

Carl Edward Fields, Jr.

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EDUCATION

MICHIGAN STATE UNIVERSITY PH.D., ASTRONOMY & ASTROPHYSICS

College of Natural Sciences
May 2021 | East Lansing, MI

CERTIFICATE IN COLLEGE TEACHING

College of Natural Sciences
May 2020 | East Lansing, MI

CERTIFICATE IN HIGH PERFORMANCE COMPUTING

College of Natural Sciences
December 2018 | East Lansing, MI

ARIZONA STATE UNIVERSITY B.S., PHYSICS, W/ HONORS

College of Liberal Arts and Sciences
May 2016 | Tempe, AZ

B.S., ASTROPHYSICS, W/ HONORS

School of Earth and Space Exploration
May 2016 | Tempe, AZ

TECHNICAL SKILLS

Languages/Programming Models
FORTRAN • Python • C++ • Kokkos

Software/Numerical Instruments
MESA • MAESTRO • FLASH • phoebus

ADVISORS

Graduate Advisor

Sean Couch
Michigan State University

Undergraduate/Thesis Advisor

Frank Timmes
Arizona State University

ADVISEES

RESEARCH

Previous:

Emma Brann, B.S. Physics, 2021, MSU

MENTORING

Previous:

Emma Brann, B.S. Physics, 2021, MSU
Bilal Jones, Ph. D Physics, 2021 MSU
Tom-Erik H., Ph. D Physics, 2021 MSU
Tyler Cox, B.S. Astrophysics, 2019, ASU

RESEARCH INTERESTS

Stellar Hydrodynamics, Core-Collapse Supernovae, Stellar Nucleosynthesis, Gravitational Waves, High-Performance Computing, and Radiation Hydrodynamics.

CURRENT/RECENT APPOINTMENTS

2022 - Present	Early Career Member-at-Large, Executive Committee, DAP-APS
2021 - Present	RPF Distinguished Postdoctoral Fellow, CCS-2, LANL
2016 - 2021	Graduate Research Fellow, National Science Foundation
2015 - 2021	Lead Developer, MESA-Web - mesa-web.asu.edu
Summer 2019	Graduate Writing Coach/Facilitator, SROP, MSU
2017 - 2019	Data Science Fellow, LSST Corporation
2016 - 2019	Predocutorial Fellow, Nat'l Academies/FORD Foundation

PUBLICATIONS SUMMARY

Summary: 18 publications: 13 refereed, 1 submitted, 1 in prep.
Citations: 731; h -index: 10; i_{10} -index: 10; i_{100} -index: 2 ([Google Scholar Link](#))

RECENT FUNDING, AWARDS, DISTINCTIONS

2022	SPOT Award, Los Alamos National Lab for outstanding performance and lasting contribution . . .
2021	Institutional Computing Grant, Los Alamos National Lab 12M SU, <i>STARS: Simulating Turbulence in Advanced and Rotating Stars</i>
2021	RPF Distinguished Postdoctoral Fellow, Los Alamos National Lab extraordinary ability in scientific research . . .
2021	Forbes 30 Under 30, Science
2020	Dr. Pliny A. and Margaret H. Price Prize, Ohio State University research excellence and exceptional promise
2020	Edward A. Bouchet Graduate Honor Society, Michigan State University exemplify the five core values of the society
2019	Beth Brown Memorial Prize, National Society of Black Physicists/AAS best graduate oral presentation
2017	Data Science Fellowship, LSST Corporation
2016	Predocutorial Fellowship, FORD Foundation/NASEM promise that you show for future achievement as a scholar . . .
2016	Graduate Research Fellowship, NSF demonstrated potential to contribute to . . .
2016	Academic Achievement Graduate Assistantship, MSU demonstrated promotion of understanding among persons . . .
2015	ASU/NASA Space Grant Undergraduate Fellowship
2015	Carl A. Rouse Fellowship, National Society of Black Physicists/Caltech in support of research in gravitational-wave science
2015	LIGO Summer Undergraduate Research Fellowship, Caltech project entitled, <i>Testing The Strong-Field Dynamics of General Relativity</i> . . .

