Brandon Lynn Barker

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EDUCATION

MICHIGAN STATE UNIVERSITY

Ph.D., Astronomy and Astrophysics
College of Natural Sciences
Exp. 2024 | East Lansing, MI

Dual Ph.D., Computational Mathematics, Science, and Engineering
College of Natural Sciences
Exp. 2024 | East Lansing, MI

UNIVERSITY OF TENNESSEE

B.S., Physics, with Honors
Secondary Major in Mathematics
Minor in Astronomy
Magna Cum Laude
College of Arts and Sciences
May 2019 | Knoxville, TN

TECHNICAL SKILLS

Languages & Programming Models
`C/C++` • Fortran• Python• Julia• `Kokkos`• `MPI`

Software & Numerical Instruments
Phoebus• Parthenon • Flash• Thornado• SNEC

ADVISORS

Graduate Advisor
Sean Couch
Michigan State University
Jonah Miller
Los Alamos National Laboratory

Undergraduate Advisors
Anthony Mezzacappa and Eirik Endeve
The University of Tennessee, Knoxville

ADVISEES

Current
Levi Webb, MSU **Past**
Anita Agasaveeran, MSU

APPOINTMENTS

2022 - Present	Graduate Research Assistant, Center for Nonlinear Studies, LANL
2019 - Present	NSF Graduate Research Fellow
2019 - Present	PhD Candidate, Michigan State University

PUBLICATIONS

- "Inferring Type II-P Supernova Progenitor Masses from Plateau Luminosities ." **B. L. Barker**, E. O'Connor, S. M. Couch. 2023. Accepted to ApJL. *Citations: 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. ApJ, 934, 67. *Citations: 15.*
- "Thornado-hydro: a discontinuous Galerkin method for supernova hydrodynamics with nuclear equations of state." D. Pochik, **B. L. Barker**, E. Endeve, et al. 2021. ApJS, 253, 21. *Citations: 3.*
- "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, 1225, 012014. *Citations: 2.*

RECENT AWARDS

2023	**MPA-Kavli Summer Research Fellow** Kavli Summer Program In Astrophysics
2019	**NSF Graduate Research Fellowship**
2019	**Michigan State University Enrichment Fellowship**
2019	**FORD Foundation Predoctoral Fellowship Honorable Mention**
2019	**Outstanding Presentation Award, APS April**
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** from the Department of Physics and Astronomy
2018	**Cooper D. Schmitt Memorial Scholarship, UTK** from the Department of Mathematics for academic merit
2018	**Katherine M. Frierson Memorial Scholarship, UTK** for 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	**Cooper D. Schmitt Memorial Scholarship, UTK** Department of Mathematics for academic merit
2017	**Outstanding Undergraduate Researcher, UTK** Department of Physics and Astronomy
2016	**Robert W. Lide Citation, UTK** Department of Physics and Astronomy for contributions to physics labs

OPEN-SOURCE SOFTWARE DEVELOPMENT

PHOEBUS | https://github.com/lanl/phoebus
Core Developer
GRRMHD code for mergers, supernovae, and accretion physics.

SINGULARITY-EOS | https://github.com/lanl/singularity-eos
Contributor
Performance portability equation of state library supporting Phoebus and other multiphysics software.

THORNADO | https://github.com/endeve/thornado
Past Core Developer
GRRMHD code for supernvoae and neutrino transport module for Flash-X.

CAREER MENTORING

MICHIGAN STATE UNIVERSITY PHYSICS AND ASTRONOMY REU | Grad Student Mentor
Summer 2020
One on one mentor for an REU student. Provided general career advice, checked on their well-being, and ensured that their REU experience was positive.

ADVANCED COMPUTATIONAL RESEARCH EXPERIENCE FOR UNDERGRADUATES | Grad Student Mentor
Summer 2021
One of two grad student mentors for the ACRES REU. Led professional development and programming workshops and provided one one one mentoring to students.

OUTREACH

ANNOOR ACADEMY SCIENCE CLUB | Coordinator
August 2018 - December 2018
Created lesson plans and assisted with demonstrations for an after school science club at Annoor Academy, a private Islamic school in Knoxville.

LEGO ROBOTICS LEAGUE, INSKIP ELEMENTARY | Activity Leader
August 2018 - December 2018
Assist with an after school LEGO robotics club at Inskip Elementary, a local community school.

SATURDAY SCIENCE CLUB | Activity Leader
September 2014 - December 2019
Pond Gap Elementary School, a Title I community school in Knoxville, is visited monthly on Saturdays, and volunteers conduct science experiments and demonstrations with grade-school students with lesson plans written by volunteers.

ACADEMIC LEADERSHIP AND SERVICE

STELLAR MENTORSHIP PROGRAM | Graduate Student Leader
2020
Offer mentorship and career support for all MSU astronomers – from beginning undergraduates to faculty. Mentees are paired by career level, matching undergraduates with early grad students, early grad students with senior grad students, and so on. In addition to mentorship, we plan professional development workshops for members of the department.

