Mowla L., Reaching for the Edge I: Probing the Outskirts of Massive Galaxies with HSC, DECaLS, SDSS and Dragonfly, in preparation.

2. van Dokkum P., Lokhorst D., Danieli S., **Li J.**, Merritt A., Abraham R., Gilhuly C., Greco J. P., Multi-resolution filtering: an empirical method for isolating faint, extended emission in Dragonfly data and other low resolution images, arXiv:1910.12867, *PASP* submitted.

3. Danieli S., Lokhorst D., Zhang J., Merritt A., van Dokkum P., Abraham R., Conroy C., Gilhuly C., Greco J., Janssens S., **Li J.**, Liu Q., Miller T., Mowla L., The Dragonfly Wide Field Survey. I. Telescope, Survey Design and Data Characterization, arXiv:1910.14045, *ApJ* submitted.

4. **Li J.**, Peng Y.-j., Guo K., Huang S., Zhang C., SDSS IV MaNGA: Inside-out quenching galaxies with Hα ring-like structures, in preparation.

HONORS AND AWARDS

Tang Li-Xin Scholarship (10,000 RMB per year, most competitive scholarship in PKU)	May 2019
AEON Scholarship, Peking University (10,000 RMB, 2/202)	Sept 2018
Leo KoGuan Scholarship, Peking University (10,000 RMB, 4/202)	Oct 2017
Weiming Physics Outstanding Student (7,000 RMB per year)	2017, 2018, 2019
National Undergraduate Research & Training Program (10,000 RMB)	May 2019
Lin-bridge Prize for Excellent Undergraduate Research (2,800 RMB, endowed by Prof. Douglas Lin)	Sept 2018
Merit Student, Peking University	2017, 2018
First Prize, 8th China Undergraduate Physicists Tournament	Aug 2017
Meritorious Winner in Mathematical Contest In Modeling (MCM/ICM)	Apr 2018
8th Place in Beijing Division, AI Challenger: SEARCHING SUPERNOVAE IN SKY SURVEY	Apr 2019
Silver Medal, 9th International Olympiad on Astronomy and Astrophysics (IOAA)	Aug 2015
Gold Medal & Best Result, China National Astronomy Olympiad	2014, 2015
Gold Medal (3rd place), 1st Princeton University Physics Competition	Jan 2015

OBSERVATIONAL EXPERIENCE

Peking University 40-cm Telescope (PKUFT)	
Shane 3-m Telescope, UCO Lick Observatory: 2 nights observation of spectroscopy.	Jan 2019
Xinglong 2.16-m Telescope (NAOC): 2 nights observation of photometry.	Oct 2019

LEADERSHIP EXPERIENCE

President of Peking University Youth Astronomy Society (YAS)	May 2017 – May 2018
Monitor of Undergraduate Class 2016, Department of Astronomy	Sept 2016 – Now

Computer Skills

Skilled Languages:	Python, LaTeX, Mathematica, Shell/Bash, Git.
Experienced with:	• Significant experience with HSC, DECaLS, Dragonfly and SDSS-MaNGA data
	• Manipulating catalogs, analyzing dataset and visualization
	• Photometry of galaxies and low surface brightness features
Often-used Packages:	`Astropy`, `IRAF`, `SExtractor`, `SWarp`, `The tractor`, `GalSim`, `emcee`, `PyTorch`.
Basic Knowledge:	SQL/ADQL, C/C++, Lightroom, Photoshop.
Software Contributions:	• `mrf`: Multi-Resolution Filtering – a method for isolating faint extended emission in Dragonfly data and other low resolution images
	• `kungpao`: Photometric analysis library for Hyper Suprime Camera images
	• `unagi`: Search and download data from Hyper Suprime Camera Subaru Strategic Survey (HSC-SSP) on Subaru Telescope
	• More works can be found on Github: `@AstroJacobLi`

Activities and Talks

Presentation in HSC galaxy group telecon	June 2019
Theoretical Problems Designer, 12nd IOAA	Nov 2018
PKU Undergraduate Astronomy Symposium	Sept 2018
Mentor, Training for Chinese Astronomy Olympiad National Team	July 2018
PKU Representative, "Young Talent Plan" 10 Year Anniversary Symposium, USTC	July 2018
Asian Science Camp, Kampar, Malaysia	Aug 2017
Pacific Astronomy and Engineering Summit, Hawaii, U.S.	Aug 2014

References

Prof. Alexie Leauthaud	University of California, Santa Cruz
✉ alexie@ucsc.edu	
Prof. Pieter van Dokkum	Yale University
✉ pieter.vandokkum@ucsc.edu	
Prof. Yingjie Peng	Kavli Institute on Astronomy and Astrophysics, Peking University
✉ yjpeng@pku.edu.cn	
Dr. Song Huang	Princeton University
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