NATIONAL/INTERNATIONAL SERVICE

2022 - 2024 *Early Career Member-at-Large, Executive Committee*, DAP-APS
2019 - 2021 *Organizing Committee/Lecturer - Stellar Modelling for Nuclear Astrophysics Workshop*, JINA-CEE/LSU
2018 - 2019 *Local Organizing Committee - JINA Frontiers 2019 Meeting*, Joint Institute for Nuclear Astrophysics, MSU
2017 - *Scientific Referee*, The American Astronomical Society Journals; Astronomy & Astrophysics
2017 *Teaching Assistant for Prof. Leslie Rogers*, 2017 MESA Summer School, UCSB
2016 *Teaching Assistant for Prof. Jim Fuller*, 2016 MESA Summer School, UCSB

TEACHING

GUEST LECTURER | LSSTC DATA SCIENCE FELLOWSHIP PROGRAM - SESSION 15

Center for Astrophysics, Harvard University | July 2022,, Cambridge, MA

Led lectures and lesson plans on *Graphics Processing Units* and *Parallel Computing in Python* as part of Session 15 of the LSSTC Data Science Fellowship Program hosted at the CfA.

LECTURER | STELLAR MODELING FOR NUCLEAR ASTROPHYSICS CONFERENCE

Department of Astronomy, Louisiana State University University | June 2022,, Baton Rouge, LA

Led lectures and lesson plans on various topics leveraging MESA for nuclear reaction rate studies in stellar models.

GRADUATE TEACHING ASSISTANT | VISUALIZING SCIENTIFIC DATASETS

Department of CMSE, Michigan State University | Spring 2020, East Lansing, MI

Teaching assistant for course focused on various aspects of learning the language and techniques of constructing visualizations for use in science. Led class of ~40 in in guest lesson on *Volumetric Visualizations*.

INSTRUCTIONAL/LABORATORY AIDE | GENERAL PHYSICS LABORATORY I/II

Department of Physics, Arizona State University | August 2014 - May 2015, Phoenix, AZ

Provided overview of material being covered in lecture component of course to over 80 students. Led students through experiments in kinematics, optics, thermodynamics, and electricity & magnetism.

PUBLIC OUTREACH

SPACETIME PROGRAM, THE PLANETARY SOCIETY | SPACETIME EXPERT

January 2018 - May 2020

The SpaceTime program is a program designed to connect experts in astronomy with classrooms across all across the country. SpaceTime experts lead discussions about their research and allow a space for students to directly ask questions they otherwise would not have the opportunity to ask.

SUMMER RESEARCH OPPORTUNITIES PROGRAM (SROP), MSU | WRITING COACH/FACILITATOR

Summer 2019

The goal of SROP is to increase the number of underrepresented students who pursue graduate study and research careers. This position gave me the opportunity to mentor students that came from a similar ethnic/socioeconomic background as myself. I met with the students on a weekly basis and provided feedback on preparing documents such as personal statements, CVs, and research proposals.

WOMAN AND MINORITIES IN PHYSICS SCIENCES (WAMPS), MSU | MENTOR

August 2017 - May 2019 | East Lansing, MI

WaMPS is a graduate student group at Michigan State University. Our purpose is to promote diversity in the physical sciences by encouraging women and minorities to pursue the field. We also work to support women and minorities who are already members of the physical science community.

THE SUNDIAL PROJECT, ASU | MENTOR

August 2014 - May 2016 | Tempe, AZ

Sundial is an organization that seeks to foster a diverse community of undergraduates, graduates, post-docs, and faculty with interest in the physical sciences.

WESTERN SCHOOL OF SCIENCE & TECHNOLOGY | INSTRUCTIONAL FELLOW/AVID TUTOR

June 2014 - May 2016 | Phoenix, AZ

Western Tech. is a new charter school in Phoenix designed to help promote interest in science and technology in those whom come from low income families or are dealing with other socioeconomic factors. My volunteer service here allows me to inspire young minds to pursue higher education as a role model assisting in the teaching process with the primary instructor.

RECENT PRESENTATIONS (INVITED)

