

# MICHIGAN STATE UNIVERSITY

## PROFESSIONAL APPOINTMENTS

Postdoctoral Research Associate, Michigan State University — 2016-Present

*Department of Physics & Astronomy*

*Joint Institute for Nuclear Astrophysics — Center for the Evolution of the Elements*

Graduate Research Assistant, University of Notre Dame — 2015-16

*Department of Physics & Astronomy*

*Joint Institute for Nuclear Astrophysics — Center for the Evolution of the Elements*

Graduate Teaching Assistant, University of Notre Dame — 2011-15

*Department of Physics & Astronomy*

## EDUCATION

University of Notre Dame, Notre Dame, IN — Ph.D. in Physics, 2016

Advisor: Dr. Grant Mathews

Thesis: Neutrinos in core-collapse supernovae

University of Notre Dame, Notre Dame, IN — M.S. in Physics, 2014

Reed College, Portland, OR — B.A. in Physics, 2011

## RESEARCH EXPERIENCE

Postdoctoral Research Associate, Michigan State University — 2016-Present

*Department of Physics & Astronomy/Joint Institute for Nuclear Astrophysics*

Advisor: Dr. Sean Couch

*Turbulence in core-collapse supernovae.* Developing novel approach to generate a successful explosion in spherical symmetry based on understanding of convection and turbulence from multidimensional supernova models. Provides more realistic model for systematic studies of progenitor dependence, nucleosynthesis, and equation of state sensitivity. Utilized the FLASH supernova code.

*Observable outcomes of massive stellar evolution.* Developing statistical analysis of theoretical stellar evolution outcomes of massive stars based on sensitivity to progenitor mass, binarity, rotation, and metallicity. Using MESA stellar evolution code.

*Nuclear physics sensitivities in electron capture supernovae.* Studying the sensitivity of explosion dynamics, remnant masses, and nucleosynthesis to nuclear interaction potential in electron capture supernovae. Using consistent Skyrme density functional description of nuclear interaction in the equation of state and nucleosynthesis calculations.

*Equation of state & nuclear burning in core-collapse supernovae.* Improving the coupling of the equation of state and nuclear network in the FLASH supernova code, to better handle transition out of nuclear statistical equilibrium.



College of  
Natural Science

Department of  
Physics and  
Astronomy

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**Graduate Research Assistant, University of Notre Dame — 2011-2016**  
***Department of Physics/Joint Institute for Nuclear Astrophysics***

Advisor: Dr. Grant Mathews

*Sterile neutrinos in core-collapse supernovae.* Investigated the impact of sterile neutrinos on supernova explosion energies. Utilized the University of Notre Dame/Lawrence Livermore National Laboratory supernova code. Collaborated with Dr. Toshitaka Kajino and Dr. Jun Hidaka, National Astronomical Observatory of Japan.

*Nuclear equation of state.* Assisted in development of the Notre Dame-Livermore Equation of State, a generalized nuclear equation of state for use in core-collapse supernova and neutron star simulations. Includes 3-body forces and transition to quark gluon plasma.

*Neutron star accretion.* Investigated neutrino emission during hypercritical accretion onto neutron stars to determine role in Thorne-Zytkow objects, supernova fallback, and long gamma-ray bursts. Collaborated with Dr. Remo Ruffini and Dr. Jorge Rueda, University of Rome “La Sapienza” and International Center for Relativistic Astrophysics (ICRA).

**TEACHING & MENTORING EXPERIENCE**

**Mentoring Experience**

Chris Murdter, Undergraduate Research Assistant — 2016-Present

Department of Physics, Michigan State University

Project: Criterion for runaway shock expansion in the neutrino-heated core-collapse supernova paradigm

Jack Mueller, Honors College Professorial Assistant — 2017-Present

Department of Physics, Michigan State University

Project: Statistical analysis of explosive outcomes for landscape of supernova progenitors from 9 to 120  $M_{\odot}$ .

