Brian William O'Shea

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Appointments

2014 –	Associate Professor (2014-2019) and full Professor (2019-), Department of Computational Mathematics, Science and Engineering, Department of Physics and Astronomy, and National Superconducting Cyclotron Laboratory, Michigan State University
2008 – 2014	Assistant Professor, Lyman Briggs College and Department of Physics and Astronomy, Michigan State University
2005 – 2008	Director's Postdoctoral Fellow, Theoretical Astrophysics Group and Applied Physics Division, Los Alamos National Laboratory
2005	Graduate Research Assistant, Theoretical Astrophysics Group, Los Alamos National Laboratory
2002 – 2005	Graduate Research Assistant, Center for Astrophysics and Space Sciences, University of California, San Diego
2000 – 2002	Graduate teaching assistant and University of Illinois Graduate Fellow, Department of Physics, University of Illinois at Urbana-Champaign

Education

2005	University of Illinois at Urbana-Champaign, M.S. & PhD, Physics. Dissertation advisor: Michael L. Norman (UCSD/SDSC)
2000	University of Illinois at Urbana-Champaign, B.S., *cum laude*, Engineering Physics with concentrations in astrophysics and computational physics

Research Interests

Theoretical and computational astrophysics*:** numerical simulation of galaxies, galaxy clusters, and galaxy/intergalactic medium interaction. Galactic chemical evolution. High-redshift structure formation. Turbulence. Plasma processes. ***Computational science: High performance computing, scientific visualization, open-source software development. Analysis and management of massive datasets. Exascale algorithms. ***Education*:** Physics and computational science education, student problem-solving, curriculum reform.

Teaching

CMSE 890, Algorithms for Next-Generation Architectures, Fall 2018
PHY 905/AST 911, Computational Astrophysics and Astrostatistics, Spring 2017, Fall 2018
CMSE 402, Visualization of Scientific Datasets, Spring 2018
CMSE 201, Introduction to Computational Modeling: Spring 2016, Fall 2016
LB 271/273, Introductory Physics, I: Fall 2008, 2009, 2010, 2011, 2012, 2013

Teaching, continued

LB 272/274, Introductory Physics, II: Spring 2009, 2010, 2012
LB 290, Interdisciplinary BRAID seminar, Spring 2012, Fall 2013
LB 490A, Methods in Computational Science, Spring 2014
LB 492, The Nuclear Age, Spring 2011, Spring 2013
AST-410, Senior thesis research, all semesters Fall 2008-Spring 2014

Publications

85 refereed publications in The Astrophysical Journal, ApJ Supplements, ApJ Letters, Physics of Plasmas, Monthly Notices of the Royal Astronomical Society, Nature, and Science.
(7,492 citations, h-index of 44)
5 refereed education research publications in The Physics Teacher, American Journal of Physics, CBE-Life Science Education, Nature Climate Change, and Transactions of Computing Education
7 refereed computer science conference proceedings
34 conference proceedings, book chapters, and white papers
66 invited seminars and colloquia (since 2008)
37 invited and contributed talks and reviews at conferences, workshops, and summer schools (since 2008)

Awards and Honors

MSU STEM Gateway Fellowship, 2016-18
Fellow of the American Physical Society, 2016
MSU Teacher-Scholar Award, 2015
University of Michigan MIRA Faculty Sabbatical Fellowship, 2014-15
Lilly Teaching Fellowship, 2011-12
National Science Foundation Astronomy and Astrophysics Postdoctoral Fellow, 2008
Los Alamos National Laboratory Director's Postdoctoral Fellowship, 2005-2008
University of Illinois Graduate Fellowship, 2000
James Scholar in Engineering, University of Illinois at Urbana-Champaign, 2000
Received the University of Illinois Graduate Teaching Certificate, 2002
Outstanding Teaching Assistant Award, UIUC Physics Department, Fall 1998, Spring 1999, Fall 1999, Spring 2000
On The Incomplete List of TAs Ranked "Excellent" By Their Students, Fall 1998, Spring 1999, Fall 1999, Spring 2000 (Ranked "Exceptional" Spring 1999, Fall 1999, Spring 2000)

