Michael Zingale / Curriculum Vitæ

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Present Position

Sept. 2021– *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 code MAESTROeX and the compressible (magneto-, radiation-) hydrodynamics code Castro. Both codes are freely available on github, use adaptive mesh refinement, and hybrid parallelism techniques to run at scale on today's supercomputers. I apply these codes to studies of X-ray bursts, different progenitor models of Type Ia supernovae, and convection in stars. Importantly, all of the code, input files, workflow scripts needed to reproduce the science done in my research group is available in our github repos.

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
2012–2021	*Associate Professor of Physics and Astronomy*, Stony Brook University
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

2019	Stony Brook University College of Arts and Sciences Godfrey Excellence in Teaching Award
2015–2016	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

80+ refereed publications and conference proceedings

Research Grants/Contracts as Principal Investigator

2020–2022	Contract with Lawrence Berkeley National Laboratory (part of the DOE ECP Exastar project), contract # 7418390, Co-I: Alan Calder	$580,951
2018–2019	Contract with Lawrence Berkeley National Laboratory (part of the DOE ECP Exastar project), contract # 7418390, Co-I: Alan Calder	$144,588
2017–2022	Department of Energy, Office of Nuclear Physics & Office of Advanced Scientific Computing Research, *Towards Exascale Astrophysics of Mergers and Supernovae (TEAMS)* (SBU subcontract through MSU, multi-institution collaboration, DE-SC0017955), Co-Is: Alan Calder, James Lattimer	$616,000
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

2019–2022	National Science Foundation, *REU Site: Broadening undergraduate research participation in Physics and Astronomy at Stony Brook University*, PI: Matthew Dawber, Co-Is: Navid Vafael-Najafabadi, Michael Zingale	$273,308
2018–2021	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	$1,140,000
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

2020	PI on a NERSC 2021 allocation, *Three-dimensional studies of white dwarfs, massive stars, and neutron star systems* (30 M MPP hours)
2021–2022	PI on an INCITE 2021 award for at OLCF, *Approaching Exascale Models of Astrophysical Explosions* (2021: 700 k node hours on summit)
2019	PI on a NERSC 2020 allocation, *Three-dimensional studies of white dwarfs, massive stars, and neutron star systems* (30 M MPP hours)

2019–2020	PI on an INCITE 2019 award for at OLCF, *Approaching Exascale Models of Astrophysical Explosions* (2019: 1.5 M node hours on titan, 105 k node hours on summit; 2020: 300 k node hours on summit)
2019	PI on a NERSC 2019 allocation, *Three-dimensional studies of white dwarfs, massive stars, and neutron star systems* (27.5 M MPP hours)
2018	PI on a NERSC 2018 allocation, *Three-dimensional studies of white dwarf and neutron star systems* (20.85 M MPP hours)
2018	PI on an INCITE 2018 award for at OLCF, *Approaching Exascale Models of Astrophysical Explosions* (40 M hours)
2017	PI on a NERSC 2017 allocation, *Three-dimensional studies of white dwarf and neutron star systems* (5 M MPP hours)
2017	PI on an INCITE 2017 award for the OLCF Cray XKT titan machine, *Approaching Exascale Models of Astrophysical Explosions* (45 M hours)
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, *Approaching Exascale Models of Astrophysical Explosions* (2015: 50 M hours, 2016: 55 M hours)
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, *Petascale Simulations of Type Ia Supernovae* (2012: 46 M hours; 2013: 55 M hours; 2014: 50 M hours)
2013	PI on XSEDE allocation on Kraken/NICS, *CASTRO Simulations of Merging White Dwarfs* (4.1 M hours)
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, *Thermonuclear Bursts on the Surfaces of Compact Astrophysical Objects* (2.1 M hours, Oct. 2011)
2011	Co-I on an INCITE 2011 award for the Cray XT5/ORNL machine, *Petascale Simulations of Type Ia Supernovae* (50 M hours)
2010	PI on a TeraGrid allocation on the Kraken machine, *Thermonuclear Bursts on the Surfaces of Compact Astrophysical Objects* (1 M hours; Oct. 2010)
2010	Co-I on an INCITE 2010 award for the Cray XT5/ORNL, *Multidimensional Models of Type Ia Supernovae from Ignition to Observables* (5 M hours initially + 20 M hours supplement)

