DAWEI ZHONG

Email: daweiz@usc.edu | Tel: 626-999-1224 | Github: github.com/dawei-zh

EDUCATION

Ph.D. Student, Department of Physics & Astronomy, University of Southern California — Aug. 2020 - Present
Major: Cosmology, Advisor: Vera Gluscevic, Mathew Madhavacheril

Bachelor of Science in Astronomy, Department of Astronomy, Xiamen University, China — Sep. 2014 - Jun. 2018
Thesis: XMM-Newton Survey of Local O VIII Absorber, Advisor: Taotao Fang

PUBLICATIONS

- **D. Zhong**, M. Valli, and K. N. Abazajian, "Near to long-term forecasts in x-ray and gamma-ray bands: Are we entering the era of dark matter astronomy?", Phys. Rev. D 102, 083008

TALKS AND PRESENTATION

- **The 235th Meeting of the American Astronomical Society**, iPoster Presentation entitled "Prospects for Dark Matter Astronomy: Galactic Dark Matter Sensitivities in the X-ray and Gamma-ray Bands" Jan. 2020

QUANTUM PROJECT

Scalable Response Matrix for Readout Error Mitigation (Final Project of EE 514) — Nov. 2021 - Present
Instructor: Daniel Lidar, Collaborated with Bibek Pokharel, University of Southern California

- Estimated the error raised during state-preparation using single-qubit gate-set tomography (GST) technique via pyGSTi, obtained the relation between clean and noisy initial states
- Conducted calibration experiments for all 5-qubits of IBM Q superconducting processor ibmq_lima, removed the state-preparation noise and estimated the response matrix with Iterative Bayesian Unfolding (IBU) method
- Reduced the scale of response matrix via subspace reduction and checked its performance on error mitigation
- Working on a new scalable method considering the architecture of ibmq_lima quantum processor

Implementation of Quantum Error Correction code With IBM Qiskit — Dec. 2021 - Jan. 2022
Personal Project, Consult from EE 514 Final Project Lists

- Implemented the encoding, error detection, recovery and decoding processes of $[[3, 1, 3]]$ bit-flip error correction code, $[[3, 1, 3]]$ phase-flip error correction code, $[[5, 1, 3]]$ perfect code and $[[7, 1, 3]]$ Steane code with IBM Qiskit
- Implemented and check3e the error detection method for fault CNOT gate (purposed in R. Chao and B. W. Reichardt, Quantum error correction with only two extra qubits) in perfect code using IBM Qiskit

CERTIFICATE

- IBM Certified Associate Developer - Quantum Computation using Qiskit v0.2X — Dec. 2021

HONORS & AWARDS

- Guangqi Scholarship of Shanghai Astronomical Observatory, Chinese Academy of Sciences, 3rd prize — Apr. 2018
- Scholarship of The National Astronomical Observatories of the Chinese Academy of Sciences — Dec. 2017
- Wenzhong CAI Scholarship, 1st prize — Apr. 2016
- Scholarship of Academic Excellence, 1st prize — Sep. 2015

RESEARCH EXPERIENCE

Cross-Correlation Between CMB Lensing Potential and Galaxies Overdensity Field Jul. 2021 - Current
Advisor: Mathew Madhavacheril & Vera Gluscevic, University of Southern California

- Constructed a Python code with healpy to calculate the power spectrum C_l^{gg} from RedMaGiC galaxy samples of Dark Energy Survey
- Adopted Cosmic Microwave Background (CMB) lensing potential data from Planck and calculated cross-correlation spectrum $C_l^{\kappa g}$ between CMB lensing potential and galaxies overdensity field

BBN Constrain on Light WIMPs Dec. 2020 - Jul. 2021
Advisor: Vera Gluscevic, University of Southern California

- Using AlterBBN to calculate effective number of neutrino species $N_{\rm eff}$ for real scalar, complex scalar, Majorana WIMP and Dirac WIMP under electromagnetic coupling and neutrino coupling
- Modified CLASS code and predicted corresponding helium abundance Y_p and $N_{\rm eff}$ for four WIMP particles with different mass m_χ

Galactic Dark Matter Signal and Detection at X-ray and Gamma-ray Bands Aug. 2019 - Feb. 2020
Advisor: Kevork Abazajian, University of California, Irvine

- Simulated dark matter spectral feature with the Latte suite of FIRE-2 cosmological baryonic simulation of Milky Way-mass galaxies, obtained energy shift and broadening information of dark matter narrow emission line at 3.5 keV
- Estimated baryon velocity profile from neutral hydrogen HI4PI survey, compared it with dark matter velocity profile, proposed an enhanced procedure to apply dark matter velocity properties on dark matter signal diagnosis and discussed the potential of future X-ray and Gamma-ray telescopes on dark matter signal searching
- Estimated dark matter annihilation and decay luminosity and discussed the potential of searching sterile neutrino dark matter with eXTP/WFM detector near 3.5 keV

XMM-Newton Survey of Local O VIII Absorber Feb. 2017 - Dec. 2019
Advisor: Taotao Fang, Xiamen University

- Collected all released *XMM-Newton* RGS data of 32 AGNs and 16 XRBs, performed simultaneous fitting of absorption features from hydrogen-like O VIII gas at $z = 0$, estimated spectral line properties including equivalent width, column density and velocity shift
- Discussed and ruled out contamination from AGN and XRB intrinsic absorption features, finally reported 3σ O VIII absorption line detections towards the line-of-sight direction of 10 AGNs and 16 XRBs (including 9 first detection)
- Calculated the gas temperature as $T \sim 1.7 - 2.3 \times 10^6$ K, concluded that O VIII gas is uniformly distributed in the Galactic halo.

Local Hot Gas Along the Quasar H 2356-309 Sight-line Sep. 2018 - Sep. 2019
Advisor: Taotao Fang, Xiamen University

- Analyzed all available *XMM-Newton* RGS data of H 2356-309, fitted the local O VII and O VIII absorption lines and estimated their line properties including equivalent width, column density and velocity shift
- Estimated absorbing gas temperature, gas density and its path length, discussed the spatial distribution of gas and the presence of multi-phase hot diffuse gas halo in Milky Way

TEACHING EXPERIENCE

- TA for Lab Session of PHYS 172L (Applied Physics II: Electricity, Magnetism and Optics) Fall 2021

COMPUTER SKILLS

Computer Programming	Well-versed in Python Often use NumPy, SciPy, Pandas, Matplotlib, Astropy and healpy Experienced in Qiskit (IBM Quantum Computation SDK) Experienced in C language and basic data structures Shell/Bash script
Astronomical Analysis Software	CIAO (for *Chandra*), SAS (for *XMM-Newton*) Spectral analysis: Xspec (HEASARC), SPEX
Other Software & Tools	Microsoft Word, Powerpoint & Excel, LaTeX, Markdown Basic operation of Linux (Ubuntu)