Students and postdoctoral researchers mentored

PhD dissertations: Carolyn Peruta (MSU, PhD May 2013), Sam Skillman (CU/Boulder, with Jack Burns; PhD May 2013), Greg Meece (MSU, with Mark Voit; PhD May 2016), Brian Crosby (MSU, PhD July 2016)

Current graduate students: Forrest Glines (MSU, 2016-present), Claire Kopenhafer (MSU, 2017-present), Jared Carlson (MSU, 2019-present; w/Sean Couch), Carlos J. Llorente (2019-present)

Former graduate advisees: Matthew Turk (Stanford, w/Tom Abel; 2007-9), David Ventimiglia (MSU, w/Mark Voit; 2008-10, 2013), Jennifer Jones (MSU, 2009), Marios Chatzikos (U. Virginia; visiting student, 2011-12), Chris Richardson (MSU, FAST fellowship advisor, 2011-13), Tom Finzell (MSU, FAST fellowship advisor, 2013-2014), Jennifer Ranta (2015), Hilary Egan (2013-2015), Austin Edmister (MSU, 2015 – 2017), Jasmin Shin (MSU, 2016-2017), Justin Grace (MSU, 2017-2019)

Undergraduate research students: Nicholas Earl (Astrophysics, 2009-11), Monica Derris (Physics, 2009-11), Chris Heuser (Computer science, 2010-11), Dan Perez (Computer Science, 2011-12), Nathan Butcher (Physics, 2012 – 2014), Hilary Egan (Physics, 2012 – 2013), Ciara Johnson (Astrophysics, 2013-2015), Jacob Kneibel (Astrophysics, w/Dr. Devin Silvia; 2013-2015), Luc Menard (Astrophysics, 2015), Yunxiao "Barry" Jia (Astrophysics, 2015), Alex Kreger (Physics, 2015-2016), Claire Kopenhafer (Physics, 2013-2017), Larissa Kennerley (Astrophysics, 2015-2017), Thomas Bolden (Chemical Physics, 2016-2017), Sarah Clay (Astrophysics, 2016-2018), Austin Gilbert (Physics; Summer 2017 CMSE REU), David Crowe (Computer Science; Summer 2017 CMSE REU), Katie Schram (Astrophysics, 2018), Meghan Davis (Astrophysics, 2018 – 2019), Birkan Cetinkaya (Computational Mathematics, 2018 – 2019), Aurora Cossairt (Physics and Math, CMSE REU; Summer 2019), Sebastian Lacayo (Astrophysics, CMSE REU; Summer 2019), Carleen Markey (Astronomy and Statistics, CMSE REU; Summer 2019), Brendan Boyd (w/Devin Silvia; 2019 – present),

Senior thesis or professorial assistant advisees: Emily Chouinard (2008-9), Nicole Kiriazis (2008-9), Joel Adelsberg (2009-10), Talya Krasnert (2010-11), Jessica Domine (2010-2011), Becca Robinson (w/Dr. Facundo Gomez; 2012-13), Jacob Kneibel (w/Dr. Devin Silvia; 2014-15), Madison Fitzgerald (2015-2016), Madison Harris (2015-2016), Erika Christensen (Computer Science, 2018 – 2019), Chris Lu (Computer Science, 2018 – present), Trevor Fush (Astrophysics, 2019 – present)

Postdoctoral researchers: Britton Smith (2009-2012), Facundo Gomez (2011-2014), Devin Silvia (2013-2017; NSF AAPF, 2014-2017), Brian Danielak (2015-2017), Benoit Cote (2015-present), Philipp Grete (2016-present), Deovrat Prasad (2018-present)

Grants awarded

"Collaborative Proposal:Framework:Software:NSCI:Enzo for the Exascale Era (Enzo-E)," MSU PI: Brian O'Shea (Michael Norman at UC San Diego is the overall PI). NSF CSSI program grant #1835402, $480,055 (MSU component), 10/1/2018 – 9/31/2021

