Zhenwei Lyu Boya fellow

Kavli Institute for Astronomy and Astrophysics, Peking University,
5 Yiheyuan Road, Haidian District, Beijing, China 100871

zwlyu@pku.edu.cn gwlyu.github.io ORCID

Fields of Interest

My current research focuses on gravitational wave (GW) astrophysics. The objective is to unravel physics buried within the data, including but not limited to:

- finite size effects of compact objects and dynamics of binaries
- any other potential detectable effects within Einstein's theory of gravity and beyond theories
- formation channels and merger rates of compact binaries (stellar mass and extreme mass ratio inspirals (EMRIs))
- implementations of GWs in cosmology: measuring Hubble parameter, constraints on dark matter and dark energy

Ongoing Projects

- Developing GW waveform model of compact objects with mass transfer effect included and their applications to binary evolution in astrophysics.
- Analyzing GW Data using normalising flow based neural networks.
- Studying GWs generated during superradiant instability with a spin-2 bosonic cloud around massive black holes.

Education

Kavli Institute for Astronomy and Astrophysics at Peking University **2022 – current**
Boya Fellow cooperated with Lijing Shao *Beijing, China*

University of Guelph and Perimeter Institute for Theoretical Physics **2018 – 2022**
Ph.D. supervised by Huan Yang, Physics *Guelph, ON, Canada*

Beijing Normal University **Sep. 2015 – Jun. 2018**
M.Sc supervised by Fan Zhang, Astronomy *Beijing, China*

Harbin Institute of Technology **Sep. 2011 – Jun. 2015**
B.Sc supervised by Ye Sun, Physics *Harbin, China*

Teaching Endeavours

Mathematical Physics **Fall semester 2020**

– As a Teaching Assistant under the supervision of Prof. Huan Yang. My main responsibility was grading their assignments

Physics for Life Sciences **Five semesters in 2018 – 2021**

– As a Teaching Assistant, my responsibilities were mainly conducting labs, grading quiz and labs, helping hours and invigilating exams.

Methods of Mathematical Physics **Two semesters in 2016 – 2017**

– As a Teaching Assistant, I have helped more than 20 students finish their assignments, graded their work and invigilated exams every semester.

Publications and Presentations

[1] **Zhenwei Lyu**, Nan Jiang, and Kent Yagi. "Constraints on Einstein-dilation-Gauss-Bonnet gravity from Black Hole-Neutron Star Gravitational Wave Events". *Phys. Rev. D* 105 (6 Mar. 2022). DOI: 10.1103/PhysRevD.105.064001. arXiv: 2201.02543 [gr-qc].

[2] **Zhenwei Lyu**, Michael LaHaye, Huan Yang, and Béatrice Bonga. *Probing Spin-Induced Quadrupole Moments in Precessing Compact Binaries*. 2023. arXiv: 2308.09032 [gr-qc].

[3] Jun Zhang, **Zhenwei Lyu**, Junwu Huang, Matthew C. Johnson, Laura Sagunski, Mairi Sakellariadou, and Huan Yang. "First Constraints on Nuclear Coupling of Axionlike Particles from the Binary Neutron Star Gravitational Wave Event GW170817". *Phys. Rev. Lett.* 127.16 (Oct. 2021). ISSN: 1079-7114. DOI: 10.1103/PhysRevLett.127.161101. arXiv: 2105.13963 [hep-ph].

[4] Zhen Pan, **Zhenwei Lyu**, Béatrice Bonga, Néstor Ortiz, and Huan Yang. "Probing Crust Meltdown in Inspiraling Binary Neutron Stars". *Phys. Rev. Lett.* 125.20 (Nov. 2020). DOI: 10.1103/PhysRevLett.125.201102. arXiv: 2003.03330 [astro-ph.HE)].

[5] Xuefeng Feng, **Zhenwei Lyu**, and Huan Yang. "Black-hole perturbation theory with post-Newtonian theory: Towards hybrid waveforms for neutron-star binaries". *Phys. Rev. D* 105 (10 May 2022). DOI: 10.1103/PhysRevD.105.104043. arXiv: 2104.11848 [gr-qc].

[6] Zhen Pan, **Zhenwei Lyu**, and Huan Yang. "Wet extreme mass ratio inspirals may be more common for spaceborne gravitational wave detection". *Phys. Rev. D* 104.6 (Sept. 2021). DOI: 10.1103/PhysRevD.104.063007. arXiv: 2104.01208 [astro-ph.HE)].

[7] Zhen Pan, **Zhenwei Lyu**, and Huan Yang. "Mass-gap extreme mass ratio inspirals". *Phys. Rev. D* 105 (8 Apr. 2022). DOI: 10.1103/PhysRevD.105.083005. arXiv: 2112.10237 [astro-ph.HE].

[8] Michael LaHaye, Huan Yang, Béatrice Bonga, and **Zhenwei Lyu**. "Efficient fully precessing gravitational waveforms for binaries with neutron stars". *Phys. Rev. D* 108 (4 Aug. 2023). DOI: 10.1103/PhysRevD.108.043018. arXiv: 2212.04657 [gr-qc].

[9] Ning Jiang, Huan Yang, Tinggui Wang, Jiazheng Zhu, **Zhenwei Lyu**, Liming Dou, Yibo Wang, Jianguo Wang, Zhen Pan, Hui Liu, Xinwen Shu, and Zhenya Zheng. *Tick-Tock: The Imminent Merger of a Supermassive Black Hole Binary*. 2022. arXiv: 2201.11633 [astro-ph.HE].

Presentations:

- Mini Workshop on Compact Objects and Gravitational Waves (KIAA, April 2023).
  Title: "Probing spin-induced quadrupole moments in precessional compact binaries"
- The Postdoc Workshop on Gravitational Waves (KIAA, Oct. 2022), organized and attended.
  Title: "Gravitational Wave Astrophysics, Cosmology and Fundamental Physics"
- Canadian Association of Physics(CAP) (2021). Title: "Constraints on Axions from GW170817"
- Canadian Student and Postdoc Conference on Gravity(CSPCG) (2021)
- Midwest Relativity Meeting (2020)

Membership, Honors and Awards

- Member of LIGO Scientific Collaboration at Perimeter Institute (from 2021)
- CSC Scholarship (2018-2022)
- Second Prize for Academic Scholarship (2017)
- Excellent Teaching Assistant of undergraduate (2017)
- First Prize for Academic Scholarship (2016)
- Excellent Student Cadre (2016)
- Excellent Teaching Assistant of undergraduate (2016)
- Honorable Mention of Mathematical Contest In Modeling (2013)
- The Star of Self-improvement of Chinese University students (2013)