

# Zidu Lin

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## RESEARCH INTERESTS

My research focuses on the intersection of nuclear physics and astrophysics. I am mainly interested in two topics: (1) improving the nuclear theories for core-collapse supernovae (CCSNe) and binary neutron star (BNS) mergers; (2) discovering new multi-messenger constraints for the test of CCSNe and BNS models.

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## EDUCATION

### Indiana University Bloomington, IN, US

Advisor: C. J. Horowitz

*Ph. D in nuclear astrophysics,*

2013-2018

### Nankai University, Tianjin, China

Advisor: BingSong Zou(Chinese Academy of Science)  
and YanAn Luo (Nankai University)

*B. S. in Physics,*

2009-2013

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## Academic Positions

### NP3M Fellow

Physics department, University of Tennessee, Knoxville

2022-present

### Postdoctoral Scholar

Physics department, University of Tennessee, Knoxville

2020-2022

### Postdoctoral Scholar

Physics department, Arizona State University

2018-2020

### Associate Instructor

Physics department, Indiana University Bloomington

2013-2014 & 2016-2018

### Research Assistant

Center for Exploration of Energy and Matter, Indiana University Bloomington

2015

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## SKILLS

**Scientific Plotting and Programming:** C/C++, Latex, Mathematica

**Language:** Chinese, English

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## Conference and Seminar Organization

NP3M seminar (seminar series organizer)

2023-present

ASU cosmology seminar (seminar series co-organizer)

2019-2020

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## Refereeing

(1) Journal of High Energy Astrophysics; (2) Nuclear Physics A; (3) Physical Review C;  
(4) Physical Review D; (5) Journal of Physics G; (6) Physical Review Letters and (7) Monthly Notices of the Royal Astronomical Society

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## Awards

John R. Pruett Award (Indiana University Bloomington)

2018

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## Publications

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### *Currently in Preparation*

1. **Z. Lin**, G. Colo, A. W. Steiner, "Connecting neutrino opacities in CCSNe with measurements of Gamow-Teller spectrum of Pb208, Sn132, and Zr90"
2. Shuzhe Shi, Horst Stoecker, K. Zhou, **Z. Lin**, A. W. Steiner, S. Han, et al., "Reconstructing equation of state using deep neural network"

### *First-Author/Significant Contributions*

- **Zidu Lin**, A. W. Steiner, "Indication of Sharp and Strong Phase-Transitions from NICER Observations", arXiv:2310.01619 [astro-ph.HE], accepted by Apj Letters
  - Tianqi Zhao, **Zidu Lin**, Bharat Kumar, Andrew W. Steiner, Madappa Prakash, "Characterizing the nuclear models informed by PREX and CREX: a view from Bayesian inference", submitted to PRL
  - Yuan-zhuo Ma, **Zidu Lin**, Bing-Nan Lu, Serdar Elhatisari, Dean Lee, Ning Li, Ulf-G. Meißner, Andrew W. Steiner, Qian Wang, "Structure Factors for Hot Neutron Matter from Ab Initio Lattice Simulations with High-Fidelity Chiral Interactions", arXiv:2306.04500 [nucl-th], Phys. Rev. Lett. 132, 232502 (2024)
  - **Z. Lin**, S. Zha, E. O'Connor, A.W. Steiner, "Detectability of neutrino-signal fluctuations induced by the hadron-quark phase transition in failing core-collapse supernovae", Phys.Rev.D 109 (2024) 2, 023005
  - **Z. Lin**, Abhinav Rijal, Cecilia Lunardini, Manuel D. Morales, Michele Zanolin, "Characterizing a supernova's Standing Accretion Shock Instability with neutrinos and gravitational waves", Phys. Rev. D 107, 083017 (2023), *Editor's Suggestion, Featured in Physics*
  - **Z. Lin**, A.W. Steiner, J. Margueron, "Uncertainty Quantification for Neutrino Opacities in Core-Collapse Supernovae and Neutron Star Mergers", Phys. Rev. C 107, 015804 (2023)
  - Mainak Mukhopadhyay, **Zidu Lin**, Cecilia Lunardini, "Memory-triggered supernova neutrino detection", Phys. Rev. D 106, 043020 (2022)
  - **Zidu Lin**, Matthew E. Caplan, Charles J. Horowitz, and Cecilia Lunardini, "Fast neutrino cooling of nuclear pasta in neutron stars: Molecular dynamics simulations", Phys. Rev. C 102, 045801 (2020), *Editors' Suggestion, Featured in Physics*
  - S. Hudan, R. T. deSouza, A. S. Uma, **Zidu Lin**, and C. J. Horowitz, "Enhanced dynamics in fusion of neutron-rich oxygen nuclei at above-barrier energies", Phys. Rev. C 101, 061601(R) (2022), *Rapid communication*
  - **Zidu Lin**, C. Lunardini, M. Zanolin, K. Kotate, C. Richardson, "Detectability of SASI activity in supernova neutrino signals", Phys. Rev. D 101, 123028 (2020)
  - **Zidu Lin**, C. Lunardini, "Observing cosmological binary mergers with next generation neutrino and gravitational wave detectors", Phys. Rev. D 101, 023016 (2020)
  - J. Vadas, Varinderjit Singh, B.B. Wiggins, J. Huston, S. Hudan, and R. T. deSouza, **Zidu Lin**, C. J. Horowitz, A. Chibihi, D. Ackermann, M. Famiano, K. W. Brown, "Probing the fusion of neutron-rich nuclei with re-accelerated radioactive beams", Phys. Rev. C 97, 031601 (2018), *Editors' Suggestion, Rapid communication*
  - F. J. Fattoyev, Edward F. Brown, Andrew Cumming, Alex Deibel, C. J. Horowitz, Bao-An Li, **Zidu Lin**, "Deep Crustal Heating by Neutrinos from the Surface of Accreting Neutron Stars", Phys. Rev. C 98, 025801 (2018)
  - **Zidu Lin**, C. J. Horowitz, "Neutrino scattering in supernovae and spin correlations of a unitary gas", Phys. Rev. C 96, 055804 (2017)
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- C. J. Horowitz, D. K. Berry, M. E. Caplan, T. Fischer, **Zidu Lin**, W. G. Newton, E. O'Connor and L. F. Roberts, "Nuclear pasta and supernova neutrinos at late times", arXiv: 1611.10226 (2016)
  - C. J. Horowitz, O.L. Caballero, **Zidu Lin**, Evan O'Connor, and A. Schwenk, "Neutrino-nucleon scattering in supernova matter from the Virial expansion", Phys. Rev. C. 95. 025801(2017)
  - Varinderjit Singh, J. Vadas, T. K. Steinbach, B.B. Wiggins, S. Hudan, and R. T. deSouza, **Zidu Lin** and C. J. Horowitz, L.T. Baby, S. A. Kuvin, V. Tripathi and I. Wiedenhover, A. S. Umar, "Fusion enhancement at near and sub-barrier energies in  $190+12\text{C}$ ", Phys. Lett. B 765, 99 (2016)
  - **Z. Lin** and C. J. Horowitz, "The full weak charge density distribution of  $48\text{Ca}$  from parity violating electron scatterings", Phys. Rev. C 92, 014313(2015), *Editor's suggestion*