2007–2009	Co-Investigator on an INCITE 2007 award for the Cray XT3/ORNL, *First Principles Models of Type Ia Supernovae*. (2007: 4 M hours; 2008: 3.5 M hours; 2009: 3 M hours)
2006	Co-Principal Investigator on the Leadership Computing Facility (ORNL) allocation, *Ignition and Flame Propagation in Type Ia Supernovae*. (3 M hours)

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, F 2020)
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, S 2017, S 2019)
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, F 2016)
Stars and Radiation (AST 341)	An overview on stellar physics for undergraduate astronomy majors. (F 2018, F 2020)
Stars (PHY 521)	A graduate-level introduction to the physical processes inside stars, stellar structure and atmospheres, and stellar explosions. (F 2013, F 2015, F2021)
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, S 2017, S 2018)
Computational Methods in Physics and Astrophysics II (PHY 604; formerly grad special topics)	A practical introduction to good development practices, order-of-accuracy, numerical differentiation, integration, interpolation, ODEs, root finding, fitting, FFTs, Monte Carlo, solving hyperbolic, elliptical, and parabolic PDEs, computational fluid dynamics, and parallel programming, with examples in python. (S 2013, S 2016, F 2017)
Astrophysical Fluids and Plasmas (grad special topics)	An introduction to hydrodynamics, fluid instabilities, applications to astrophysics, and an introduction to MHD. (S 2018, S 2021)

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)

Other Teaching Experience

Fall 2020	Instructor for Software Carpentry training event at Institute for Advanced Computational Science, Stony Brook, NY (taught: bash, git)
Summer 2020	Developed and led the Physics and Astronomy REU *Python Tutorial* of introductory tutorials and exercises over the 10 week program (`https://github.com/sbu-phy-ast-reu/reu-python-tutorial`).
Feb 2019	Instructor for Software Carpentry training event at Institute for Advanced Computational Science, Stony Brook, NY (taught: python, git).
Summer 2017	Developed and led the *Python Boot Camp* week-long tutorial for the IACS Data + Compute = Discovery Research Experience for Undergraduates program (`https://sbu-python-summer.github.io/`)
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

2018	Software Carpentry instructor certification
2001	student at Finite Volume Upwind and Centered Methods for Hyperbolic Conservation Laws (Barcelona, Spain)
1999	student at NASA Summer School for High Performance Computational Earth and Space Sciences

Stony Brook Physics and Astronomy Service

2021	Promotion Committee for Astronomy colleague, Dept. of Physics and Astronomy
2020–	Astronomy Director of Undergraduate Studies
2020–	Undergraduate Curriculum Committee, Dept. of Physics and Astronomy
2018–	Diversity Committee, Dept. of Physics and Astronomy (chair: 2019, 2021)
2017–	Undergraduate Research Committee, Dept. of Physics and Astronomy

2019	Three-year Reappointment Committee for Physics colleague, Dept. of Physics and Astronomy (chair)
2011–2012, 2013–2019	Strategic Advising Committee, Dept. of Physics and Astronomy
2017	Tenure Committee for Astronomy colleague, Dept. of Physics and Astronomy
2006–2007, 2016–2017	Graduate Admission Committee, Dept. of Physics and Astronomy
2016–2017	Examine the Graduate Exam Committee, Dept. of Physics and Astronomy
2013–2016	Astronomy Open Nights coordinator, Dept. of Physics and Astronomy
2008, 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
2009	Long Range Planning Committee, Dept. of Physics and Astronomy
2007–2009	Graduate Advising Committee, Dept. of Physics and Astronomy
2007–2008	Astronomy Faculty Search Committee, Dept. of Physics and Astronomy
2006–2007	NYCCS Faculty Search Committee (Dept. level), Dept. of Physics and Astronomy

Stony Brook University Service

2010	Teaching Learning Technology (TLT) Advisory Committee
2006–2009	University Senate Committee on Computing and Communications (chair: Feb. 2008 – May 2009)

