Brandon Barker

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Education

2019–2024	Michigan State University. Dual PhD, Astronomy and Astrophysics & Computational Mathematics, Science, and Engineering.
2014–2019	The University of Tennessee, Knoxville. BS, with honors in physics, secondary major in mathematics, minor in astronomy, *magna cum laude*.

Appointments

2024–Present	Metropolis Postdoctoral Fellow, Los Alamos National Laboratory
2022–2024	Graduate Research Assistant, Center for Nonlinear Studies, Los Alamos National Laboratory
2019–2024	NSF Graduate Research Fellow
2019–2024	PhD Candidate, Michigan State University

Refereed publications

9. "Kilonovae and Long-duration Gamma-ray Bursts." M. Ristić, **B. L. Barker**, et al. 2025, The Astrophysical Journal, Submitted.

8. " Not-quite-transcendental Functions for Logarithmic Interpolation of Tabulated Data." P. Hammond, ..., **B. L. Barker**. 2025, The Astrophysical Journal Supplement Series, Volume 277, Issue 2, id.65, 8 pp.

7. "Let There Be Neutrons! Hadronic Photoproduction from a Large Flux of High-energy Photons." M. Mummpower et al. 2025. The Astrophysical Journal, Volume 982, Issue 2, id.81, 16 pp.

6. "Physics-driven Explosions of Stripped High-mass Stars: Synthetic Light Curves and Spectra of Stripped-envelope Supernovae with Broad Light Curves." J. Lu, **B. L. Barker**, et al. 2025. The Astrophysical Journal, Volume 979, Issue 2, id.148, 13 pp.

5. "Phoebus: Performance Portable GRRMHD for Relativistic Astrophysics." **B. L. Barker** et al. 2024. Submitted to ApJS.

4. "Singularity-EOS: Performance Portable Equations of State and Mixed Cell Closures." J. M. Miller, et al. 2024. Journal of Open Source Software, 9(103), 6805.

3. "Inferring Type II-P Supernova Progenitor Masses from Plateau Luminosities." **B. L. Barker**, E. O'Connor, S. M. Couch. 2023. The Astrophysical Journal Letters, Volume 944, Issue 1, id.L2, 7 pp.

2. "Connecting the Light Curves of Type IIP Supernovae to the Properties of their Progenitors." **B. L. Barker**, C. E. Harris, M. Warren, E. O'Connor, S. M. Couch. 2022. The Astrophysical Journal, Volume 934, Issue 1, id.67, 19 pp.

1. "Thornado-hydro: a discontinuous Galerkin method for supernova hydrodynamics with nuclear equations of state." D. Pochik, **B. L. Barker**, E. Endeve, et al. 2021. The Astrophysical Journal Supplement Series, Volume 253, Issue 1, id.21, 44 pp.

0. "Thornado-hydro: towards discontinuous galerkin methods for supernova hydrodynamics." E. Endeve, J. Buffaloe, S. Dunham, N. Roberts, K. Andrew, **B. L. Barker**, D. Pochik, J. Pulsinelli, A. Mezzacappa. 2019. Journal of Physics: Conference Series, Volume 1225, Issue 1, article id. 012014 (2019).

Open Source Software Development

Athelas — Lead Developer — High order radiation hydrodynamics for astrophysical transients

Phoebus — Core Developer — Performance portable GRRMHD

Parthenon — Developer — Performance portable block structured adaptive mesh refinement

Singularity-eos — Developer — Performance portable equation of state routines

Thornado — Prior Developer — Performance portable equation of state routines

Sordine — Developer — Small radiation hydrodynamics verification suite

mplcolors — Developer — Command line tool for color exploration.

Awards

2024	**Metropolis Computational Physics Postdoctoral Fellowship**
2023	**MPA-Kavli Summer Research Fellow**
2019	**NSF Graduate Research Fellowship**
2019	**Michigan State University Enrichment Fellowship**
2019	**FORD Foundation Predoctoral Fellowship Honorable Mention**
2019	**Chancellor's Undergraduate Researcher of the Year, UTK**
2018	**Barry Goldwater Scholarship Honorable Mention**

