

ZIXUAN PENG

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EDUCATION

Doctor of Philosophy, Physics, UC Santa Barbara Sept. 2021 - Present

Emphasis: Astrophysics

Committee: Dr. Crystal L. Martin, Dr. Joseph F. Hennawi, Dr. S. Peng Oh

Bachelor of Science, Physics, UC Santa Barbara Sept. 2017 - June 2021

Minor: Astronomy And Planetary Science

Bachelor Honors Thesis: Extreme Emission-Line Galaxies: Electron Temperature, Electron Density, and Metallicity (Advisor: Dr. Crystal L. Martin)

RESEARCH EXPERIENCES

Physical Origins of Outflowing Cold Clouds in Local Star-forming Galaxies June 2022 - Present

Advisor: Dr. Crystal L. Martin

- Studying the physical origins of outflowing cold clouds in a sample of 14 low-redshift star-forming galaxies from [CLASSY](#) using Keck/ESI (Echelle Spectrograph and Imager) data.
- Tracing outflowing cold clouds with strong optical emission lines (e.g., [O III] $\lambda 5007$ and $H\alpha$), distinguishing very-broad (VB) components (FWHM ~ 1000 km s $^{-1}$) from broad components (FWHM ~ 300 km s $^{-1}$).
- Quantitatively modeling the cooling luminosities and velocity widths of [O III] $\lambda 5007$ using both single-phase (i.e., direct condensation of hot winds) and multiphase (i.e., turbulent radiative mixing layers) analytical supernova-driven galactic wind models. Although the observed outflow velocities are consistent with either galactic wind model, both models underestimate the observed [O III] $\lambda 5007$ surface brightness by 2 - 4 dex.
- Discussing other possible energy sources (e.g., merger-driven flows) for these broad wings in strong optical emission lines and concluding that most luminosities should come from stellar photoionization.

Using KCWI to Explore the Chemical Inhomogeneities and Evolution of J1044+0353 March 2022 -

July 2023

Advisor: Dr. Crystal L. Martin

- Traced the propagation of the starburst across this small galaxy using Balmer emission- and absorption-line equivalent widths and find a post-starburst population ($\sim 15 - 20$ Myr) roughly one kpc east of the much younger, compact starburst ($\sim 3 - 4$ Myr).
- Used KCWI (Keck Cosmic Web Imager) to find the spatial variations in metallicity in the EELG (Extreme Emission Line Galaxy) J1044+0353, a local analog of the high redshift galaxies during the Epoch of Reionization.
- Mapped the Doppler shift and width of the strong emission lines. The steepest gradients (~ 30 km s $^{-1}$ kpc $^{-1}$) appear to emanate from the oldest star clusters in the post-starburst region along the galaxy's minor axis. The increased line widths around the post-starburst region convincingly identify the velocity gradient as a galactic outflow viewed edge-on.
- Applied an analytical chemical evolution model with a metal-enriched wind to understand the chemical abundances of this galaxy.

OBSERVING EXPERIENCES

Keck II Keck Cosmic Web Imager (KCWI/KCRM) Dec. 2021 & Sept. 2023

3 half nights with Dr. Crystal L. Martin

Keck II Echelle Spectrograph and Imager (ESI) Nov. 2022 - Apr. 2023

3 and half nights with Dr. Crystal L. Martin, Jichen Zhang, and Yuan Li

TEACHING EXPERIENCES

Teaching Assistant (Physics Department at UC Santa Barbara)	Oct. 2021 - June 2022
• PHYS 133 (Galaxies and Cosmology)	Mar. 2022 - June 2022
• PHYS 131 (Stellar Structure and Evolution)	Jan. 2022 - Mar. 2022
• PHYS 3L (Physics Laboratory)	Oct. 2021 - Jan. 2022
Learning Assistant (Physics Department at UC Santa Barbara)	Apr. 2019 - Dec. 2020
• PHYS 115A (Quantum Mechanics A)	Aug. 2020 - Dec. 2020
• PHYS 115B (Quantum Mechanics B)	Apr. 2020 - June 2020
• PHYS 104 (Advanced Mechanics)	Apr. 2019 - June 2019

SELECTED FELLOWSHIPS AND AWARDS

Future Investigators in NASA Earth and Space Science and Technology Award	Oct. 2023 - Oct. 2026
Worster Summer Research Fellowship	June 2022 - Sept. 2022
Role: Mentor	
Mentee: Yuan Li	
UCSB Physics Academic High Honors Award	June 2021
UCSB Physics Research Honors Award	June 2021

PUBLICATIONS

- (In Preparation) **Peng Z.**, Martin C., Chen Z., Fielding D., Xu X., Heckman T., et al., “Physical Origins of Outflowing Cold Clouds in Local Star-forming Galaxies”
- (Accepted for Publication in ApJ) Martin C., **Peng Z.**, and Li Y., “Resolving the Mechanical and Radiative Feedback in J1044+0353 with KCWI Spectral Mapping”
- (Published in ApJ) **Peng, Z.**, Martin, C., Thibodeaux P., Zhang, J., Hu, W., Li, Y., “Using KCWI to Explore the Chemical Inhomogeneities and Evolution of J1044+0353” (<https://arxiv.org/abs/2308.00351>)

TALKS AND POSTERS

- Talk: “Using KCWI to Explore the Chemical Evolution and Feedback in a Reionization-era Spectral Analog J1044+0353,” 2023 ELT Science in Light of JWST, UCLA Faculty Center, UC Los Angeles
- Talk: “Using KCWI to Explore Spatial Variations in Metallicity in an Extreme Emission-Line Dwarf Galaxy,” Fall 2022 Astro Lunch, Physics Department, UC Santa Barbara
- Poster: “J1044+0353: Using KCWI to Explore Spatial Variations in Metallicity,” 2022 Keck Science Meeting, Cahill Center for Astronomy and Astrophysics, California Institute of Technology

TECHNICAL SKILLS

Programming Languages: Python, Matlab, Mathematica, C++, Linux/Unix

Astrophysics Packages/Softwares: [BEAGLE](#), [Cloudy](#), [IRAF](#), [MESA](#), [SAOImageDS9](#), [STARBURST99](#)

SELECTED COURSEWORKS

Graduate Classes:

PHYS 215ABC - Quantum Mechanics	PHYS 219 - Statistical Mechanics
PHYS 231AB - General Relativity	PHYS 240 - Statistics Data Analysis and Machine Learning
PHYS 232 - Stellar Structure and Evolution	PHYS 233 - Interstellar Medium
PHYS 234 - High Energy Astrophysics	PHYS 235 - Extragalactic Astrophysics
PHYS 236 - Cosmology	PHYS 237 - Galactic Dynamics