CARNEGIE OBSERVATORIES

ASTRONOMY COLLOQUIUM | MARCH 2022

Next-Generation Simulations of The Remarkable Deaths of Massive Stars

STOCKHOLM UNIVERSITY, THE OSKAR KLEIN CENTRE

ASTRONOMY COLLOQUIUM | FEBRUARY 2022

Next-Generation Simulations of The Remarkable Deaths of Massive Stars

UNIVERSITY OF CALIFORNIA (SAN DIEGO), DEPARTMENT OF PHYSICS

ASTRONOMY SEMINAR | JANUARY 2022

Next-Generation Simulations of The Remarkable Deaths of Massive Stars

KAVLI INSTITUTE FOR THEORETICAL PHYSICS, PROBES OF TRANSPORT IN STELLAR INTERIORS

INVITED TALK | NOVEMBER 2021

Next-Generation Simulations of Massive Stars and Their Explosions

UNIVERSITY OF TEXAS, AUSTIN, DEPARTMENT OF ASTRONOMY

COLLOQUIUM | OCTOBER 2021

Next-Generation Simulations of Massive Stars and Their Explosions

NASA, GODDARD SPACE FLIGHT CENTER

ASD COLLOQUIUM | APRIL 2021

Multidimensional Progenitor Models For Core-collapse Supernovae

HARVARD UNIVERSITY, CENTER FOR ASTROPHYSICS

GCSP SEMINAR | NOVEMBER 2020

Multidimensional Progenitor Models For Core-collapse Supernovae

CALIFORNIA INSTITUTE FOR TECHNOLOGY, DEPARTMENT OF ASTRONOMY

ASTRONOMY TEA TALK | NOVEMBER 2020

Multidimensional Progenitor Models For Core-collapse Supernovae

UNIVERSITY OF MASSACHUSETTS (DARTMOUTH), DEPARTMENT OF PHYSICS

PHYSICS COLLOQUIUM | OCTOBER 2020

Multidimensional Progenitor Models For Core-collapse Supernovae

UNIVERSITY OF CALIFORNIA (BERKELEY), DEPARTMENT OF ASTRONOMY

ASTRO LUNCH SEMINAR | OCTOBER 2020

Multidimensional Progenitor Models For Core-collapse Supernovae

UNIVERSITY OF CONNECTICUT, DEPARTMENT OF PHYSICS

ASTRONOMY SEMINAR | OCTOBER 2020

Multidimensional Progenitor Models For Core-collapse Supernovae

OHIO STATE UNIVERSITY, CENTER FOR COSMOLOGY AND ASTROPARTICLE PHYSICS

PRICE PRIZE SEMINAR | SEPTEMBER 2020

Multidimensional Progenitor Models For Core-collapse Supernovae

FLATIRON INSTITUTE, CENTER FOR COMPUTATIONAL ASTROPHYSICS

COMPACT OBJECT GROUP MEETING TALK | SEPTEMBER 2020

Multidimensional hydrodynamic simulations of massive stars

HARVARD UNIVERSITY, THE BANNEKER INSTITUTE

ORAL PRESENTATION | JULY 2019 - CAMBRIDGE, MASSACHUSETTS

On Getting to grad school, star stuff, and beyond

UNIVERSITY OF TOKYO, KAVLI INSTITUTE FOR PHYSICS & MATHEMATICS OF THE UNIVERSE

SEMINAR | JANUARY 2019 - KASHIWA, JAPAN

The Progenitors of Core-Collapse Supernovae

RECENT PRESENTATIONS (CONTRIBUTED, PUBLIC)