"NRT-HDR: Intersecting computational and data science to address grand challenges in plant biology," PI; Shinhan Shiu (I am co-PI). NSF NRT program, grant #1828149, $2,999,052, 10/1/2018-9/31/2023

"Precipitation-regulated AGN Feedback in Halos from 10^12 - 10^15 Msun," MSU PIs: Mark Voit and Brian O'Shea, NASA Chandra Theory Grant, $60K, 1/1/2018-12/31/2019

"Figuring Out Gas & Galaxies in Enzo (FOGGIE): The Gas-Galaxy Connection at z>2," MSU PI: Brian O'Shea (Molly Peeples at STScI is the overall PI), NASA Astrophysics Theory Program, $86,105 (MSU component), 8/1/2018-7/31/2021

"REU Site: iCER ACRES: iCER Advanced Computational Research Experience for Students," MSU PIs: Kenneth Merz & Brian O'Shea, NSF REU program, grant #1560168, $360K, 3/1/2016-2/28/2019

"Collaborative research: Multiscale physics and feedback in real and simulated circumgalactic gas over cosmic time," MSU PI: Brian O'Shea, NSF AST program, grant #1514700, $234,275, 9/14/2015 – 9/13/2019

"Can thermal instabilities drive galactic precipitation and explain observed circumgalactic structure?", PI: Brian O'Shea, Hubble Theory Program, grant #AR-14315, $60K, 12/1/2015-11/30/2016

"Petascale adaptive mesh simulations of Milky Way-type galaxies and their environments," PI: Brian O'Shea, NSF PRAC program #1514580, $32K and 80 million core-hours on Blue Waters, 9/1/2015 – 8/31/2017.

"Beyond the fluid approximation: Improved modeling of the intracluster plasma," PI: Brian O'Shea. NASA ATFP program, grant #14-ATP14-0038, $631,630, 10/1/2015 – 9/31/2018

"Unlocking the secrets of absorption line complexes in the intergalactic medium," PI: Brian O'Shea. Hubble Theory Program, grant #AR-13261.01, $53K, 10/1/2013-9/30/2015.

"Modeling multi-wavelength observations of galaxy clusters with adaptive mesh refinement cosmological simulations." PI: Brian O'Shea. NASA ATFP program, grant #NNX12AC98G, $534K, 1/1/2012-12/31/2016

"Collaborative research: Software institute for abstractions and methodologies for HPC simulation codes on Future Architectures." PI: Anshu Dubey (I am a co-PI). NSF SI2 program. MSU component is $9,218, 7/1/2012-6/30/2014.

"The astrophysics of galaxy clusters: the effect of nonthermal baryonic processes on cluster observables." PI: Brian O'Shea. NASA ATFP Program, Grant #08-ATFP08-0028, $238,989, 2/1/2009 – 1/31/2012

"Formation of the First Galaxies: predictions for the next generation of observatories." PI: Brian O'Shea. NSF PRAC program, grant #0832662. $40,000. 5/1/2009-4/31/2013

"Tracing the History of Galaxy Formation." PI: Brian O'Shea. DOE/LANL IGPP collaborative grant program. $150,000. 10/1/2009 – 9/31/2012

"Cooling and star formation in the Universe's largest galaxies." PI: Mark Voit (I am a co-PI). NSF AST program, grant #0908819. $267,520, 9/15/2009-8/31/2013

"CDI Type II Proposal: From models and data to knowledge and understanding." NSF CDI program, grant #0941373. PI: Scott Pratt (I am a co-PI). $2,360,715. 11/1/2009-10/31/2014

"Predicting the Gamma-ray signature of cosmic ray protons in galaxy clusters using numerical cosmological simulations." PI: Eric Hallman (CU Boulder). I am a co-PI. NASA Fermi guest investigator program, Cycle 2. Grant #21077. $79,921. 8/14/2009-8/13/2010.