MSU ASTRONOMY SEMINAR COMMITTEE | Graduate Student Representative
August 2020 - May 2021
Graduate student representative for the MSU astronomy seminar. Help ensure seminar is conducted in a way that is both beneficial to graduate students and speakers.

MSU ASTRONOMY PROSPECTIVE STUDENT VISIT | Graduate Student Organizer
Spring 2020, Spring 2021
Lead organization of the astronomy prospective student visits.

GOLDWATER SCHOLARS' COMMUNITY COUNCIL | Member
2019 - 2020
Organize programming and events for Goldwater Scholars. Help to foster a community among Scholars.

DEAN'S STUDENT ADVISORY COUNCIL | Member
August 2018 - May 2019
Representative for the Department of Physics and Astronomy. Advise Dean of the College of Arts and Sciences on issues of student concern.

UNDERGRADUATE RESEARCH STUDENTS' ASSOCIATION | Executive Board Member
January 2018 - May 2019
Organize an annual undergraduate research symposium and promote undergraduate research across campus.

PHYSICS JOURNAL CLUB | Co-Founder
January 2017 - May 2019
Weekly meetings with faculty advisor to discuss a paper in physics or astronomy.

PURSUIT - THE JOURNAL OF UNDERGRADUATE RESEARCH | Research Editor for the Sciences and Engineering
August 2016 - May 2019
Pursuit is a university wide, cross-discipline undergradaute research journal at UTK. Delegate submissions to referees and communicate with authors. Led a team of reviewers.

SOCIETY OF PHYSICS STUDENTS | Executive Officer
August 2014 - May 2019
Host numerous public outreach activities at local schools and other areas. Organize panels, trips to conferences, and host an undergraduate conference roughly once every other academic year.

INVITED TALKS

HARVARD INSTITUTE FOR THEORY AND COMPUTATION LUNCH TALKS Invited Speaker | October 2023
``On the prospects for r-process nucleosynthesis in collapsars''

VIRTUAL ASTRONOMY SOFTWARE TALKS Invited Speaker | October 2023
``Phoebus: PHifty One Ergs Blows Up Stars''

NUMERICAL RELATIVITY COMMUNITY CALL Invited Speaker | June 2023
``Phoebus: PHifty One Ergs Blows Up Stars''

LANL ASTROPHYSICS DISTINGUISHED SEMINAR SERIES 2023 Invited Speaker | April 2023
``On the prospects for r-process nucleosynthesis in collapsars''

SIAM CONFERENCE ON COMPUTATIONAL SCIENCE AND ENGINEERING (CSE21)
Computational Methods in Explosive Nuclear Astrophysics Minisymposium | March 2021 - Virtual
``High-Order Magnetohydrodynamic Simulations of Core-Collapse Supernovae with Two-Moment Neutrino Transport using Flash''

PRESENTATIONS

FRONTIERS IN NUCLEAR ASTROPHYSICS Oral Presenter | May 2023
``On the prospects for r-process nucleosynthesis in collapsars''

242ND MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY Oral Presenter | May 2023
``On the prospects for r-process nucleosynthesis in collapsars''

APS APRIL MEETING 2023 Oral Presenter | April 2023
``On the prospects for r-process nucleosynthesis in collapsars''

SUPERVIRTUAL SUPERNOVA CONFERENCE Student Presenter | November 2021
``Type IIP Supernova Light Curves From Neutrino-Driven Explosions: Correlations, Degeneracies, and Core Constraints''

236TH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY
Student Presenter | June 2020 - Virtual
``Constraining the Core Structure of Core-Collapse Supernovae''

235TH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY
Student Presenter | January 2020 - Honolulu, HI

``Constraining the Core Structure of Core-Collapse Supernovae''

SIAM SOUTH EASTERN ATLANTIC SECTION MEETING
Student Presenter | September 2019 - Knoxville, TN
``Application of the Discontinuous Galerkin Method to Supernova Hydrodynamics in thornado''

APS APRIL MEETING 2019
Student Presenter | April 2019 - Denver, CO
``Equation of State Dependence of the Observable Properties of Turbulence-aided Neutrino-driven Core-collapse Supernovae''

EXHIBITION OF UNDERGRADUATE RESEARCH AND CREATIVE ACHIEVEMENT
Student Presenter | April 2019 - Knoxville, TN
``Equation of State Dependence of the Observable Properties of Turbulence-aided Neutrino-driven Core-collapse Supernovae''

UNDERGRADUATE RESEARCH SYMPOSIUM
Student Presenter | April 2019 - Knoxville, TN
``Equation of State Dependence of the Observable Properties of Turbulence-aided Neutrino-driven Core-collapse Supernovae''

EXHIBITION OF UNDERGRADUATE RESEARCH AND CREATIVE ACHIEVEMENT
Student Presenter | April 2019 - Knoxville, TN
``Equation of State Dependence of the Observable Properties of Turbulence-aided Neutrino-driven Core-collapse Supernovae''

FIFTH JOINT MEETING OF THE NUCLEAR PHYSICS DIVISIONS OF THE APS AND JPS
Student Presenter | October 2018 - Waikoloa, HI
``Effects of Input Nuclear Physics on Core Collapse Supernova Simulations''