**ISEE Professional Development Program; Lansing, MI — 2017**

The program results in about 100 hours spent designing and implementing an inquiry activity in the classroom, including several multi-day workshops on inquiry, assessment, and equity & inclusion in the classroom. Participants are responsible for aiding in the design and teaching of the inquiry activity. I was responsible for addressing aspects of equity & inclusion in the process of designing this teaching activity.

**Teaching Practicum, University of Notre Dame; Notre Dame, IN — 2015**

Structured teaching experience where three lectures are planned, delivered and observed, and reflected upon. Lectures given in introductory physics courses for engineering students and physics majors.

**Teaching Assistant, University of Notre Dame; Notre Dame, IN — 2011-15**

Responsible for grading essays, homework assignments, and exams, holding office hours and help sessions, and assisting in laboratory courses. Assisted in

undergraduate general science, introductory physics, and advanced courses and graduate level courses.

**“Guest” Lectures, University of Notre Dame; Notre Dame, IN — 2013-15**

Planned and delivered lectures in several undergraduate courses.

2015 “Geoengineering as a counter strategy,” Climate Physics

2015 “Multi-physics simulations in astrophysics,” Computational Methods in Physics

2014 “Radiation and the radiation reaction,” Electromagnetic Waves

2013 “Parallel transport and the Riemann tensor,” General Relativity

**GRANTS & AWARDS**

2018 National Science Foundation Astronomy & Astrophysics  
Postdoctoral Fellowship

2016 University of Notre Dame Shaheen Graduate School Award

2015,-13 University of Notre Dame Downes Memorial Professional  
Development Grant

2015,-14,-13 University of Notre Dame Graduate Student Union Conference  
Grant

2013 University of Notre Dame Luksic Travel Grant

2013 University of Notre Dame Notebaert Professional Development  
Travel Grant

2013 National Science Foundation Graduate Research Fellowship  
Honorable Mention

2012 Department of Energy Office of Science Graduate Fellowship  
Finalist

**REFEREED PUBLICATIONS**

[1] **M. L. Warren**, S. M. Couch, and E. P. O’Connor. “Simulating turbulence-aided neutrino driven core-collapse supernova explosions in spherical symmetry.” (In prep.)

[2] J. P. Olson, **M. L. Warren**, M. Meixner, G. J. Mathews, N. Q. Lan, and H. E. Dalhed. “Generalized density functional equation of state for astrophysical simulations with 3-body forces and quark gluon plasma.” *Phys.Rev.C*, 2017. (In review) arXiv:1612.08992

[3] G. J. Mathews, **M. L. Warren**, J. Hidaka, and T. Kajino. “Sterile neutrino dark matter and core-collapse supernovae.” *Fourteenth Marcel Grossmann Meeting*, 2016. (In press) arXiv:1604.012431

[4] **M. L. Warren**, M. Meixner, G. J. Mathews, J. Hidaka, and T. Kajino. “Impact of sterile neutrino dark matter in core-collapse supernovae.” *IJMPA*, **31**: 25, 2016. arXiv:1603.05503

[5] **M. L. Warren**, M. Meixner, G. J. Mathews, J. Hidaka, and T. Kajino. “Sterile neutrino oscillations in core-collapse supernovae.” *Phys.Rev.D*, **90**: 103007, 2014. arXiv:1405.6101

## **SEMINARS & INVITED TALKS**

- [1] *Microphysics in Computational Relativistic Astrophysics*, Michigan State University, 2017.
- [2] *Astronomy Seminar*, Michigan State University, 2016.
- [3] *Symposium on Neutron Stars in the Multimessenger Era*, Ohio University, 2016.
- [4] *Triangle Nuclear Theory Seminar*, North Carolina State University, 2015.
- [5] *Astrophysics Seminar*, University of Notre Dame, 2015.
- [6] *Physics Department Seminar*, Reed College, 2014.
- [7] *ICRANet Meeting: Black Holes: the largest energy sources in the universe*, National Academy of Sciences, Armenia, 2014.
- [8] *Supernovae, Gamma-ray bursts, and Induced Gravitational Collapse*, Ecole de Physique, France, 2014.