Professional Service

2020–	Associate Editor for *Living Reviews in Computational Astrophysics*
2014–	OLCF User Group Executive Board (Elected to 3 year term 2014, re-elected in 2017; re-elected in 2020; Vice chair: 2014–2015, 2018–2019; Chair: 2015–2016, 2019–2020)

ongoing	Referee for *Astronomy and Astrophysics*, the *Astrophysical Journal*, *Communications in Applied Mathematics and Computational Science*, *Computing in Science and Engineering*, *Journal of Computational Physics*, *Journal of Open Source Software*, *Monthly Notices of the Royal Astronomical Society*, *Nature*, *Nuclear Physics A*, and *Physical Review Letters*
2021	Served on a NASA Open Source Tools, Frameworks, and Libraries review panel
2020	External review committee member for Operational Assessment of the Oak Ridge Leadership Computing Facility (OLCF) (April 21–22, 2020)
2006–	Annual *Astronomy Open Night* public outreach talks, Stony Brook (Open Night coordinator from Fall 2013–Fall 2016)
2019	Reviewer for UK Science & Technology Facilities Council
2016–2019	Elected to the NERSC User's Group Executive Committee (NUGEX)
2018	Reviewer for UK DiRAC HPC Facility
2018	Reviewer for Pazy Foundation / Israeli University Planning and Budgeting Committee and the Israeli Atomic Energy Commission (IAEC)
2016	Reviewer for Deutsche Forschungsgemeinschaft
2013, 2016	Served on a NASA ATP grant review panel
2011, 2014, 2016, 2018, 2020	External reviewer for DOE Office of Nuclear Physics
2014, 2016	External reviewer for NSF PRAC
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

2022	Organizer of the *Physics and Astrophysics of Common Envelopes* meeting (Los Alamos National Laboratory, Feb. 2022)
2021	Co-chair of the Physics and Astronomy track of the SciPy 2021 meeting (virtual, July 2021)
2021	Co-organizer of a SIAM CSE 2021 mini-symposium *Performance Portability in Astrophysics Simulation Codes* (virtual, Feb. 2021)
2020	Co-chair of the Astronomy and Astrophysics track of the SciPy 2020 meeting (virtual, July 2020)
2020	Co-organizer of the *yAC: yt at CCA* meeting (Flatiron Institute / Center for Computational Astrophysics, March 2020)

2019	Scientific Organizing Committee, 2019 Compressible Convection Conference (Newcastle, UK, Sept. 2019)
2018–2019	Member of the SC19 Reproducibility Challenge track committee
2017	Co-organizer of the third *New York Area Computational Astrophysics meeting* (Flatiron Institute / Center for Computational Astrophysics, Sept. 2017)
2016–2017	Member of the Program Committee for the *13th International Workshop on OpenMP (IWOMP) 2017* (Stony Brook, NY 2017)
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)

Community Astrophysical Software / Other Projects

ongoing	Co-developer of the publicly-available low Mach number hydrodynamics code MAESTROeX, `https://amrex-astro.github.io/MAESTROeX/`
ongoing	Co-developer of the publicly-available compressible (radiation-, magneto-) hydrodynamics code Castro, `https://amrex-astro.github.io/Castro/`
ongoing	Creator and co-developer of the publicly-available teaching and prototyping hydrodynamics code pyro, `https://github.com/python-hydro/pyro2/`
ongoing	Creater / co-developer of the pynucastro library, `https://github.com/pynucastro/pynucastro`
ongoing	Creator of the Open Astrophysics Bookshelf github organization `http://open-astrophysics-bookshelf.github.io/` and author of the open text *Introduction to Computational Astrophysical Hydrodynamics*
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://zingale.github.io/astro_animations/`, also available on youtube, `http://www.youtube.com/user/michaelzingale`

ongoing	Contributor to and *project member* of the volumetric visualization package yt
2020–	Ombudsperson for the TARDIS Monte Carlo radiative transfer code (`https://tardis-sn.github.io/tardis/team.html`)
1997–2002	Original member of the FLASH Code development team

Guest/Visiting Appointments

2019–2020	Visiting Scholar at the Flatiron Institute / Center for Computational Astrophysics
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 Astronomical Society
Member of the American Physical Society
Member of the Society for Applied and Industrial Mathematics

