SIJIN CHEN

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EDUCATION

Ludwig-Maximilians-Universität München, Germany *10/2022 - present*

- Master of Science in Astrophysics, grade: (1.25/1.0)
- Main Courses: Formation and Evolution of Cosmic Structures (1.0 – Excellent), Cosmology and Large-Scale Structure (1.0 – Excellent), The Origin and Emergence of Structure in the Universe (1.0 – Excellent), Hydrodynamics (1.3 – Excellent), Gravitational Dynamics (simulation of N-body system), From Data to Insights (Bayesian inference and AI), Machine Learning

Jilin University, China *09/2018 - 06/2022*

- Bachelor of Science in Physics, overall grade: 90.30/100 (5% in rank)

RESEARCH EXPERIENCE

Research Project: Parity Violation Detection Using Weak Lensing Trispectrum *05/2025 – present*

Advisor: Dr. Zhengyangguang (Laurence) Gong & Dr. Jiamin Hou

- Developed an analytical framework to compute the weak lensing convergence trispectrum based on a primordial curvature trispectrum template.
- Derived theoretical expressions for both the full and reduced trispectrum.
- Performed analytical calculations of the expected signal-to-noise ratio (SNR) for configurations where four points lie within the same or across different tomographic bins.
- Found that the predicted SNR is largest when all points are in the same bin and smallest when distributed across bins, with a theoretical maximum of 1.2.

Master Thesis: Cosmological Constraints with Weak Lensing Scattering Transform *10/2023 – 05/2025*

Advisor: Dr. Stella Seitz & Dr. Zhengyangguang (Laurence) Gong

- Wavelet convolution on weak lensing convergence maps.
- Performed cosmological parameter forecast with Fisher analysis using scattering coefficients (mean value of modulus of convolved maps).
- Captured non-Gaussian information.
- Developed neural network-based emulators trained on CosmoGridV1 simulations to predict scattering coefficients for different cosmologies. Used these emulators to perform MCMC sampling and obtained posterior distributions, thereby deriving precise cosmological constraints.
- Implemented the emulators trained in different tomographic bins and cosmologies with systematic effects, like galaxy shape noise, intrinsic alignment, multiplicative bias, baryonic feedback and photometric redshift uncertainty, to conduct a tomographic analysis, and deriving cosmological constraints on mock data.
- Cosmological constraints on masked mock data yielded $\Omega_m = 0.275^{+0.049}_{-0.060}$, $\sigma_8 = 0.825^{+0.081}_{-0.092}$, $S_8 = 0.776^{+0.045}_{-0.049}$, achieving 48%, 37%, and 26% tighter constraints, respectively, compared to using the power spectrum alone.

Bachelor Thesis: Time-Dependent Kinetic Study of Positron-Hydrogen Collisions *12/2021 – 04/2022*

Advisor: Prof. Liguang Jiao

- Investigated the positron-hydrogen scattering problem using time-dependent wave function evolution and the five-point formula on a position grid.
- Applied FFTs to kinetic energy in momentum space, then transform back to position space for potential calculations using a symmetric split of energy terms.
- Simulated and tracked wave functions, showing positronium formation at high energies and independent scattering at low energies.

Materials Physics and Battery *10/2019 – 10/2020*
Advisor: Prof. Xiaofeng Wang

- Prepared chlorophyll films of different thicknesses by the spin-coating method in a nitrogen environment, produced chlorophyll cells, and tested the conductivity of different film thicknesses
- Analyzed the influence of rotation speeds on the chlorophyll film from collected data, and generalized the conductivity of the chlorophyll cell under different rotation speeds

TALKS

- **Munich Large-Scale Structure Days**: *"Probing Parity Violation with Weak Lensing Trispectrum"* *10/2025*
- **Cambridge-LMU Cosmology Meeting**: *"Probing Parity Violation with Weak Lensing Trispectrum"* *09/2025*
- **Ringberg MPE OPINAS Group Conference**: *"Scattering Transform on Weak Lensing with Systematics"* *04/2025*
- **Institute for Theoretical Physics, Heidelberg**: *"Probing Weak Lensing Cosmology with Scattering Transform"* *02/2025*
- **Munich Dark Energy Day**: *"Parameter Constraints with Weak Lensing Scattering Transform"* *01/2025*
- **Munich ORIGINS Lensing Workshop**: *"Cosmological Constraints with Weak Lensing Scattering Transform"* *11/2024*
- **Ringberg MPE OPINAS Group Conference**: *"Scattering Transform on Cosmological Parameter Constraints"* *03/2024*

EXTRA CURRICULAR ACTIVITIES

Tonale Winter School on Cosmology *12/2024*
- Topic: Dark Energy, Galaxy Clusters, Data Inference & Machine Learning, Testing Fundamental Physics with GW

Cambridge Academic Programme of Quantum Computing *01/2022 - 02/2022*
- Grasped Machine Learning and basic knowledge of Quantum Computing, and took Grover's Algorithm as an example to research what is QC good for and why

Cambridge Statistical Physics and Complex Systems Summer School *07/2021*
- Topic: the application of statistical physics in molecular simulation, biophysical neural network, economics, finance

TEACHING

Weak Gravitational Lensing Lab *06/2025 - 07/2025*
- Supervised the Weak Gravitational Lensing laboratory course for master students.

HONORS & AWARDS

- **Canada Mitacs Globalink Research Internship Scholarship** *10/2021*
- **First Prize Scholarship**, Jilin University (Top 5%) *09/2021*
- **Merit Student** *06/2020*
- **Outstanding Student Leader** *05/2020*
- **Outstanding Volunteer** *10/2019*
- **Second Prize Scholarship**, Jilin University (Top 10%) *09/2019*

TECHNICAL SKILLS

- Programming: Python, C/C++, MATLAB.
- Packages: `PyTorch`, `emcee`, `ChainConsumer`, `SymPy`, `SciPy`.
- Computational Tools: Linux, LaTeX, Origin.
- Astrophysical Methods: Fisher forecasting, cosmological parameter inference, higher-order statistics, weak lensing analysis, Markov chain Monte Carlo (MCMC).