## **CONFERENCE PRESENTATIONS**

- [1] *Forging Connections: Nuclei to the Cosmic Web*, Facility for Rare Isotope Beams, 2017.
- [2] *Fifty One Ergs*, Oregon State University, 2017.
- [3] *r-Process Nucleosynthesis: Connecting FRIB with the Cosmos*, Michigan State University, 2016.
- [4] *IceCube Particle Astrophysics Symposium*, University of Wisconsin-Madison, 2015.
- [5] *American Physical Society April Meeting*, Maryland, 2015.
- [6] *Joint Institute for Nuclear Astrophysics Frontiers Meeting*, Michigan State University, 2015.
- [7] *4th Joint Meeting of the APS Division of Nuclear Physics and the Physical Society of Japan*, Hawaii, 2014.
- [8] *III INCAI Workshop: Exploring the Nature of the Evolving Universe*, Pontificia Universidad Catolica de Chile, Chile, 2013.
- [9] *222nd American Astronomical Society Meeting*, Indiana, 2013.
- [10] *American Physical Society April Meeting*, Colorado, 2013.
- [11] *Joint Institute for Nuclear Astrophysics Frontiers Meeting*, Michigan State University, 2012.

## **SCHOOLS & WORKSHOPS**

- 2016 “MESA Summer School,” UC Santa Barbara
- 2015 “TALENT School on Nuclear Physics of Neutron Stars & Supernovae,” Institute for Nuclear Theory, University of Washington
- 2014 “ICRANet School in Armenia: Black Holes,” International Center for Relativistic Astrophysics, Armenia

- 2014 “TALENT School on Nuclear Theory for Astrophysics,” Joint Institute for Nuclear Physics, Michigan State University
- 2013 “National Nuclear Physics Summer School,” Stony Brook University

### **SERVICE & OUTREACH**

- 2018 “Making STEM fields LGBTQIA+ inclusive” talk
- February 2018: Central Michigan University
  - February 2018: Albion College
- 2017- Present Member of the American Astronomical Society Task Force on Diversity in Graduate Education
- 2017- Present Member of the American Astronomical Society Committee for Sexual-orientation and Gender Minorities in Astronomy
- 2017- Present Speaker, Astronomy on Tap — Lansing:
- September 2017: “Music in Space”
  - June 2017: “Gay is Good: The life of Frank Kameny, astronomer & activist”
  - January 2017: “The Solar Neutrino Problem”
- 2016-17 Chairperson of 2017 *JINA-CEE Frontiers in Nuclear Astrophysics* Conference Organizing Committee
- 2014- Present Team member, Popscope Astronomy Outreach Program
- 2014-15 Quality of Life Chairperson, University of Notre Dame Graduate Student Union
- 2014-15 Member, University of Notre Dame Committee for Sexual Assault Prevention
- 2014-15 Cofounder & Member, Graduate LGBTQ and Ally Student Society, University of Notre Dame
- 2013-15 Member, University Committee for Women Faculty & Students, University of Notre Dame
- 2014,-12 Representative, Department of Physics Graduate Recruitment Committee, University of Notre Dame
- 2012-16 Cofounder & Member, Association for Women in Science, University of Notre Dame

### **SKILLS**

*Programming & Visualization:* Fortran, C, Python, Mathematica, LaTeX, Gnuplot, xmgrace

*Graduate Courses:* Classical Mechanics, Quantum Mechanics, Electromagnetism, Mathematical Methods in Physics, Experimental Methods in Physics, Special & General Relativity, Statistical Thermodynamics, Nuclear Structure, Nuclear Reactions, Nuclear Astrophysics, Stellar Astrophysics, Galaxies

### **PROFESSIONAL MEMBERSHIPS**

- Member of the American Astronomical Society (AAS)
- Member of the American Physical Society (APS)