Students Advised

PhDs advised	Chris Malone (Stony Brook, PhD 2011, thesis: *Multidimensional Simulations of Convection Preceding a Type Ia X-ray Bursts*)
	Max Katz (Stony Brook, PhD 2016, thesis: *White Dwarf Mergers on Adaptive Meshes*)
	Adam Jacobs (Stony Brook, PhD 2016, thesis: *The Explosive Possibilities of Little Dwarfs: Low-Mach Number Modeling of Thin Helium Shells on Sub-Chandrasekhar Mass White Dwarfs*)
	Maria Guadalupe Barrios Sazo (Stony Brook, PhD 2020, thesis: *Studies toward the modeling of White Dwarf Mergers and Magnetohydrodynamics*)
	Xinlong Li (Stony Brook, PhD 2021, thesis: *3-d Simulation of Convection in an Electron-capture O-Ne Core*)
Masters students advised	Mu-Hung Chang (Stony Brook, MA 2017, thesis: *Application of Spectral Deferred Correction for 1-D Astrophysical Detonation*)
	Hengrui Zhan (Stony Brook, MA 2019, thesis: *Implementation of an Improved Multipole Expansion Method*)
postdocs advised	Alice Harpole (current postdoc, working on Maestro rotation support, GPU acceleration, algorithm development, massive star evolution).
current grad students	Eric Johnson
	Alexander Smith Clark

undergrad honors theses	Kiran Eiden (Stony Brook, BS 05/2020, thesis *Propagation of Thermonuclear Flame Fronts in Type I X-ray Bursts*)
	Abigail Bishop (Stony Brook, BS 05/2019, thesis *Expanding the Modeling of Type Ia Supernovae*)
	Luke Nolan (Stony Brook, BS 05/2016, thesis *Flame Wave Propagation on the Surface of Neutron Stars During Type I X-Ray Bursts*)

References

references available upon request

Michael Zingale / Publications and Talks

Refereed Publications

61. *Dynamics of Laterally Propagating Flames in X-ray Bursts. II. Realistic Burning & Rotation,*

    A. Harpole, N. M. Ford, K. Eiden, M. Zingale, A. D. Willcox, Y. Cavecchi, & M. P. Katz, 2021, ApJ, 912, 36

60. *CASTRO: A Massively Parallel Compressible Astrophysics Simulation Code,*

    A. Almgren, M. Barrios Sazo, J. Bell, A. Harpole, M. Katz, J. Sexton, D. Willcox, W. Zhang, & M. Zingale, 2020, Journal of Open Source Software, 5, 54, 2513

59. *Preparing Nuclear Astrophysics for the Exascale,*

    M. Katz, A. Almgren, M. Barrios Sazo, K. Eiden, K. Gott, A. Harpole, J. Sexton, D. Willcox, W. Zhang, & M. Zingale, 2020, accepted to SC20

58. *Dynamics of Laterally Propagating Flames in X-ray Bursts. I. Burning Front Structure,*

    K. Eiden, M. Zingale, A. Harpole, D. Willcox, Y. Cavecchi, & M. P. Katz, 2020, ApJ, 894, 6

57. *The Castro AMR Simulation Code: Current and Future Developments,*

    M. Zingale, A. S. Almgren, M. Barrios Sazo, J. B. Bell, K. Eiden, A. Harpole, M. P. Katz, A. J. Nonaka, D. E. Willcox, & W. Zhang, 2020, Journal of Physics: Conference Series, 1623, 012021, 14th Int. Conf. on Numerical Modeling of Space Plasma Flows: ASTRONUM-2019 1-5 July 2019, Paris, France

56. *Modelling low Mach number stellar hydrodynamics with MAESTROeX*

    A. Harpole, D. Fan, M. P. Katz, A. J. Nonaka, D, E. Willcox, & M. Zingale, 2020, Journal of Physics: Conference Series, 1623, 012015, 14th Int. Conf. on Numerical Modeling of Space Plasma Flows: ASTRONUM-2019 1-5 July 2019, Paris, France

55. *MAESTROeX: A Massively Parallel Low Mach Number Astrophysical Solver,*

    D. Fan, A. Nonaka, A. S. Almgren, A. Harpole, & M. Zingale, 2019, ApJ, 887, 212

54. *Improved Coupling of Hydrodynamics and Nuclear Reactions via Spectral Deferred Corrections,*

