# Zi-Liang Zhang

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## Research interests

Fast radio bursts; High-energy transient phenomena; Multi-messenger astronomy

## Education

**Central China Normal University** — Wuhan, China
M.Sc. in Astronomy — 2021/9 – Present
Advisor: Prof. Yun-Wei Yu *GPA: 90.5/100*

**Central China Normal University** — Wuhan, China
B.Sc. in Physics — 2017/9 – 2021/6
Thesis: Dispersion Measure and Rotation Measure of Core-Collapse Supernova Remnant (Grade: Excellent)
Advisor: Prof. Yun-Wei Yu

## Publications

*Diverse origins for non-repeating fast radio bursts: Rotational radio transient sources and cosmological compact binary merger remnants*
**Zi-Liang Zhang**, Yun-Wei Yu, Xiao-Feng Cao.
*Astronomy & Astrophysics, 675, A66.*

## Honors and scholarships

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|---|---|
| **National Scholarship**, Ministry of Education of China | 2023 |
| Outstanding Graduate Student | 2023 |
| Second Class Scholarship for Academic Achievement*3 | 2021, 2022, 2023 |
| Proactive Member of Student Club Activities | 2020 |
| ShuRen Scholarship | 2020 |
| Theoretical Physics Talent Training Base Class Scholarship*3 | 2018, 2019, 2020 |

## Research experience

### Diverse Origins for Non-repeating Fast Radio Bursts (FRBs)

2022/09 – Present

- Discovered a potential low-energy population of non-repeating FRBs, enriching the current understanding of FRB diversity and origins.
- Considered the direction-dependent sensitivity of the CHIME telescope to unveil the true galactic latitude distribution of low-energy FRBs.
- Discussed the possible explanations behind the observed galactic plane concentration of these low-energy FRBs.
- Engaged in ongoing efforts to gather more comprehensive evidence to substantiate the existence and characteristics of the identified low-energy FRB population.

**Scattering time of FRBs and Their Relation with Persistent Radio Source** 2022/10 – Present

• Applying the galactic electron density model to dissect the scattering time and dispersion measure of FRBs, distinguishing contributions from the Milky Way, intergalactic medium, and host galaxy medium.

• Engaging in a thorough exploration aimed at elucidating the persistent radio source of FRBs, hypothesizing synchrotron radiation resulting from the interaction between pulsar wind nebulae and supernova remnants.

• Endeavoring to construct a cohesive model that interlinks scattering time, dispersion measure, rotation measure, and the evolution of persistent radio sources to offer a more unified understanding of FRB environment.

• Conducting a meticulous literature review and deriving theoretical frameworks concerning radiation and angular distribution of a point charge in motion, curvature radiation, and coherence radiation.

**Programming Markov Chain Monte Carlo Method** 2021/09 – 2022/03

• Studying the principles of Markov Chain Monte Carlo Method.

• Writing a simple 2 dimension Markov Chain Monte Carlo algorithm.

**Redshift Distribution and Energy Function of CHIME Non-repeating FRBs** 2021/06 – 2022/07

• Testing whether redshift distribution of FRBs tracks cosmic star formation rate or compact binary merger rate.

• Constraining energy function of FRBs.

• Considering the selection effects of CHIME telescope.

• Utilizing the Monte Carlo method with various redshift distributions to simulate mock FRBs, determining which could most accurately reproduce real observations.

**Dispersion Measure and Rotation Measure of Core-Collapse Supernova Remnant** 2021/01 – 2021/06

• Researching the evolution of dispersion measure and rotation measure of Fast Radio bursts for two environments: core-collapse supernova and compact binary merger.

• Calculating the shock wave radius of different ejecta, and dispersion measure and rotation measure from shocked and unshocked region.

**Research on Issues Related to White Dwarf and Neutron Star/Black Hole Merger Events** 2018/09 – 2020/08

• Studying numerical solutions of Lane–Emden equation and calculating Mass-Radius relation of stars and white dwarfs by MATLAB.

• Programming runge-kutta method of ODE system to solve TOV equation of neutron star and calculating Mass-Radius relation.

## Teaching experience

**Undergraduate supervision at Central China Normal University**

ChangLan Linghu: Statistical study of repeating FRBs. 2022/12 – 2023/05

TianEn Chen: Statistical study of non-repeating FRBs. 2021/12 – 2022/05

*Co-supervisor with Prof. Yun-Wei Yu*

**Teaching assistants at Central China Normal University**

An Introduction to Astronomy (mixed undergraduate and graduate Course), TA and observation organizer Fall 2021, 2022, 2023

General Physics Spring 2023

## Skills

**Programming**

Proficient in: MATLAB, Python and LaTex; skillful in numerical calculation and scientific data analysis.

**Languages**

Chinese (native speaker and speak several dialects), English (IELTS: band6.5)

## Public Outreach

**Speaker & Organizer**, *Not So Simple Star Party.* 2023/10

• Curated an interactive astronomical observation session focused on normal stars and deep sky objects.

• Utilized telescopes and astrography cameras to facilitate public observations, enhancing their celestial experience.

• Communicated complex astrophysical concepts in an accessible manner, fostering a deeper appreciation and understanding of the observed stars and star clusters.

Core member & star party organizer, Amateur Astronomers Association of CCNU. 2017–2023

Observation manager of several astronomy courses. 2021–2023

Examiner, Hubei Province astronomy knowledge competition. 2022/07

## Conference Talks

"Diverse origins for non-repeating fast radio bursts: Rotational radio transient sources and cosmological compact binary merger remnants", Fast/Future Pulsar Symposium 12, Nanyang, Henan 2023/07

"The origin diversity of non-repeating fast radio bursts: Rotational radio transient sources and cosmological compact binary merger remnants?", 14th Zhang Heng Academic Symposium of the Chinese Astronomical Society, Wuhan, Hubei 2023/04

"Revisiting the event rate and energy function of fast radio bursts: Are they originate from compact binary mergers?", Fast/Future Pulsar Symposium 11, Xiangtan, Hunan 2022/08

## Conferences and Summer Schools

POLAR-2 Scientific Mission and HERD Design Plan Symposium, Nanning, Guangxi 2021/04

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| Gravitational Wave Astrophysics Conference 2021, Hefei, Anhui | 2021/06 |
| Hubei Astronomical Society 2021 Annual Meeting, Wuhan, Hubei | 2021/07 |
| Chinese Astronomical Society 2021 Academic Annual Meeting, Online | 2021/10 |
| FAST 2022 Summer School, 4 days, Pingtang, Guizhou | 2022/07 |
| Fast/Future Pulsar Symposium 11, Xiangtan, Hunan | 2022/08 |
| 2022 Pulsar Summer School, 10 days, Xiamen, Fujian | 2022/08 |
| 1st CSST Scientific Annual Meeting, Beijing | 2023/03 |
| 14th Zhang Heng Academic Symposium of the Chinese Astronomical Society, Wuhan, Hubei | 2023/04 |
| Fast Radio Bursts and Their Astrophysics Symposium, Hefei, Anhui | 2023/05 |
| The First LHAASO Symposium, Chengdu, Sichuan | 2023/05 |
| Fast/Future Pulsar Symposium 12, Nanyang, Henan | 2023/07 |
| 1st FAST Science Forum, Pingtang, Guizhou | 2023/09 |
| International Workshop on Intelligent Computing In Astronomy, Hangzhou, Zhejiang | 2023/11 |
| 32nd Texas Symposium on Relativistic Astrophysics, Shanghai | 2023/12 |