SHI-HUI ZANG

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EDUCATION

Tsinghua University, China *Sept 2018 - June 2022*

Tsien's Excellence in Engineering Program, School of Aerospace Engineering

- **Overall GPA**: 3.86/4.00
- **Ranking**: 8/28
- **TOEFL**: 109 (Home Edition); 103 (Normal Edition)
- **GRE: 325** (V: 156; Q: 169; AW: 4.0)
- **Research interests**: ***Large scale structure, N-Body simulation, Cosmological data analysis***
- **Core Courses**: Electrodynamics (score 98/100), Quantum Mechanics (score 100/100), Fundamentals of Dynamics and Control (score 92/100), Thermodynamics and Statistical Physics (score 87/100), Probability and Statistics (score 100/100), Signal and System Analysis (score 98/100), Methods of Mathematical Physics (score 100/100), Finite Element Method (score 98/100), Foundations of Scientific and Engineering Computing (score 92/100), Electrical Engineering and Applied Electronics (score 92/100), Fluid Mechanics (score 78/100), Foundation of Solid Mechanics (score 98/100).

WORK EXPERIENCE

National Astronomical Observatories, CAS, China *July 2022 - July 2023 (expected)*

Research Assistant, Supervised by Prof. Gong-Bo Zhao

PUBLICATIONS

1. **Shi-Hui Zang**, Hong-Ming Zhu, Marcel Schmittfull & Ue-Li Pen, *Cosmic tidal reconstruction in redshift space*, in prep
2. **Shi-Hui Zang**, Hong-Ming Zhu, Baojiu Li, Ue-Li Pen & Gong-Bo Zhao, *Constraining $\nu\Lambda CDM$ with Nonlinear Reconstruction*, in prep

RESEARCH EXPERIENCE

Detecting Local Primordial non-Gaussianity With Halo Spin *June 2022 - present*

Online Internship, Supervised by Prof. Ue-Li Pen, CITA, University of Toronto

- Led the largest $f_{\rm NL}$ CDM N-body simulation on NiagaraAtScale event.
- Used 1728 nodes (69120 CPUs in total) to complete two simulations of more than six trillion particles each. These two simulations enabled the accurate modeling of $f_{\rm NL}$ signal in statistics like halo bias and galaxy spin.
- Current analyzing the effects of $f_{\rm NL}$ on the alignment between the halo spin, protohalo spin, and initial angular momentum proposed by the tidal torque theory.

Cosmic Tidal Reconstruction In Redshift Space *Mar 2021 - Nov 2021*

Online Internship, Supervised by Prof. Ue-Li Pen, CITA, University of Toronto

- Employed halo tides in the redshift space to reconstruct the large-scale structure of the universe, which has the potential to implement multi-tracer analysis in future surveys.
- Modeled the full-shear-term reconstructed field in the redshift space using a propagator in a brief quadratic form, which enabled the quantitive analysis of reconstructed large-scale structures.
- Verified the robustness of the transverse-shear term tidal reconstruction in the redshift space.
- Built `TideRec`, a parallel computing Python package for performing and analyzing tidal reconstruction.

Measuring Cosmic Tides With DES Y1 Data *Oct 2021 - present*

Online Internship, Supervised by Prof. Ue-Li Pen, CITA, University of Toronto

- Evaluated and quantified the influence of different photo-Z errors on tidal reconstruction.
- Developed and verified a planar tidal reconstruction algorithm using various depths and number density.
- Currently developing a data analysis pipeline to measure the reconstructed power spectrum of DES Y1 data to improve cosmological constraints.

Constraining νCDM With Iterative Initial Condition Reconstruction *Mar 2022 - Oct 2022*

Online Internship, Supervised by Prof. Ue-Li Pen, CITA, University of Toronto

- Implemented the standard reconstruction, iterative displacement reconstruction, and multigrid relaxation reconstruction on δ_{cb} fields of 11,000 Quijote simulations. These reconstruction methods retrieve the high-order information back into two-point functions.
- Identified the Fisher information of six cosmological parameters in pre- and post- reconstruction power spectrums.
- Verity that the non-linear reconstruction improves the constraints from the $P_{\rm cb}$ on these parameters by a factor of approximately two at cutoff scale $k_{\rm max} = 0.5h/{\rm Mpc}$ compared to the standard reconstruction. This implies the great potential of non-linear reconstruction in future surveys with much higher number density.
- Built `StdRec` and `DisIter`, two parallel computing Python packagse for initial condition reconstruction.

Extracting BAO Information From Halos With Non-linear Reconstruction *July 2022 - present*

Independent Research Program, Supervised by Prof. Gong-Bo Zhao & Dr. Hong-Ming Zhu

- Applied the multigrid relaxation reconstruction on halo density fields of the Abacus-Summit simulation in the redshift space to sharpen the Baryonic Acoustic Oscillation (BAO) wiggle.
- Identified the Fisher information of six cosmological parameters in pre- and post- reconstruction power spectrums.
- Currently investigating the Fisher information about two geometric parameters and growth rate from the reconstructed BAO signal.

Flexible Electrostatic Sampler Based On Traveling Wave *Sept 2020 - June 2021*

Independent Research Program, Supervised by Prof. Hexi Baoyin, School of Aerospace Engineering, Tsinghua Univ.

- Simulated the motion of ionized lunar regolith under the coupling of electric gravity fields.
- Established a four/six phase high voltage square wave generator, developed and 3D printed a model of the sampler.
- Performed experiments to evaluate the acceleration effect of an electric field on the simulated lunar regolith.

TALKS

CITA Cosmology Discussion | University of Toronto *Dec 10 2021*

Measuring cosmic tides with DES Y1 data

SOFTWARE DEVELOPMENT

TideRec | Author and Maintainer https://github.com/Zangshihui/TideRec

A tool to perform tidal reconstruction using halo catalogs and evaluate the reconstructed density field.

StdRec | Author and Maintainer https://github.com/Zangshihui/StdRec

A tool to perform standard reconstruction on particle catalogs.

TideRec | Author and Maintainer https://github.com/Zangshihui/DisIter

A tool to perform iterative initial condition reconstruction on particle catalogs.

TECHNICAL SKILLS

Programming: Proficient in Python, LaTeX, Matlab and Simulink. Working knowledge of C++.

Software: Nbodykit, CAMB, Cython, GetDist, mpi4py, Solidworks, AutoCAD, abaqus.

AWARDS AND HONORS

Scholarships

Globalink Research Award, Mitacs *Dec 2021*

Scholarship For Academic Excellence, Tsinghua University *Sep 2021*

Scholarship For Sports Excellence, Tsinghua University *Sep 2021*

Xuetang Award, Tsinghua University *Oct 2020*

Awards

The fifth place in men's 1500 meters in Tsinghua University Games *May 2019*

The second prize in mixed relay in Laser-run of Capita University Students Games *Nov 2020*