    M. Zingale, M. P. Katz, J. B. Bell, M. L. Minion, A. J. Nonaka, & W. Zhang, 2019, ApJ, 886, 105

53. *MAESTROeX: A Massively Parallel Low Mach Number Astrophysical Solver,*

    D. Fan, A. Nonaka, A. Almgren, D. Willcox, A. Harpole, & M. Zingale, 2019, Journal of Open Source Software, 4, 43, 1757

52. *AMReX: a framework for block-structured adaptive mesh refinement,*

    W. Zhang, A. Almgren, V. Beckner, J. Bell, J. Blaschke, C. Chan, M. Day, B. Friesen, K. Gott, D. Graves, M. P. Katz, A. Myers, T. Nguyen, A. Nonaka, M. Rosso, S. Williams, & M. Zingale, 2019, Journal of Open Source Software, 4, 37, 1370

51. *Numerical Stability of Detonations in White Dwarf Simulations,*

    M. P. Katz & M. Zingale, 2019, ApJ, 874, 169

50. *pyro: a framework for hydrodynamics explorations and prototyping,*

    A. Harpole, M. Zingale, I. Hawke, & T. Chegini, 2019, Journal of Open Source Software, 4, 34, 1265

49. *Toward Resolved Simulations of Burning Fronts in Thermonuclear X-ray Bursts,*

    M. Zingale, K. Eiden, Y. Cavecchi, A. Harpole, J. B. Bell, M. Chang, I. Hawke, M. P. Katz, C. M. Malone, A. J. Nonaka, D. E. Willcox, & W. Zhang, 2019, Journal of Physics: Conference Series, 1225, 012005

48. *Thermonuclear (Type Ia) Supernovae and Progenitor Evolution,*

    A. C. Calder, D. E. Willcox, C. J. DeGrendele, D. Shangase, M. Zingale, & D. M. Townsley, 2019, Journal of Physics: Conference Series, 1225, 012002

47. *Turbulence-driven thermal and kinetic energy in the atmospheres of hot Jupiters,*

    T. Ryu, M. Zingale, & R. Perna, 2018, Monthly Notices of the Royal Astronomical Society, 481, 4, 5517–5531

46. *pynucastro: an interface to nuclear reaction rates and code generator for reaction network equations,*

    D. E. Willcox & M. Zingale, 2018, Journal of Open Source Software, 3 (23), 588; DOI: `https://doi.org/10.21105/joss.00588`

45. *Observatory science with eXTP,*

    J. J. M. in 't Zand et al., 2018, Science China Physics, Mechanics & Astronomy, 62, 29506

44. *Meeting the Challenges of Modeling Astrophysical Thermonuclear Explosions: Castro, Maestro, and the AMReX Astrophysics Suite,*

    M. Zingale, A. S. Almgren, M. G. Barrios Sazo, V. E. Beckner, J. B. Bell, B. Friesen, A. M. Jacobs, M. P. Katz, C. M. Malone, A. J. Nonaka, D. E. Willcox, & W. Zhang, 2018, Journal of Physics: Conference Series, 1031, 1, 012024

43. *Best Practices in Running Collaborative GPU Hackathons: Advancing Scientific Applications with a Sustained Impact,*

    S. Chandrasekaren, G. Juckeland, M. Otten, M. Lin, J. E. Stone, M. Zingale, & F. Foertterm 2018, Computing in Science and Engineering, 20, 4, 95–106

42. *Toward Simulating Black Widow Binaries with Castro,*

    P. Karpov, M. Barrios Sazo, M. Zingale, W. Zhang, & A. C. Calder, 2017, Journal of Computational Science Education, 8, 25–29

41. *Review: White paper on nuclear astrophysics and low energy nuclear physics Part 1: Nuclear astrophysics,*

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40. *Low Mach Number Modeling of Convection in Helium Shells on Sub-Chandrasekhar White Dwarfs II: Bulk Properties of Simple Models,*

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Invited Lectures / Seminars / Colloquia

