Michael Zingale / Curriculum Vitæ

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youtube: https://www.youtube.com/user/michaelzingale

Present Position:

Jan. 2012–	*Associate Professor of Physics and Astronomy*, Stony Brook University, Stony Brook, NY

Research Interests:

I am interested in developing and applying computational hydrodynamics algorithms to problems in nuclear astrophysics. A large part of this work is the development of low Mach number hydrodynamics algorithms suited toward long-time evolution in astrophysical flows. The low Mach number simulation code Maestro (developed together with collaborators at LBNL) has been applied to a variety of problems to model convection in stellar environments, including Type Ia supernovae, X-ray bursts, novae, and massive star evolution. Maestro is publicly available.

Education:

2000	Ph.D. in Astronomy and Astrophysics, University of Chicago *thesis*: *Helium Detonations on Neutron Stars* *advisor:* Dr. J. W. Truran
1998	M.S. in Astronomy and Astrophysics, University of Chicago
1996	B.S. in Physics and Astronomy, University of Rochester, Magna Cum Laude *thesis*: *Magnetohydrodynamical Wave Support of Molecular Clouds* Minor in Mathematics, University of Rochester

Academic Appointments:

2014–	*Affiliate*, Institute for Advanced Computational Science, Stony Brook University, Stony Brook, NY
2006–2011	*Assistant Professor of Physics and Astronomy*, Stony Brook University
2001–2005	*Postdoctoral Researcher*, SciDAC Supernova Science Center, University of California, Santa Cruz. Worked on simulations of turbulent thermonuclear flames in Type Ia supernova. Initiated a collaboration with Lawrence Berkeley Lab to apply low Mach number hydrodynamics methods to astrophysical flames. *advisor:* Dr. S. E. Woosley
2000–2001	*Research Associate*, Center for Astrophysical Thermonuclear Flashes, University of Chicago. One of the developers of the FLASH Code. Research focused on flame simulations in Type Ia supernovae. *advisor:* Dr. J. W. Truran

1997–2000   *Graduate student researcher*, Center for Astrophysical Thermonuclear Flashes and Department of Astronomy and Astrophysics, University of Chicago. One of the developers of the FLASH Code.   *advisor:* Dr. J. W. Truran

Honors / Awards:

2015   Scialog Fellow for *Scialog: Time Domain Astrophysics: Stars and Explosions*

2006   Presidential Early Career Award in Science and Engineering (PECASE). Nomination through DOE NNSA.

2006   DOE Office of Nuclear Physics Outstanding Junior Investigator (OJI) Award for a proposal entitled: *Multidimensional Modeling of Astrophysical Thermonuclear Explosions*

2000   Gordon Bell Award in High Performance Computing, Special Category for a paper entitled *High-Performance Reactive Fluid Flow Simulations Using Adaptive Mesh Refinement on Thousands of Processors*, Calder et al. 2000. (SC 2000 conference)

2000   Carl Sagan Award for Excellence in Teaching (Dept. of Astronomy & Astrophysics, University of Chicago)

1997   Gregor Wentzel graduate teaching award (Dept. of Physics, University of Chicago)

1996   Stoddard Prize in physics for senior thesis (University of Rochester)

1996   Flagg Award for highest GPA in physics (University of Rochester)

1996   Inducted into Phi Beta Kappa honor society (University of Rochester)

1994   Inducted into Sigma Pi Sigma physics honor society (University of Rochester)

Publications:

60+ refereed publications and conference proceedings, h-index = 20 (ISI)

Research Grants/Contracts as Principal Investigator:

2011–2013   Department of Energy, Office of Nuclear Physics (2.5-year renewal), *Multidimensional Modeling of Astrophysical Thermonuclear Explosions*, DOE DE-FG02-06ER41448 $253,000

2010–2011   Contract with Lawrence Livermore National Laboratory, *Multidimensional Modeling of Nova with Realistic Nuclear Physics*, 2010: B589924; 2011: B593287 $99,768

2009–2011   Department of Energy, Office of Nuclear Physics Outstanding Junior Investigator Award (2-year renewal), *Multidimensional Modeling of Astrophysical Thermonuclear Explosions*, DOE DE-FG02-06ER41448 $186,000

