

# 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 • 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

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.
- "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.
- "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.
- "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.

## RECENT AWARDS

- 2023 MPA-Kavli Summer Research Fellow
- 2019 NSF Graduate Research Fellowship
- 2019 Michigan State University Enrichment Fellowship
- 2019 FORD Foundation Fredoctoral 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

## 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 on 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 undergraduate 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

### **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 newspaper addressing 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.

### ISTITUTO 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.