03/02/2021	Invited talk in the *Computational Methods in Explosive Nuclear Astrophysics* session at the SIAM Computational Science and Engineering 2021 meeting, *Modeling Astrophysical Reacting Flows*
01/30/2020	Princeton University, Department of Astrophysical Sciences Thunch talk, *Modeling Stellar Explosions*
01/09/2020	Invited presentation at Texas Advanced Computing Center *Workshop on Future Directions in Extreme Scale Computing for Scientific Grand Challenges* on *Challenges in Modeling Astrophysical Thermonuclear Explosions*
11/06/2019	Stony Brook University, Department of Physics and Astronmomy Colloquium, *Modeling Thermonuclear X-ray Bursts*
07/05/2019	Invited talk at AstroNum 2019–14th International Conference on Numerical Modeling of Space Plasma Flows, Paris, France, *Improved Coupling of Hydrodynamics and Nuclear Burning in Astrophysical Flows using SDC*
02/26/2019	Invited talk in the *Spectral Deferred Correction Methods for Temporal Integration* session at the SIAM Computational Science and Engineering 2019 meeting, *Improved Coupling of Hydrodynamics and Nuclear Burning in Astrophysical Flows using SDC*
10/12/2018	Flatiron Institute Center for Computational Astrophysics Colloquium, *Algorithmic Demands for Modeling X-ray Bursts and Type Ia Supernovae*
08/23/2018	Talk at the TEAMS Collaboration meeting, *StarKiller Microphysics*
06/26/2018	Invited talk at AstroNum 2018—13th International Conference on Numerical Modeling of Space Plasma Flows, Panama City, Florida, *Modeling X-ray Bursts with the AMReX Astrophysics Suite*
08/10/2017	Seminar at LLNL High Energy Density Science Center, LLNL, *Modeling Stellar Explosions with the AMReX Astrophysics Suite*
07/27/2017	Seminar at Computational Science Initiative, BNL, *The AMReX Astrophysics Suite: Simulating the Stars at the Exascale*

06/30/2017 Invited talk at AstroNum 2017—12th International Conference on Numerical Modeling of Space Plasma Flows, St. Malo, France, *Computational Challenges of Modeling X-ray Bursts and Type Ia Supernovae*

06/02/2017 Invited participant / overview talk at Stellar Hydro Days, Univesity of Victoria, *Modeling Stellar Convection and Explosions with Maestro, Castro, and the BoxLib/AMReX Astrophysics Suite*

04/05/2017 Astronomy Seminar at Michigan State University, *Computational Challenges of Modeling X-ray Bursts and Type Ia Supernovae*

02/23/2017 Seminar at Stony Brook Institute for Advanced Computational Science, *Computational Challenges of Modeling X-ray Bursts and Type Ia Supernovae*

06/15/2016 Case study talk at DOE Nuclear Physics / ASCR Exascale Requirements Review, Gaithersburg, MD, *Thermonuclear Transients*

04/29/2016 Seminar at Oak Ridge National Laboratory, *Modeling Stellar Explosions with Maestro, Castro, and the BoxLib Astrophysics Suite*

03/17/2016 Talk at the *18th Workshop on Nuclear Astrophysics*, Ringberg Castle, Tegernsee, Germany, *Models of convection in X-ray bursts and pre-SNe Ia white dwarfs*

02/26/2016 Seminar at the U. S. Naval Research Laboratory, *Computational Challenges of Modeling X-ray Bursts and Type Ia Supernovae*

08/02/2015 Invited talk at the *International Colloquium on the Dynamics of Explosions and Reactive Systems (ICDERS)*, Leeds, UK, *Understanding Ignition in Type Ia Supernovae*

06/22/2015 Invited talk at the *OLCF User's Meeting*, ORNL, Oak Ridge, TN, *Computation Challenges of Modeling Astrophysical Explosions*

06/03/2015 Invited talk at the *Fifty One Ergs* meeting, NCSU, *Modeling the Early Phases of Type Ia Supernovae*

05/24/2015 "Setting the Stage" talk on *Stellar Hydrodynamics* at the JINA *GNASH: The anomalous metal-poor stars and convective-reactive nuclear astrophysics* workshop, Victoria, BC, Canada, `http://jina-cee.phys.uvic.ca/gnash-workshop/talks-and-contributions/monday/setting-the-stage`

04/08/2015 Seminar at U Mass Darthmouth, *Algorithmic Developments for Modeling Stellar Explosions*

01/15/2015 CCS-2 Seminar at Los Alamos National Laboratory, *The Challenges of Modeling Type Ia Supernovae and X-ray Bursts*

09/15/2014 Invited talk at the *Type Ia Supernovae: progenitors, explosions, and cosmology* conference, Chicago, IL, *Modeling the Early Phases of SNe Ia*, `https://kicp-workshops.uchicago.edu/sn2014/presentations.php`

04/30/2014 Invited presentation at *Large Scale Computing and Storage Requirements for Nuclear Physics (NP): Target 2017* meeting, *Convection in X-ray Bursts*