2018	**Society of Physics Students (SPS) National Organization Leadership Award**
2018	**SPS Outstanding Undergraduate Research Award Honorable Mention**
2018	**Chancellor's Citation Award, UTK** for Extraordinary Academic Achievement
2018	**Chancellor's Citation Award, UTK** for Extraordinary Professional Promise
2018	**James W. McConnell Award for Academic Excellence, UTK**, Department of Physics and Astronomy
2018	**Cooper D. Schmitt Memorial Scholarship**, UTK, Department of Mathematics for academic merit
2018	**Katherine M. Frierson Memorial Scholarship**, UTK, outstanding academic achievement
2018	**Inducted into Sigma Pi Sigma Physics Honor Society**
2017	**Katherine M. Frierson Memorial Scholarship, UTK**
2017	**Dr. Glenn R. and Elise I. Young Scholarship**, UTK, Department of Mathematics for academic merit
2017	**Outstanding Undergraduate Researcher**, UTK, Department of Physics and Astronomy

Tehcnical skills

Languages & Programming Models

`C/C++`, Kokkos, FORTRAN, Python, Julia

Software & Numerical Instruments

Phoebus, Parthenon, Flash, Athena, Thornado, Flash, Snec

Outreach

"Exploring the Lives and Deaths of Stars Through Poetry." Astronomy on Tap public talk, Lansing, MI.

"Exploring the Lives and Deaths of Stars Through Poetry." Astronomy on Tap public talk, Albuquerque, NM.

Annoor Academy Science Club — Coordinator. Created lesson plans and assisted with demonstrations for an after school program at Annoor Academy, an Islamic school in Knoxville.

LEGO Reobitics League, Inskip Elemetary — Activity Leader. Volunteer with an after school LEGO rebotics club.

Saturday Science Club — Organizer, Leader. Write and run science experiments with students at Pond Gap Elementary School, a Title I community school in Knoxville. Monthly for 5 years.

Professional Mentorship

Michigan State University Stellar Mentorship Program — Leader, Mentor.

Michigan State University Physics and Astronomy REU — Grad Student Mentor.

Advanced Computational Research Experience for Undergraduates – Grad Student Mentor.

Service

Conference organization

CENAM Conference *Frontiers in Nuclear Astrophysics 2025*, Ohio University

Graduate School

Michigan State University Stellar Mentorship Program

- Michigan State University Astronomy Seminar Committee
- Goldwater Scholars' Community council

Undergraduate

- Undergraduate Research Students' Association Executive Board
- UTK Journal of Undergraduate Research (Pursuit) Research Editor for Sciences and Engineering
- Dean's Student Advisory Council

Invited talks

5. "On the prospects for r-process nucleosynthesis in collapsars" Harvard Institute for Theory and Computation Lunch Talks. October 2023.
4. "Phoebus: PHifty One Ergs Blows Up Stars" Virtual Astronomy Software Talks. October 2023.
3. "Phoebus: PHifty One Ergs Blows Up Stars" Numerical Relativity Community Cal. June 2023.

2. "On the prospects for r-process nucleosynthesis in collapsars" LANL Astrophysics Distinguished Seminar Series. April 2023.

1. "High-order Magnetohydrodynamics Simulations of Core-Collapse Supernovae with Two-Moment Neutrino Transport using FLASH" SIAM Conference on Computational Science and Engineering. March 2021.

Colloquia and Seminars

1. "A Biased Overview of Computational Astrophysics." Rutgers Transient Soriee. 2025.

Other talks

21. "On the prospects for r-process nucleosynthesis in collapsars" Frontiers in Nuclear Astrophysics. May 2023.

20. "On the prospects for r-process nucleosynthesis in collapsars" 242nd Meeting of the American Astronomical Society. May 2023.

19. "On the prospects for r-process nucleosynthesis in collapsars" APS April Meeting 2023. April 2023.

18. "Type IIP Supernova Light Curves From Neutrino-Driven Explosions: Correlations, Degeneracies, and Core Constraints" SuperVirtual Supernova Conference. November 2021.

17. "Constraining the Core Structure of Core-Collapse Supernovae" 236th Meeting of the American Astronomical Society. June 2020.

16. "Constraining the Core Structure of Core-Collapse Supernovae" 235th Meeting of the American Astronomical Society. January 2020.

15. "Application of the Discontinuous Galerkin Method to Supernova Hydrodynamics in thornado" SIAM South Eastern Atlantic Section Meeting. September 2019.

14. "Equation of State Dependence of the Observable Properties of Turbulence-aided Neutrino-driven Core-collapse Supernovae" APS April Meeting 2019. April 2019.