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA TORONTO CENTRE

SPEAKER'S NIGHT (PUBLIC) | APRIL 2022

The Remarkable Death of Massive Star

CONFERENCE OF THE NATIONAL SOCIETY OF BLACK PHYSICIST

ORAL PRESENTATION | NOVEMBER 2019 - PROVIDENCE, RHODE ISLAND

The Progenitors of Core-Collapse Supernovae

LOS ALAMOS NATIONAL LABORATORY, CENTER FOR THEORETICAL ASTROPHYSICS

ASTRO SEMINAR | JULY 2018 - LOS ALAMOS, NM, USA

The Progenitors of Core-Collapse Supernovae

CONFERENCE OF FORD FELLOWS

STUDENT PRESENTER | (POSTPONED MAY 2018) - SAN JUAN, PR

Multi-Dimensional Simulations of Massive Stars

JINA-CEE FRONTIERS IN NUCLEAR ASTROPHYSICS

STUDENT PRESENTER | FEBRUARY 2017 - EAST LANSING, MI

On Variations of Pre-Supernova Model Properties

NATIONAL SOCIETY OF BLACK PHYSICISTS FALL WORKSHOP

STUDENT PRESENTER | OCTOBER 2016 - FERMILAB

On Variations of Pre-Supernova Model Properties

AGEP MICHIGAN ALLIANCE 2016 FALL CONFERENCE

STUDENT PRESENTER | OCTOBER 2016 - EAST LANSING, MI

On Variations of Pre-Supernova Model Properties

CONFERENCE OF FORD FELLOWS

STUDENT PRESENTER | SEPTEMBER 2016 - EAST LANSING, MI

On Variations of Pre-Supernova Model Properties

227TH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY

STUDENT PRESENTER | JANUARY 2016 - KISSIMMEE, FL

On The Origin of The Elements: The Spectacular Role of White Dwarfs

FUNDING, AWARDS, DISTINCTIONS

- 2022 **SPOT Award, Los Alamos National Lab**
for outstanding performance and lasting contribution . . .
- 2021 **Institutional Computing Grant, Los Alamos National Lab**
12M SU, *STARS: Simulating Turbulence in Advanced and Rotating Stars*
- 2021 **RPF Distinguished Postdoctoral Fellow, Los Alamos National Lab**
extraordinary ability in scientific research . . .
- 2020 **Forbes 30 Under 30, Science**
- 2020 **Dr. Pliny A. and Margaret H. Price Prize, Ohio State University**
research excellence and exceptional promise
- 2020 **Edward A. Bouchet Graduate Honor Society, Michigan State University**
exemplify the five core values of the society
- 2019 **Beth Brown Memorial Prize, National Society of Black Physicists/AAS**
best graduate oral presentation
- 2019 **Stellar Modelling for Nuclear Astrophysics Workshop, JINA-CEE/NSF**
organizing committee
- 2017 **Data Science Fellowship, LSST Collaboration**
- 2016 **Graduate Research Fellowship, National Science Foundation**
demonstrated potential to contribute to . . .
- 2016 **Predoctoral Fellowship, FORD Foundation/Nat'l Academies of Science, Engineering, and Medicine**
promise that you show for future achievement as a scholar . . .
- 2016 **Academic Achievement Graduate Assistantship, Michigan State University**
demonstrated promotion of understanding among persons . . .
- 2016 **Chambliss Astronomy Achievement Award (Hon. Ment.), American Astronomical Society**
undergraduate poster presentation
- 2015 **Space Grant Undergraduate Fellowship, National Aeronautical and Space Administration**
academic achievement, research experience
- 2015 **Carl A. Rouse Fellowship, National Society of Black Physicists/Caltech**
in support of research in gravitational-wave science
- 2015 **LIGO Summer Undergraduate Research Fellowship, California Institute of Technology**
research experience, academic achievements
- 2015 **APIASF/Coca-Cola Scholarship, Asian & Pacific Islander American Scholarship Foundation**
academic achievement, outstanding community service and financial need
selected out of nearly 9,000 applicants from over 48 countries
- 2015 **Undergraduate Summer Enrichment Award, Arizona State University, College of Liberal Arts & Sciences**
for proposal titled, *On The Evolution of The Elements*
- 2015 **Norm Perrill Origins Project Undergraduate Scholar, Arizona State University Origins Project**
academic achievement, origins based research
- 2015 **AAS Beth Brown Memorial Prize, National Society of Black Physicists/American Astronomical Society**
best undergraduate poster presentation
- 2014 **APIASF/Wells Fargo Scholarship, Asian & Pacific Islander American Scholarship Foundation**
academic achievement, outstanding community service and financial need
selected out of 7,000 applicants from over 41 countries

SELECTED PRESS

- 2020 ***MSU astrophysics doctoral student Carl Fields named one of Forbes' 30 Under 30 for science***
Lansing State Journal, Newspaper
- 2020 ***Black voices in physics: Carl Fields***
Physics Today, Interview (Journal)
- 2020 ***2020 Price Prize Winners Announced***
Center for Cosmology and AstroParticle Physics, OSU
- 2017 ***Study of the Evolution of Stars and Stellar Explosions***
Institute for Cyber Enabled Research, MSU, Interview
- 2016 ***Determination is the key***, ASU Now, Interview
highlight of my graduate research fellowships + general Q/A about my time at ASU.
- 2015 ***A Cutting-Edge Research Tool***, The UC Santa Barbara Current., Interview
brief discussion about the MESA stellar evolution code and how it is used in my research.
- 2015 ***Up and Down The Ladder***, ASU EdX: Introduction to Solar Systems & Astronomy, Video Presentation
guest dialogue with Prof. Timmes on atomic structure of matter, phase transitions, and energy
as part of the lecture series for ASU's 111x course, the largest college-credit astronomy course in the world.
- 2015 ***Google Hangout for JINA CEE***, National Science Foundation, Video Presentation
brief discussion about my current research and my role as an undergraduate JINA-CEE.
- 2014 ***The Evolution of Carbon Burning Flames Inside Super-Asymptotic Giant Branch Stars***, $\Sigma\Xi$ (Sigma Xi), Interview
brief discussion about my current research and long term goals.