"Conduction and multiphase structure in the ICM," PI: Mark Voit (MSU). I am a co-PI. NASA Chandra Theory Program, grant #TM9-0008X. $76,403. 1/1/2009-12/31/2009

Computing time awarded

"Probing the fossils of the Local Group using petascale adaptive mesh galaxy simulations," PI: Brian O'Shea, NSF PRAC program, 6/1/2018 – 3/31/2019, 24 million core-hours on Blue Waters.

"Beyond the Fluid Approximation: Improved Modeling of the Intracluster Plasma," PI: Brian O'Shea, NASA HEC program (SMD-15-6514 and SMD-16-7720, on Pleiades). 100K SBUs (2015), 853K SBUs (2016), 1M SBUs (2017), 1M SBUs (2018). Note: 4 SBUs is approximately 1 node-hour (24 core-hours) on Pleiades.

"Probing galaxy formation at low and high redshifts." PI: Brian O'Shea. NSF XRAC program, Grant #TG-AST090040. 6.28M CPU-hours (2008), 3.2M CPU-hours (2010; renewal), 4.5M CPU-hours (2011; renewal), 4.7M CPU-hours (2012; renewal); 1.53M CPU-hours (2014; renewal); 284K node-hours (2017; renewal; note change from CPU- to node-hours)

"Petascale adaptive mesh simulations of Milky Way-type galaxies and their environments," PI: Brian O'Shea, NSF PRAC program, 9/1/2015 – 1/31/2018, 80 million core-hours on Blue Waters.

"Petascale adaptive mesh simulations of Milky Way-type galaxies and their environments." PI: Brian O'Shea. Great Lakes Consortium for Petascale Computation program (for Blue Waters), 4/1/2015 – 3/31/2016, 12.8 million CPU-hours.

"Formation of the First Galaxies: Predictions for the Next Generation of Observatories." PI: Brian O'Shea. NSF PRAC program (for the Blue Waters supercomputer), 2013-2015. 124 million CPU-hours.

"Computational studies of cosmological structure on the largest scales: galaxy clusters and filaments." PI: Eric Hallman (I am a co-PI). NSF XRAC program, grant #TG-AST100004. 4.4 million

CPU-hours (2010), 4.5 million CPU-hours (2010; renewal), 2.5 million CPU-hours (2011; renewal), 3.9 million CPU-hours (2012; renewal); 1.0 million CPU-hours (2014; renewal)

"Understanding the nature of the missing baryons and the warm-hot intergalactic medium," PI: Britton Smith (I am a co-PI). NSF XRAC program, grant #TG-AST120009. 7.5 million CPU-hours (2012)

"Characterizing the formation history of the Milky Way," PI: Facundo Gomez (I am a co-PI). NSF XRAC program, grant #TG-AST120022. 1.2 million CPU-hours (2012); 3.93 million CPU-hours (2014; renewal)

"Searching for the missing baryons: non-equilibrium chemistry and synthetic spectra," PI: Devin Silvia (I am a co-PI). NSF XRAC program, grant #TG-AST140065. 1.1 million CPU-hours (2014)

"Examining the Processes of Formation and Feedback for Stars and AGN in the AMR Code Enzo," PI: John Wise (I am a co-PI). NSF XRAC program, grant #TG-AST140081. 868,000 CPU-hours (2014)

Service

National service: Enzo project (http://enzo-project.org) community leader and software developer (2000-present), NSF "Future of HPC in the United States" panelist, 2009-2012, Great Lakes Consortium for Petascale Computing Applications Committee (2009-present), Argonne National Laboratory CELS review panel (2015), Blue Waters SETAC Advisory Panel (2016-present), LANL CSES advisory panel (2016-present), "Beyond Blue Waters" advisory panel (astrophysics section leader), US Extremely Large Telescope (ELT) Program Advisory Committee (2018-present)

