

ZHIWEI SHAO

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RESEARCH INTERESTS

I am eager to learn about all aspects of astronomy and am particularly interested in researches related with cosmology:

- Cosmological simulations: AGN and stellar feedback, hydrodynamic solvers;
- Observational cosmology: halo boundary, intra-cluster light, large-scale structure;
- Galaxy evolution: galaxy-halo connection, galaxy quenching.

EDUCATION

Nanjing University

B.S. in Astronomy, Overall GPA: 4.44/5.00, Major GPA: 4.50/5.00

Nanjing, China

Sept 2016 – June 2020

- Thesis: “Galaxy Distribution around redMaPPer Clusters in SDSS”
- Advisor: Ying Zu, Shanghai Jiao Tong University

RESEARCH POSITIONS

- Research Assistant, DoA, Shanghai Jiao Tong University, China Aug 2020 – Now
- Research Intern, University of Victoria, Canada July 2019 – Aug 2019
- Undergraduate Research Assistant, Nanjing University, China Oct 2017 – Dec 2019

REFERENCES

Prof. Ying Zu

yingzu@sjtu.edu.cn

Shanghai Jiao Tong University

Prof. Arif Babul

babul@uvic.ca

University of Victoria

Prof. Zi-Gao Dai

dzg@nju.edu.cn

Nanjing University

Prof. Bin-Bin Zhang

bbzhang@nju.edu.cn

Nanjing University

PUBLICATIONS

- [1] **Z. Shao**, C. Yin, B. Zhang, and Z. Dai, “Anisotropic Ejecta Distribution of Kilonova AT 2017gfo”, submitted to *ApJ*.
- [2] Y. Zu, H. Shan, J. Zhang, S. Singh, **Z. Shao**, X. Chen, J. Yao, J. B. Golden-Marx, W. Cui, E. Jullo, J.-P. Kneib, P. Zhang, and X. Yang, “Does Concentration Drive the Scatter in the Stellar-to-Halo Mass Relation of Galaxy Clusters?”, arXiv:2012.08629, submitted to *MNRAS*.

RESEARCH EXPERIENCE

Galaxy Distribution around redMaPPer Clusters in SDSS

Advisor: Ying Zu, Shanghai Jiao Tong University

Shanghai, China

Jan 2020 – Now

- Calculated cluster-galaxy cross-correlation using SDSS DR8 photometric catalog and redMaPPer cluster catalog, reproduced previous measurements of splashback radius and halo assembly bias and contributed to a paper submitted to MNRAS (arXiv:2012.08629).
- Introduced isolation criteria to identify clusters suffering from projection effects, tested different ways of conducting isolation and confirmed our criteria could reduce the discrepancy between splashback measurements using redMaPPer clusters and simulations.
- Currently working on building a simplified redMaPPer cluster finding algorithm and using mock data to test our isolation criteria.

Unified Modelling of the Galaxies and Hot Diffuse Gas in Cosmic Environments

Advisor: Arif Babul, University of Victoria

Victoria, Canada

July 2019 – Now

- Used PyAtomDB to calculate the X-ray properties of intra-group medium in hydro simulations, including luminosities, temperatures, entropies, etc. Wrapped the codes into a python package XIGrM and wrote detailed documentations for public usage (project website: <https://xigrm.readthedocs.io/>).
- Analyzed a series of simulations with different stellar feedback models to see their influences on intra-group medium and their consistency with observations. Generated X-ray images and radial profiles of groups to investigate the morphological differences in detail.
- Applied similar analysis to another cluster zoom-in simulation, found the cluster had abnormally high luminosity and pinned the problem on a group of hot but dense gases which was unusual.
- Currently working on studying the origin and evolution history of those unusual gases.

Anisotropic Ejecta Distribution of Kilonova AT 2017gfo

Advisors: Zi-Gao Dai and Bin-Bin Zhang, Nanjing University

Nanjing, China

Oct 2017 – Now

- Considered ISM extinction and processed the multi-band data collected by `Open Kilonova Catalog` to make the observables directly comparable with simulation results.
- Built a semi-analytical model and used MCMC to determine the best fitting kilonova ejecta distribution in AT 2017gfo event. Our results showed previous spherical multi-components model was incomplete and helped to understand the behaviour of dynamical and wind ejecta during a binary neutron star merger.
- Took relativistic Doppler effects into consideration when calculating observables, which was later proved to play an important role in shaping the observed light curve.
- Currently working on using simulation which includes detailed radiation transport to validate our simplified model according to reviewer's advice.

SHORT-TERM PROJECTS

Plasma Code

Advisor: Li Ji, Purple Mountain Observatory

Nanjing, China

Oct 2017 – Jan 2018

- Offered theoretical support to the use of PyAtomDB, generated a series of spectra under different physical conditions and checked the reliability of the database via comparing with other data.
- Used AtomDB and PyAtomDB to do line diagnostics of SNR N132D, successfully identified Fe, S and Si lines and derived the temperature of plasma.

Satellites Distribution in C-EAGLE

Advisor: Liang Gao, National Astronomical Observatories of China

Beijing, China

Jan 2019

- Illustrated satellites number density profiles in C-EAGLE simulation with different stellar mass limits and demonstrated their connections with the mass distribution of the cluster.
- Compared number density profiles in C-EAGLE with observational data to examine its accordance with the real universe.

HONORS AND AWARDS

- Outstanding Graduate of Nanjing University 2020
- Member of NJU Elite Project 2016 – 2020
- Elite Project Scholarship 2017, 2019
- People’s Scholarship 2017 – 2019
- Annual Scholarship of NAOC, CAS 2018
- Excellent Student 2017

COMPUTER SKILLS

- **Proficient with:** Python, Linux, L^AT_EX.
- **Working knowledge of:** C++, MATLAB, Mathematica, Shell scripts, MPI, SExtractor, PyRAF, Mangle, SQL, Git.
- **Often-used Packages:** Astropy, pynbody, emcee, dynesty, multiprocessing, PyAtomDB, Corrfunc.
- **Software Contributions:**
 - [XIGrM](#): Tools for analyzing X-ray properties of intra-group medium in simulations.
 - [simplified_redmapper](#): A simplified version of redMaPPer cluster finder while still captures projection effects.
 - [pytspec](#): For calculating spectroscopic temperature in simulations.

OUTREACH

- **Translation** June 2018 – Now
Translating the cosmology part of *An Introduction to Modern Astrophysics* by Bradley W. Carroll and Dale A. Ostlie into Chinese.
- **Teaching** at Qinhuai 2nd Experimental Primary School Spring 2017
Teaching pupils elementary astronomy knowledge.