13. "Equation of State Dependence of the Observable Properties of Turbulence-aided Neutrino-driven Core-collapse Supernovae" Exhibition of Undergraduate Research and Creative Achievement. April 2019.

12. "Equation of State Dependence of the Observable Properties of Turbulence-aided Neutrino-driven Core-collapse Supernovae" Undergraduate Research Symposium. April 2019.

11. "Equation of State Dependence of the Observable Properties of Turbulence-aided Neutrino-driven Core-collapse Supernovae" Exhibition of Undergraduate Research and Creative Achievement. April 2019.

10. "Effects of Input Nuclear Physics on Core Collapse Supernova Simulations" Fifth Joint Meeting of the Nuclear Physics Divisions of the APS and JPS. October 2018.
9. "Effects of Input Nuclear Physics on Core Collapse Supernova Simulations" Mid-Michigan Symposium for Undergraduate Research Experiences. July 2018.
8. "Prospects for High Energy Follow-up Studies of Gravitational Wave Transients" Exhibition of Undergraduate Research and Creative Achievement. April 2018.
7. "Prospects for High Energy Follow-up Studies of Gravitational Wave Transients" Undergraduate Research Symposium. April 2018.
6. "High Energy Follow-up Study of Gravitational Wave Transients" 231st Meeting of the American Astronomical Society. January 2018.
5. "Discontinuous Galerkin Methods in Nuclear Astrophysics Simulations" Exhibition of Undergraduate Research and Creative Achievement. April 2017.
4. "Discontinuous Galerkin Methods in Nuclear Astrophysics Simulations" Sigma Pi Sigma Quadrennial Physics Conference. November 2016.
3. "A Singular Value Decomposition of $15M_{\odot}$ Progenitor CHIMERA Data" Exhibition of Undergraduate Research and Creative Achievement. April 2016.
2. "A Singular Value Decomposition of $15M_{\odot}$ Progenitor CHIMERA Data" Undergraduate Research Symposium. April 2016.
1. "A Singular Value Decomposition of $15M_{\odot}$ Progenitor CHIMERA Entropy Data" Southeast Section of the American Physical Society Annual Meeting. November 2015.

Press

"A passion for the stars and beer inspires this week's Good Neighbors" — Michigan local news segment about Astronomy on Tap.

"Ask A Scientist: How Big Is A Quasar" — SciComm article in UTK's campus newspaper, co-authored with Scott Satinover.

"Bridging The Synapse: Blue Light" — Podcast episode with Anu Kumar and Madeline MacArthur, guest appearance discussing the physics of light.

Undergraduate Research

Advanced Computational Research Experience for Students — Summer Undergraduate Research Fellow, East Lansing, MI. May 2018 – August 2018. Worked with Sean Couch and MacKenzie Warren on core-collapse supernova sensitivity to nuclear physics variations.

Istituto Nazionale di Fisica Nucleare (INFN) — Summer Undergraduate Research Fellow, Pisa, Italy. June 2017 – August 2017. Studied gravitational wave and gamma ray burst joint detection rates with Barbara Patricelli under the DOE-INFN Exchange Program.

Joint Institute for Computational Sciences, ORNL — Undergraduate Researcher, Knoxville, TN. August 2016 – Present. Developed algorithms for supernova hydrodynamics using discontinuous Galerkin methods with Eirik Endeve and Anthony Mezzacappa.

Joint Institute for Advanced Materials, ORNL — Research Assistant, Knoxville, TN. May 2016 – August 2016. Built a vacuum suitcase and helped commission an X-ray photoelectron spectrometer with Norman Mannella and Paolo Vilmercati.

Work Experience

Undergraduate Learning Assistant — Department of Physics and Astronomy, UTK. January 2018 – May 2019. Tutored students, assisted with in-class activities, and graded for an introductory astronomy course.

Grader — Department of Mathematics, UTK. January 2018 – May 2018. Graded written and computer assignments for a numerical algorithms course.

Tutor — Department of Physics and Astronomy, UTK. August 2016 – May 2019. Tutored students in introductory physics and astronomy.

Laboratory Setup Assistant — Department of Physics and Astronomy, UTK. October 2014 – December 2018. Set up equipment for introductory physics labs, coordinated with graduate TAs on lab activities and logistics.