02/28/2014 Astronomy Seminar at the Center for Cosmology and Particle Physics, New York University, *Modeling Convective Burning in Type Ia Supernovae and X-ray Bursts*

09/27/2013 Nuclear Theory Seminar at Brookhaven National Lab, *Modeling Convective Burning in Type Ia Supernovae and X-ray Bursts*

07/09/2013 Seminar at the Flash Center, University of Chicago, *Modeling Convective Burning in Type Ia Supernovae and X-ray Bursts*

10/10/2012 Astro Computation working group at *2012 Nuclear Astrophysics Town Meeting*, *Thermonuclear Driven Events*

04/04/2012 Nuclear Astrophysics Seminar at Ohio University entitled *The Challenges of Modeling Explosive Phenomena*

07/28/2010 Invited talk at the Lorentz Center Workshop on *X-ray Bursts and Burst Oscillations* entitled *The Algorithmic Challenges of Multidimensional Models of X-ray Bursts*, `http://www.lorentzcenter.nl/lc/web/2010/408/info.php3?wsid=408`

05/13/2010 Joint NRAO / UVa Dept. of Astronomy Colloquium (Charlottesville, VA) entitled *Modeling Convection and Ignition in Type Ia Supernovae*

03/31/2010 Center for the Study of Cosmic Evolution Seminar, Dept. of Physics and Astronomy, Michigan State University (E. Lansing, MI), entitled: *Modeling Convection and Ignition in Type Ia Supernovae*

05/12/2009 Astronomy Seminar at the American Museum of Natural History (New York, NY), entitled: *Modeling Convection and Ignition in Type Ia Supernovae*

09/30/2008 Astronomy Seminar at the Institute for Advanced Studies (Princeton, NJ), entitled: *New Methods for Modeling Type Ia Supernovae*

07/15/2008 Invited Poster at the *SciDAC 2008* conference (Seattle, WA), entitled: *Astrophysical Applications of the Maestro Code* (with co-authors: A. S. Almgren, J. B. Bell, C. M. Malone, & A. J. Nonaka)

04/06/2007 Astronomy Seminar at Rutgers University (New Brunswick, NJ), entitled: *The Challenges of Modeling Type Ia Supernova*

10/31/2006 Astronomy Colloquia at McGill University (Montreal, CA), entitled: *Understanding Type Ia Supernovae*

06/27/2006 Invited talk at the *SciDAC 2006* conference (Denver, CO), entitled: *The Challenges of Modeling Type Ia Supernovae*

10/03/2005 T-13 Seminar, Los Alamos National Laboratory, entitled: *Simulations of Thermonuclear Flames in Type Ia Supernovae*

06/26/2005 Invited poster at the *SciDAC 2005* conference (San Francisco, CA), *The Physics of Thermonuclear Flames in Type Ia Supernovae*

03/01/2005 Astronomy Seminar at SUNY Stony Brook, *Flame Instabilities in Type Ia Supernovae*

02/23/2005 N Division Seminar, Lawrence Livermore National Laboratory, *Flame Instabilities in Type Ia Supernovae*

12/17/2003 Astrophysics Seminar, Institute for Advanced Study, Princeton, NJ, *Flame Instabilities in Type Ia Supernovae*

Popular Press Features

How Stars Explode, Forbes.com, Oct. 1, 2009
(`http://www.forbes.com/2009/09/30/supernovae-universe-science-technology-breakthroughs-stars.html`)

Unveiled: The First Full 3-D Model of a Star Going Supernova, Popular Science Online, Sept. 24, 2009
(http://www.popsci.com/military-aviation-amp-space/article/2009-09/first-3-d-models-white-dwarf-supernova)

Flash Upon a Neutron Star, American Scientist, Sept.–Oct. 2000, vol. 88, no. 5, p. 400.

Popular Press Mentions

Stars Go Kaboom, Spilling Cosmic Secrets, Science News, 2009, Vol. 176, #4 (Aug. 15, 2009)
(see also http://www.sciencenews.org/view/feature/id/46029/title/Stars_go_kaboom,_spilling_cosmic_secrets)

Supernova explosion simulated in exquisite detail, New Scientist Online, July 2006
(http://www.newscientist.com/article/dn9604-supernova-explosion-simulated-in-exquisite-detail.html)

Life-or-Death Question: How Supernovas Happen? NY Times, Nov. 9, 2004.

Physics Today cover, Feb. 2002.