2007–2009   Contract with Lawrence Livermore National Laboratory, *Verification and Validation of Radiation Hydrodynamics for Astrophysical Applications*, 2007: B568673; 2008: B574691; 2009 B582735 $150,000

2006–2009	Department of Energy, Office of Nuclear Physics Outstanding Junior Investigator Award, *Multidimensional Modeling of Astrophysical Thermonuclear Explosions*, DOE DE-FG02-06ER41448	$255,000

Research Grants/Contracts as Co−Investigator:

2015–2018	Department of Energy, Office of Nuclear Physics *Research in Nuclear Astrophysics: Supernovae, Compact Objects, and Algorithms*, DOE DE-FG02-87ER40317, PI: James Lattimer, Co-Is: Alan Calder, Michael Zingale	$1,100,000
2013–2015	Department of Energy, Office of Nuclear Physics *Research in Nuclear Astrophysics: Supernovae, Compact Objects, and Algorithms*, DOE DE-FG02-87ER40317, PI: James Lattimer, Co-Is: Alan Calder, Michael Zingale	$640,000
2012–2015	NSF, *White Dwarf Mergers as Progenitors of Type Ia Supernovae*, AST-1211563, PI: Alan Calder, Co-Is: Doug Swesty, Michael Zingale	$437,643

Large Computer Time Allocations:

2016	PI on a NERSC 2016 allocation, *Three-dimensional studies of neutron star systems* (4.6 M MPP hours)
2015–2016	PI on an INCITE 2015 award for the OLCF Cray XK7 titan machine entitled *Approaching Exascale Models of Astrophysical Explosions* (2015: 50 Mh, 2016: 55 Mh)
2011–2015	Co-I on NSF PRAC for NCSA/Blue Waters, *Type Ia Supernovae* (9.1 M node hours)
2015	PI on a NERSC 2015 allocation, *Three-dimensional studies of convection in X-ray bursts* (5.9 M MPP hours)
2014	PI on a NERSC 2014 allocation, *Three-dimensional studies of convection in X-ray bursts* (14 M MPP hours)
2014	Co-I on a NERSC 2014 allocation, *Type Ia Supernovae and X-Ray Bursts* (9 M MPP hours)
2012–2014	Co-I on an INCITE 2012 award for the OLCF Cray XT5 for a proposal entitled *Petascale Simulations of Type Ia Supernovae* (2012: 46 Mh; 2013: 55 Mh; 2014: 50 Mh)
2013	PI on XSEDE allocation on Kraken/NICS, *CASTRO Simulations of Merging White Dwarfs* (4.1 Mh)
2013	Co-I on a NERSC 2013 allocation, *Type Ia Supernovae and X-ray Bursts* (3.5 M MPP hours)
2011	Co-I on a TeraGrid allocation on the Kraken machine for a proposal entitled *Thermonuclear Bursts on the Surfaces of Compact Astrophysical Objects* (2.1 Mh, Oct. 2011)
2011	Co-I on an INCITE 2011 award for the Cray XT5/ORNL for a proposal entitled *Petascale Simulations of Type Ia Supernovae* (50 Mh)
2010	PI on a TeraGrid allocation on the Kraken machine for a proposal entitled *Thermonuclear Bursts on the Surfaces of Compact Astrophysical Objects* (1 Mh; Oct. 2010)

2010	Co-I on an INCITE 2010 award for the Cray XT5/ORNL for a proposal entitled *Multidimensional Models of Type Ia Supernovae from Ignition to Observables* (5 Mh initially + 20 Mh supplement)
2007–2009	Co-Investigator on an INCITE 2007 award for the Cray XT3/ORNL for a proposal entitled *First Principles Models of Type Ia Supernovae.* (2007: 4 Mh; 2008: 3.5 Mh; 2009: 3 Mh)
2006	Co-Principal Investigator on the Leadership Computing Facility (ORNL) allocation entitled *Ignition and Flame Propagation in Type Ia Supernovae.* (3 Mh)

Stony Brook Physics and Astronomy Teaching Experience:

Astronomy Today (AST 100)	A one-credit undergraduate seminar on current astronomy topics, where students lead the discussion on current topics. (F 2010, F 2011, F 2014, F 2015)
Introduction to the Solar System (AST 105)	An overview of solar system topics (solar system dynamics, Kepler's laws, planetary processes, exoplanets, . . .) for non-majors. (F 2007, F 2008, F 2009, F 2011, S 2014, S 2015)
Astronomy (AST 203)	A calculus-based introduction to astronomy and astrophysics for majors, covering the basics of radiation, spectra, binary stars, stellar evolution, ISM, clusters, galaxies, and cosmology. (S 2007, S 2008, S 2009, S 2010, S 2011, S 2012)
Introduction to Planetary Sciences (AST 205)	A calculus-based introduction to the solar system for majors covering basic solar system motion, planetary processes, exoplanets, and solar system formation. (F 2010, F 2014)
Stars (PHY 521)	A graduate-level introduction to the physical processes inside stars, stellar structure and atmospheres, and stellar explosions. (F 2013, F 2015)
Python for Scientific Computing (PHY 546; formerly grad special topics)	A one-hour weekly graduate seminar that I created that introduces python and a variety of libraries (NumPy, matplotlib, SciPy, SymPy) for numerical analysis, visualization, and data processing, as well as basic software engineering practices (git/github, debugging, testing). (S 2014, S 2015, S 2016)
The Application of Simulation in Astrophysics (grad special topics)	Develop the equations of hydrodynamics, instabilities common in astrophysics, and discuss numerical methods for solving the Euler equations (finite-volume methods, Riemann solvers, etc.) (S 2006)
Numerical Methods for (Astro)Physics (grad special topics)	A practical introduction to good development practices, order-of-accuracy, numerical differentiation, integration, interpolation, ODEs, root finding, solving hyperbolic, elliptical, and parabolic PDEs, computational fluid dynamics, and parallel programming, with examples in python. (S 2013, S 2016)

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Other Teaching Experience:

Summer 2001
University of Chicago / Department of Computer Science:
Teaching assistant for the Introduction to Programming in C class in the Computer Science Professional Masters Program at the University of Chicago.

1997–1998
Center of Astronomical Research in Antarctica (CARA) outreach program:
Developed and taught thermodynamics, E&M, and mechanics experiments to grade 7–12 Chicago school students. Awarded the Carl Sagan teaching award.

1996–1997
Introductory Physics Teaching Assistant (University of Chicago):
Taught weekly discussion and laboratory sections. Awarded the Gregor Wentzel teaching award.

Professional Development:

2001
Finite Volume Upwind and Centered Methods for Hyperbolic Conservation Laws (Barcelona, Spain)

1999
NASA Summer School for High Performance Computational Earth and Space Sciences

Stony Brook University Service:

2013–
Astronomy Open Nights coordinator, Dept. of Physics and Astronomy

2011–2012, 2013–
Strategic Advising Committee, Dept. of Physics and Astronomy

2014–2015
Department Chair Search Committee, Dept. of Physics and Astronomy

2014–2015
Three-year Reappointment Committee for Astronomy colleague, Dept. of Physics and Astronomy

2013–2014
Undergraduate Astronomy Coordinator, Dept. of Physics and Astronomy

2013–2014
Tenure Committee for Astronomy colleague, Dept. of Physics and Astronomy

2013–2014
Astronomy Faculty Search Committee, Dept. of Physics and Astronomy

2013
Ad-hoc Committee for High-Energy Physics Hire, Dept. Physics and Astronomy

2007–2012
Colloquium Committee, Dept. of Physics and Astronomy (chair: Fall 2008, Fall 2009, Fall 2010, Fall 2011)

2011
CESAME/Physics and Astronomy joint hire committee, Dept. of Physics and Astronomy

2010
Teaching Learning Technology (TLT) Advisory Committee

2009
Long Range Planning Committee, Dept. of Physics and Astronomy

2007–2009
Graduate Advising Committee, Dept. of Physics and Astronomy

2006–2009
University Senate Committee on Computing and Communications (chair: Feb. 2008 – May 2009)

2008
Department Chair Search Committee, Dept. of Physics and Astronomy

2007–2008	Astronomy Faculty Search Committee, Dept. of Physics and Astronomy
2006–2007	Graduate Admission Committee, Dept. of Physics and Astronomy
2006–2007	NYCCS Faculty Search Committee (Dept. level), Dept. of Physics and Astronomy

