

# Yuanze DING

Physics Ph.D. Candidate

Email: yding@caltech.edu

ORCID: 0000-0002-5770-2666

## EDUCATION

**Wuhan University**, Wuhan, Hubei province, China

September 2018 - June 2022

**B.S. in Physics**, School of Physics and Technology & **Honor Science Program** of Hongyi College

Cumulative GPA: 3.88/4.00, rank 1/44

**California Institute of Technology**, Pasadena, CA, United States

September 2022 - Present

**Ph.D. in Physics**, Division of Physics, Mathematics and Astronomy

Advisor: Prof. Fiona Harrison

## PUBLICATIONS

**Yuanze Ding** et al., *QPOs and orbital elements of X-ray binary 4U 0115+63 during the 2017 outburst observed by Insight-HXMT*, 2021, MNRAS, 503, 4, 6045.

**Yuanze Ding** et al., *Timing and spectral variability of high mass X-ray pulsar GX 301-2 over orbital phases viewed by Insight-HXMT*, 2021, MNRAS, 506, 2, 2712.

**Yuanze Ding**, Ruancun Li, Luis C. Ho and Claudio Ricci, *Accretion Disk Outflow during the X-ray Flare of the Super-Eddington Active Nucleus of I Zwicky 1*, accepted for publication in ApJ.

**Yuanze Ding** et al., *Phase resolved spectroscopy and varying CRSFs in X-ray binary GX301-2*, in prep.

X. Chen, W. Wang, Y. M. Tang and **Yuanze Ding** et al., *Relation of cyclotron resonant energy and luminosity in a strongly magnetized neutron star GRO J1008-57 observed by Insight-HXMT*, 2021, ApJ, 919, 33.

X. Chen, W. Wang, and **Yuanze Ding** et al., *Wavelet analysis of MAXI J1535-571 with Insight-HXMT*, submitted to MNRAS.

Q. Liu, W. Wang, and X. Chen and **Yuanze Ding** et al., *Variations of cyclotron resonant scattering features in Vela X-1 revealed with Insight-HXMT*, in prep.

## RESEARCH EXPERIENCE & EMPLOYMENT & CONFERENCE PRESENTATIONS

**Intern, Kavli Institute for Astronomy and Astrophysics, Peking University**

July 2021 – Present

Advisor: Prof. Luis C. Ho

*Broad band spectroscopy of I Zwicky 1 with NuSTAR and XMM-Newton*

July 2021 – present

- Found several bugs in Xspec. Contributed to the Xspec 12.12.0f patch.
- Found rapid corona cooling event, possibly being the result of strong pair production and runaway, supporting a disk-like corona with complicated inner structure.
- Found correlation between outflow ionization state and velocity,  $\xi \sim v^{3.58^{+0.50}_{-0.56}}$ , consistent with a super-Eddington wind.
- Found two sequence of UFOs with distinct properties. Based on observation, I proposed a possible mechanism for the production of standard M- $\sigma$  relation.
- Complete the manuscript as first author, which will be submitted to ApJ in this month.

**Keywords:** Active galactic nucleus, AGN feedback, Ultra-fast outflow, reflection spectroscopy.

**Conference presentation:**

*Multi-band reverberation mapping*

KIAA AGN Workshop

August, 2021, Peking University, Beijing, China.

**Research Assistant, Center of Astrophysics, Wuhan University**

July 2019 – Present

Advisor: Prof. Wei Wang

*Timing analysis of X-ray binary 4U 0115+63 with Insight-HXMT*

July 2019 – March 2021

- Confirmed the spinning up and apsidal motion of 4U 0115+63.
- Obtained spin periods with period folding technique and derived orbital elements with apparent spin periods.
- Discovered new QPO with wavelet analysis technique, confirmed previous discovered ones.
- Sketched out local and global features of QPOs in different period with wavelet analysis and corresponding indication factors.
- Proposed new hypothesis (Multi-vortex polygon) to account for the origin of QPOs in 4U 0115+63, which is a kind of symmetry breaking phenomenon occurred in swirling flow.

**Keywords:** High mass X-ray binary, Neutron star, Accretion disc, Quasi-periodic Oscillations.

**Conference presentation:**

*Wavelet analysis and QPOs of X-ray binary 4U 0115+63*  
December, 2020, Shandong province, Jinan, China.

3rd X-ray binary multi-band conference

**Timing and spectrum variability of GX301-2**

January 2021 – June 2021

- Confirmed a correlation between the equivalent width of iron line complex and local absorption column density, which indicates that the accretion flow is highly inhomogeneous.
- **Discovered a significant linear correlation between two CRSFs'(cyclotron resonant scattering features) centroid energy.**
- **Provide a firm detection of the accretion state transformation in neutron star X-ray binary (i.e. from subcritical Coulomb deceleration regime to supercritical radiation deceleration regime).**
- Proposed that the accretion parameter  $\Lambda$  in this case should be between  $\sim 0.3$  and 1, indicating a complex environment around neutron star including a blending of wind and disc accretion.

**Keywords:** High mass X-ray binary, Neutron star, Fe K $\alpha$  line, Cyclotron resonant scattering features.

**Conference presentation:**

*Spectral analysis of GX 301-2 with Insight-HXMT*  
December, 2021, Sichuan province, Nanchong, China.

Annual meeting of Chinese Astronomical Society

**Varying CRSFs in X-ray binary GX301-2**

May 2021 – present

- Derived phase resolved spectrum in different orbital phases.
- Obtained the phase dependency of CRSF line parameters in GX301-2.
- **Cooperate with Prof. Osamu Nishimura, trying to reproduce the line profile with simulation.**

**Keywords:** High mass X-ray binary, Neutron star, Cyclotron resonant scattering features.

## SELECTED HONORS AND AWARDS

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First-class Scholarship of Wuhan University

*top 5%, Wuhan University*

October 2019&21

First-class Scholarship for excellent young Astronomers

*1/524, National Astronomical Observatories*

October 2019

Model Student at Wuhan University

*top 10%, Wuhan University*

October 2019&20&21

National Astronomical Observatories Scholarship

*3/524, National Astronomical Observatories*

October 2020

1st Prize, 12th Chinese Undergraduate Physics Tournament of Central and South China

*Leader of Top 2 team, Ministry of Education of China*

May 2021

1st Prize, Outstanding Undergraduate Students in Academic Record

*Top 7 undergraduate students in China, Ministry of Education of China*

November 2021

1st Prize, President scholarship for creative learning

*12/30000, Wuhan University*

November 2021

Top 10 Most Influential Students at Wuhan University

*10/30000, Wuhan University*

December 2021

## COMMUNITY ENGAGEMENT & VOLUNTEER ACTIVITY

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**Chorus of Physics Department**

October 2018 – January 2020

- Organize chorus training and performance.
- Accompany for the department chorus. We wonned the highest place since 2016 in campus culture festival.

**Reading to the Blind**

October 2018 – January 2020

- Read physics text book for the Blind
- Helped a talented blind person complete his book, which is about mathematical method in physics.

**Leadership in the astronomy class**

October 2018 – January 2020

- Serve as a vice-monitor in the astronomy class of physics department.
- Organize class activity, introducing research field of astronomy faculties in WHU.
- Passing information from department to students

## SKILLS AND LANGUAGES

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**Programming language & software:** Bash, Python, TCL, Fortran, C, Matlab, Mathematica, Zeus-mp and LaTeX

**Language:** Mandarin Chinese (native), English (IELTS 7.5)