University committees: Computational Science Department Committee (co-chair), Learning Management Systems Futures Committee, CIRTL advisory council / FAST fellowship advisory committee, CRCSTL advisory panel, ICER Scientific Advisory Panel

College-level (LBC) and departmental (Physics and CMSE) committees: LBC Educational Policy Committee (Chair, 2013-15), LBC Student Evaluation Committee (2011-13), JINA advisory committee (2008-present), astrophysics seminar co-chair (AY2010-11, 12-13, 15-16), galaxy formation discussion group organizer (2012-14), biophysics search committee (2011-12), LBC physics faculty search committee (2013-14; chair), CMSE Chair's Advisory Committee (2015-2017), CMSE Graduate Studies Committee (2015-present), CMSE Undergraduate Study Committee (2015-present), CMSE search committees (2015-16, 2016-17 [chair], 2017-18, 2018-19 [chair]), P&A "Computing through the Curriculum" committee (2016-present), CMSE data science degree committee (2017-present), CMSE RPT committee (2017-present), PI and leader of CMSE/ICER REU (2016-present), CMSE Colloquium committee (2016-present; chair), CMSE Research Hardware Committee (2017-present), PA RPT Committee (2017-present), CMSE Strategic Planning Committee (2015-2017), CMSE Graduate Director (2015-present)

Referee for The Astrophysical Journal, Monthly Notices of the Royal Astronomical Society, Advances in Astronomy, New Astronomy Reviews, Science, Nature, Parallel Computing, and the Journal of Computational Science Education.

Reviewer for DOE (funding and computing time; INCITE, SciDAC, ALCF), Research Corporation for Science Advancement, National Science Foundation, NASA, Netherlands Organization for Scientific Research, the Templeton Foundation, the Krell Institute

Conference Organization: First Stars III (Santa Fe, 2007; LOC chair), Chair of JINA GCE 2010 workshop organizing committee (in East Lansing, MI, April 29-May 1, 2010), 1st Annual Enzo User and Developer Workshop (San Diego, 2010; SOC and LOC), Enzo Developer Workshop (East Lansing, 2011; LOC Chair), Enzo Developer workshop (New York, 2011, SOC), YT user workshop (Chicago, 2012; SOC), Nuclear Astrophysics Town Meeting (Detroit, 2012; SOC member, GCE/BBN working group chair), University of Chicago SIMAC workshop (Chicago, 2012; SOC), Notre Dame Workshop on the Circumgalactic Medium (South Bend, IN, 2014, SOC), SC14 (Applications technical

committee; 2014), Great Lakes Cosmology Workshop 2016, Forging Connections: From Nuclei to the Cosmos (2017; chair of SOC and LOC), Education 2035 (East Lansing, MI, 2019, LOC/SOC)

Conference proceedings: Chief editor of First Stars III conference proceedings, American (Institute of Physics Conference Proceedings Series #990, 2008)

Professional memberships: American Astronomical Society (1998-present), American Physical Society (1998-present), International Astronomical Union, American Association of Physics Teachers (2008-2015), American Association for the Advancement of Science (2008-2012), Society of Industrial and Applied Mathematics (2015-present)

Community Outreach

Lecturer, MSU Physics of Atomic Nuclei Summer School, 2009-present
MSU Research Experience for Undergraduates seminar speaker, 2009-present
Presenter at Astronomical Horizons lecture series, MSU Abrams Planetarium, 2008-present
Impression 5 Physics & Astronomy Day, 2015 - present (lead organizer 2015-2016)
Astronomy on Tap presenter and panelist, 2015-present
MSU Data Science Student Association, faculty advisor (2016-present)
Lecturer on computational astrophysics, MSU Society of Physics Students, 2009, 2013, 2014, 2017
MSU Grandparents University, 2009-2014
Michigan Science Olympiad, 2009-2014
Judge, New Mexico Supercomputing Challenge, 2006, 2007
EarthWatch Lecturer, Los Alamos National Lab Bradbury Science Museum, 2007
Los Alamos Summer School Lecturer, 2006-2008