REFEREED PUBLICATIONS

1ST AUTHOR PUBLICATIONS

7. *3D Hydrodynamic Simulations of Rotating Massive Stars Reveal Unique Convective Burning Shell Configurations*, **C. E. Fields** & J. A. Goldberg, 2022, ApJ, in prep.
6. *MESA-Web: A cloud resource for stellar evolution in astronomy curriculum*
C. E. Fields, Richard H. D. Townsend, A.L. Dotter, Michael Zingale and F.X. Timmes, 2022, AEJ, submitted.
5. *The Three-Dimensional Collapse of a Rapidly Rotating $16 M_{\odot}$ Star*
C. E. Fields, 2022 ApJL, **924**, L15
4. *Three-dimensional Hydrodynamic Simulations of Convective Nuclear Burning in Massive Stars Near Iron Core Collapse*
C. E. Fields & S. M. Couch, 2021, ApJ, 2021 ApJ, **921**, 28
3. *On The Development of Multidimensional Progenitor Models For Core-collapse Supernovae*
C. E. Fields & S. M. Couch, 2020, ApJ, 2020 ApJ, **901**, 33
2. *The Impact of Nuclear Reaction Rate Uncertainties On The Evolution of Core-Collapse Supernova Progenitors*
C. E. Fields, R. Farmer, I. Petermann, S. M. Couch, & F. X. Timmes, 2018 ApJS, **867**, 30
1. *Properties of Carbon-Oxygen White Dwarfs From Monte Carlo Stellar Models*
C. E. Fields, R. Farmer, I. Petermann, C. Iliadis, & F. X. Timmes, ApJ, 823, **46**, 2016

CO-AUTHOR PUBLICATIONS

8. *Testing White Dwarf Age Estimates using Wide Double White Dwarf Binaries from Gaia EDR3*
Heintz, Tyler and 87 other co-authors including **C. E. Fields**, ApJ, **934**, 148 (2022).
7. *On the Impact of ^{22}Ne on the Pulsation Periods of Carbon-Oxygen White Dwarfs with Helium-dominated Atmospheres*
Chidester, Morgan and 8 other co-authors including **C. E. Fields**, ApJ, **910**, 24 (2021).
6. *Evolutionary roads leading to low effective spins, high black hole masses, and O1/O2 rates for LIGO/Virgo binary black holes*
K. Belczynski, J. Klencki, & **C. E. Fields** et al., A&A, 636, A104 (2020).
5. *Understanding the Engines and Progenitors of Gamma-Ray Bursts*
C. L. Fryer and 7 other co-authors including **C. E. Fields**, Eur. Phys. J. A (2019) 55: 132.
4. *The Impact of White Dwarf Luminosity Profiles on Oscillation Frequencies*
F. X. Timmes, Richard H. D. Townsend, Evan B. Bauer, Anne Thoul, **C. E. Fields** & William M. Wolf, 2018 ApJL, **234**, 19.
3. *The $^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$ Reaction and Its Implications for Stellar Helium Burning*
R. J. deBoer and 12 other co-authors including **C. E. Fields**, Rev. Mod. Phys. **89**, 035007 (2017).
2. *On Variations Of Pre-Supernova Model Properties*
R. Farmer, **C. E. Fields**, I. Petermann, L. Dessart, M. Cantiello, B. Paxton, & F. X. Timmes, ApJS, 2016, **227**, 22.
1. *On Carbon Burning in Super Asymptotic Giant Branch Stars*
R. Farmer, **C. E. Fields**, & F. X. Timmes, ApJ, 807, **184**, 2015.

NON-REFEREED PUBLICATIONS/ABSTRACTS

3. *Catching Element Formation In The Act ; The Case for a New MeV Gamma-Ray Mission: Radionuclide Astronomy in the 2020s*
C. L. Fryer, F. X. Timmes, A. L. Hungerford, A. Couture, and many other authors including **C. E. Fields**, Bulletin of the American Astronomical Society, Vol. 51, Issue 3, id. 2 (2019).
2. **starkiller-astro/Microphysics**: common astrophysical microphysics routines with interfaces for the different AMReX codes
the StarKiller Microphysics Development Team; including **C. E. Fields**, 10.5281/zenodo.2620545.
1. *On The Origin of The Elements: The Spectacular Role of White Dwarfs*, **C. E. Fields**, R. Farmer, I. Petermann, & F. X. Timmes, 227th Meeting of the AAS, Abstract #144.01.