MID-MICHIGAN SYMPOSIUM FOR UNDERGRADUATE RESEARCH EXPERIENCES
Student Presenter | July 2018 - East Lansing, MI
``Effects of Input Nuclear Physics on Core Collapse Supernova Simulations''

EXHIBITION OF UNDERGRADUATE RESEARCH AND CREATIVE ACHIEVEMENT
Student Presenter | April 2018 - Knoxville, TN
``Prospects for High Energy Follow-up Studies of Gravitational Wave Transients''

UNDERGRADUATE RESEARCH SYMPOSIUM
Student Presenter | April 2018 - Knoxville, TN
``Prospects for High Energy Follow-up Studies of Gravitational Wave Transients''

231ST MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY
Student Presenter | January 2018 - National Harbor, MD
``High Energy Follow-up Study of Gravitational Wave Transients''

EXHIBITION OF UNDERGRADUATE RESEARCH AND CREATIVE ACHIEVEMENT
Student Presenter | April 2017 - Knoxville, TN
``Discontinuous Galerkin Methods in Nuclear Astrophysics Simulations''

SIGMA PI SIGMA QUADRENNIAL PHYSICS CONFERENCE
Student Presenter | November 2016 - San Francisco, CA
``Discontinuous Galerkin Methods in Nuclear Astrophysics Simulations''

EXHIBITION OF UNDERGRADUATE RESEARCH AND CREATIVE ACHIEVEMENT
Student Presenter | April 2016 - Knoxville, TN
``A Singular Value Decomposition of $15M_{\odot}$ Progenitor CHIMERA Data''

UNDERGRADUATE RESEARCH SYMPOSIUM
Student Presenter | April 2016 - Knoxville, TN
``A Singular Value Decomposition of $15M_{\odot}$ Progenitor CHIMERA Data''

SOUTHEAST SECTION OF THE AMERICAN PHYSICAL SOCIETY ANNUAL MEETING
Student Presenter | November 2015 - Mobile, AL
``A Singular Value Decomposition of $15M_{\odot}$ Progenitor CHIMERA Entropy Data''

PRESS

ASK A SCIENTIST: HOW BIG IS A QUASAR Brandon Barker and Scott Satinover
Scicomm article in UTK's campus newpaper adressing a submitted question about the size of quasars as part of Ask A Scientist's column.

BRIDGING THE SYNAPSE: BLUE LIGHT Anu Kumar and Madeline MacArthur, Guest: Brandon Barker
Appeared in an episode of *Bridging The Synapse* to discuss the physics of light.

UNDERGRADUATE RESEARCH EXPERIENCE

ADVANCED COMPUTATIONAL RESEARCH EXPERIENCE FOR STUDENTS | Summer Undergraduate Research Fellow
May 2018 - August 2018 | East Lansing, MI
Worked with **Sean Couch** and **MacKenzie Warren** exploring the sensitivity of core-collapse supernovae to variations in input nuclear physics.

INSTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) | Summer Undergraduate Research Fellow
June 2017 – August 2017 | Pisa, Italy
Received a competitive scholarship under the DOE-INFN Student Exchange Program to work with **Barbara Patricelli**.
Investigated possible joint detection rates for gravitational wave signals from binary neutron star mergers and short gamma ray bursts.

JOINT INSTITUTE FOR COMPUTATIONAL SCIENCES, ORNL | Undergraduate Researcher
August 2016 – Present | Knoxville, TN
Developed algorithms for supernova hydrodynamics utilizing discontinuous Galerkin methods with **Eirik Endeve** and **Anthony Mezzacappa**.

JOINT INSTITUTE FOR ADVANCED MATERIALS, ORNL | Research Assistant
May 2016 – August 2016 | Knoxville, TN
Developed a vacuum suitcase for use in the lab, and helped commission an X-ray photoelectron spectrometer with **Norman Mannella** and **Paolo Vilmercati**.

JOINT INSTITUTE FOR COMPUTATIONAL SCIENCES, ORNL | Undergraduate Researcher
May 2015 – May 2016 | Knoxville, TN
Studied the impact of turbulent flows on the evolution of the supernova explosion with **Anthony Mezzacappa** and **Eirik Endeve**.

WORK EXPERIENCE

DEPARTMENT OF PHYSICS AND ASTRONOMY, UTK | Undergraduate LA
January 2018 - May 2019
Tutored students in an introductory astronomy class, helped with in-class activities, and graded for the instructor.

DEPARTMENT OF MATHEMATICS, UTK | Grader
January 2018 - May 2018
Graded written and computer assignments for a numerical algorithms class.

DEPARTMENT OF PHYSICS AND ASTRONOMY, UTK | Tutor
August 2016 - May 2019
Tutored students in introductory physics and astronomy.

DEPARTMENT OF PHYSICS AND ASTRONOMY, UTK | Laboratory Setup Assistant
October 2014 - December 2018
Worked under the Director of Undergraduate Laboratories. Oversaw the setup of all 100-200 level introductory Physics lab sections. Worked with graduate TA's to coordinate setup, lesson plans, and makeup labs.