### ***Other Contributed Publication***

- D. Androic, *et al.*, "First Determination of the  $27\text{Al}$  Neutron Distribution Radius from a Parity-Violating Electron Scattering Measurement", Phys. Rev. Lett. 128, 132501 (2022)
- R.T. deSouza, Varinderjit Singh, S. Hudan, **Z. Lin**, C. J. Horowitz, "Effect of increasing neutron-excess on the fusion cross-section in  $12-15\text{C} + 12\text{C}$  at above-barrier energies", Physics Letters B, Volume 814, 136115 (2021)
- Romualdo deSouza, Justin Vadas, Varinderjit Singh, Blake Wiggins, Tracy Steinbach, **Z. Lin**, Chuck Horowitz, Lagy Baby, Sean Kuvin, Vandana Tripathi, Ingo Wiedenhover, Sait Umar, "Fusion of neutron-rich oxygen nuclei", EPJ Web of Conferences, Volume 163, 00013 (2017)
- Evan O'Connor, C. J. Horowitz, **Z. Lin**, Sean Couch, "Core-Collapse Supernova Simulations including Neutrino Interactions from the Virial EOS", IAU Symp. 331 (2017) 107-112
- A. S. Schneider, D. K. Berry, M. E. Caplan, C. J. Horowitz, **Z. Lin**, "Effect of topological defects on nuclear pasta observables", Phys. Rev. C. 93, 065806 (2016)

### **Selected Talks**

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- "Supernovae neutrino pasta interaction", **talk**, Flavor Observations with Supernova Neutrinos, INT, Seattle, Aug 15-20, 2016
- "Weak neutral current interactions in nuclei and supernovae", **invited talk**, Lawrence Livermore National Lab, CA, November 2017
- "Weak neutral current interactions in nuclei and supernovae", **invited talk**, Argonne National Lab, IL, 2018
- "Detectability of neutrinos from binary compact object mergers", **talk**, JINA-CEE Frontiers in Nuclear Astrophysics, Lansing, May 23, 2019
- "Detectability of SASI activity of supernova neutrino fluxes", **talk**, Midwest Workshop on Supernovae and Transients, Columbus, September 27, 2019
- "Fast neutrino cooling of nuclear pasta in neutron stars: Molecular dynamics simulations", **talk**, ORNL, Tennessee, September 2020
- "Impact of EoS on neutrino opacities in CCSNe", **invited talk**, UC Berkeley N3AS seminar, online, September 2021
- "Uncertainty Quantification for Neutrino Opacities in Core-Collapse Supernovae and Neutron Star Mergers", **invited talk**, TD Lee Institute, Shanghai, December 2022
- "Uncertainties and Constraints for neutrino opacities in core-collapse supernovae and neutron star mergers", **invited talk**, Institute for nuclear theory, University of Washington, April 2023

- “Connecting neutrino opacities in core-collapse supernovae and binary neutron star mergers with terrestrial experiments”, **invited talk**, Lawrence Livermore National Lab, CA, May 2023
- “Indication of Sharp and Strong Phase-Transitions from NICER Observations”, **invited talk**, FRIB Nuclear Theory Seminar, Michigan State University, October 2023
- “Bayesian analysis of neutrino emissions from core-collapse supernovae: what can we learn from neutrino messengers?”, talk, Institute for nuclear theory, University of Washington, July 2024