Professional Service:

2016–	Elected to the NERSC User's Group Executive Committee (NUGEX)
2014–	Elected to the OLCF User Group Executive Board (Vice chair: 2014–2015; Chair: 2015–2016)
ongoing	Referee for the *Astrophysical Journal*, *Astronomy and Astrophysics*, *Nature*, *Monthly Notices of the Royal Astronomical Society*, *Journal of Computational Physics*, and *Nuclear Physics A*
2006–	Annual *Astronomy Open Night* public outreach talks, Stony Brook (Open Night coordinator from Fall 2013–)
2011, 2014, 2016	External reviewer for DOE Office of Nuclear Physics
2014	External reviewer for NSF PRAC
2013	Served on a NASA ATP grant review panel
2013	External reviewer for NSF Office of Cyber Infrastructure
2012	Reviewer for the Great Lakes Consortium for Petascale Computation (2012) proposals for the NCSA Blue Waters machine.
2007	External reviewer for NASA Astrophysics Theory and Fundamental Physics Program
2006	Served on NSF Astronomy and Astrophysics Program review panel

Meeting Organization:

2016	Co-organizer of the second *New York Area Computational Astrophysics meeting* (American Museum of Natural History, April 2016)
2015	Scientific organizing committee for the workshop *GNASH: The anomalous metal-poor stars and convective-reactive nuclear astrophysics* (U. Victoria, Victoria, BC)
2015	Co-organizer of the *New York Area Computational Astrophysics meeting* (Farmingdale State College, April 2015)
2014–2015	Organizing committee for the 2015 *Oak Ridge Leadership Computing Facility User Meeting*
2012–2013	Local organizing committee for the *National Nuclear Physics Summer School* (NNPSS 2013).
2012	Co-convener of *Thermonuclear explosions: Type Ias, Novae, and X-ray bursts* working group at *Nuclear Astrophysics Town Meeting* (Detroit, MI)

Astrophysical Software / Other Projects:

ongoing	Creator of the Open Astrophysics Bookshelf github organization `http://open-astrophysics-bookshelf.github.io/` and author of the open text *Computational Hydrodynamics for Astrophysics*
ongoing	Co-developer of the publicly-available low Mach number hydrodynamics code `Maestro`, `http://bender.astro.sunysb.edu/Maestro/`
ongoing	Co-developer of the publicly-available compressible hydrodynamics code `Castro`, `https://ccse.lbl.gov/Downloads/downloadCASTRO.html`
ongoing	Developed and distribute many simple teaching codes (advection, Eulerian compressible and incompressible hydro solvers, multigrid, etc., with accompanying notes and exercises), `http://www.astro.sunysb.edu/mzingale/software/`
ongoing	Created a library of astronomy animations introducing basic concepts (e.g. Kepler's laws, blackbody radiation, waves, binary star/exoplanet dynamics, etc.) as well as more advanced concepts (e.g. entropy in convection), `http://www.astro.sunysb.edu/mzingale/software/astro/`, also available on youtube, `http://www.youtube.com/user/michaelzingale`
ongoing	Contributor to the astrophysics visualization package yt
1997–2002	Original member of the FLASH Code development team

Guest Appointments:

2000–2003	Guest Appointment at Argonne National Laboratory / Mathematics and Computer Science Division
April 2001	Guest at the Max-Planck-Institut für Astrophysik

Professional Societies:
Member of the American Association of Physics Teachers
Member of the American Astronomical Society
Member of the American Physical Society

Students Advised:

graduate	Chris Malone (Stony Brook, PhD 2011, thesis: *Multidimensional Simulations of Convection Preceding a Type Ia X-ray Bursts*)
	Adam Jacobs (Stony Brook, current student, working on `Maestro` simulations of sub-Chandrasekhar mass SNe Ia)
	Max Katz (Stony Brook, current student, working on Castro simulations of white dwarf mergers)
undergraduate	Max Katz (REU student at Stony Brook, summer 2010, worked on generating initial models with the MESA code)
	Adam Siegel (Stony Brook, BS 2011, worked on flame modeling)

Ryan Orvedahl (Stony Brook, BS 2013, worked on Maestro algorithm issues and particle analysis)

References:

references available upon request