

# Michael Zingale / Curriculum Vitæ

Department of Physics and Astronomy, Stony Brook University, Stony Brook, NY 11794-3800

*phone:* (631) 632-8225 *e-mail:* michael.zingale@stonybrook.edu

*web:* <http://www.astro.sunysb.edu/mzingale/>

*github:* <https://github.com/zingale>

*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 = 19 (ISI)

### Research Grants/Contracts as Principal Investigator:

2011–2013	Department of Energy, Office of Nuclear Physics (2.5-year renewal), <i>Multidimensional Modeling of Astrophysical Thermonuclear Explosions</i> , DOE DE-FG02-06ER41448	\$253,000
2010–2011	Contract with Lawrence Livermore National Laboratory, <i>Multidimensional Modeling of Nova with Realistic Nuclear Physics</i> , 2010: B589924; 2011: B593287	\$99,768
2009–2011	Department of Energy, Office of Nuclear Physics Outstanding Junior Investigator Award (2-year renewal), <i>Multidimensional Modeling of Astrophysical Thermonuclear Explosions</i> , DOE DE-FG02-06ER41448	\$186,000
2007–2009	Contract with Lawrence Livermore National Laboratory, <i>Verification and Validation of Radiation Hydrodynamics for Astrophysical Applications</i> , 2007: B568673; 2008: B574691; 2009 B582735	\$150,000

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

#### Research Grants/Contracts as Co-Investigator:

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

#### Large Computer Time Allocations:

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

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

### **Stony Brook Physics and Astronomy Teaching Experience:**

<i>Astronomy Today</i> (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)
<i>Introduction to the Solar System</i> (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)
<i>Astronomy</i> (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)
<i>Introduction to Planetary Sciences</i> (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)
<i>Stars</i> (PHY 521)	A graduate-level introduction to the physical processes inside stars, stellar structure and atmospheres, and stellar explosions. (F 2013, F 2015)
<i>Python for Scientific Computing</i> (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)
<i>The Application of Simulation in Astrophysics</i> (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)
<i>Numerical Methods for (Astro)Physics</i> (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)

**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
- 2013–2014 Undergraduate Astronomy Coordinator, 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 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:

2014–	Elected to the OLCF User Group Executive Board (Vice chair: 2014–2015; Chair: 2015–2016)
ongoing	Referee for the <i>Astrophysical Journal</i> , <i>Astronomy and Astrophysics</i> , <i>Nature</i> , <i>Monthly Notices of the Royal Astronomical Society</i> , <i>Journal of Computational Physics</i> , and <i>Nuclear Physics A</i>
2006–	Annual <i>Astronomy Open Night</i> public outreach talks, Stony Brook (Open Night coordinator from Fall 2013–)
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.
2011	External reviewer for DOE Office of Nuclear Physics
2007	External reviewer for NASA Astrophysics Theory and Fundamental Physics Program
2006	Served on NSF Astronomy and Astrophysics Program review panel

### Meeting Organization:

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

### Astrophysical Software / Other Projects:

ongoing	Creator of the Open Astrophysics Bookshelf github organization <a href="http://open-astrophysics-bookshelf.github.io/">http://open-astrophysics-bookshelf.github.io/</a> and author of the open text <i>Computational Hydrodynamics for Astrophysics</i>
---------	--

ongoing	Co-developer of the publicly-available low Mach number hydrodynamics code Maestro, <a href="http://bender.astro.sunysb.edu/Maestro/">http://bender.astro.sunysb.edu/Maestro/</a>
ongoing	Co-developer of the publicly-available compressible hydrodynamics code Castro, <a href="https://ccse.lbl.gov/Downloads/downloadCASTRO.html">https://ccse.lbl.gov/Downloads/downloadCASTRO.html</a>
ongoing	Developed and distribute many simple teaching codes (advection, Eulerian compressible and incompressible hydro solvers, multigrid, etc., with accompanying notes and exercises), <a href="http://www.astro.sunysb.edu/mzingale/software/">http://www.astro.sunysb.edu/mzingale/software/</a>
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), <a href="http://www.astro.sunysb.edu/mzingale/software/astro/">http://www.astro.sunysb.edu/mzingale/software/astro/</a> , also available on youtube, <a href="http://www.youtube.com/user/michaelzingale">http://www.youtube.com/user/michaelzingale</a>
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: <i>Multidimensional Simulations of Convection Preceding a Type Ia X-ray Bursts</i> )
	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

# Michael Zingale / Publications and Talks

## Refereed Publications

40. *Double White Dwarf Mergers on Adaptive Meshes I. Methodology and Code Verification*,  
M. P. Katz, M. Zingale, A. C. Calder, F. D. Swesty, A. S. Almgren, W. Zhang  
2015, submitted to ApJ
39. *Low Mach Number Modeling of Convection in Helium Shells on Sub-Chandrasekhar White Dwarfs II: Bulk Properties of Simple Models*,  
A. M. Jacobs, M. Zingale, A. Nonaka, A. S. Almgren, & J. B. Bell  
2015, submitted to ApJ
38. *Comparisons of Two- and Three-Dimensional Convection in Type I X-ray Bursts*  
M. Zingale, C. M. Malone, A. Nonaka, A. S. Almgren, & J. B. Bell  
2015, ApJ, 807, 60.
37. *On the Piecewise Parabolic Method for Compressible Flow with Stellar Equations of State*,  
M. Zingale & M. P. Katz  
2015, ApJS, 216, 31.
36. *pyro: A teaching code for computational astrophysical hydrodynamics*,  
M. Zingale  
2014, Astronomy & Computing, 6, 52.
35. *Multidimensional Modeling of Type I X-ray Bursts. II. Two-Dimensional Convection in a Mixed H/He Accretor*,  
C. M. Malone, M. Zingale, A. Nonaka, A. S. Almgren, & J. B. Bell  
2014, ApJ, 788, 115.
34. *The Deflagration Stage of Chandrasekhar Mass Models For Type Ia Supernovae: I. Early Evolution*,  
C. M. Malone, A. Nonaka, S. E. Woosley, A. S. Almgren, J. B. Bell, S. Dong, & M. Zingale  
2014, ApJ, 782, 11.
33. *Low-Mach Number Modeling of Core Convection in Massive Stars*,  
C. Gilet, A. S. Almgren, J. B. Bell, A. Nonaka, S. E. Woosley, & M. Zingale  
2013, ApJ, 773, 137.
32. *Low Mach Number Modeling of Convection in Helium Shells on Sub-Chandrasekhar White Dwarfs. I. Methodology*,  
M. Zingale, A. Nonaka, A. S. Almgren, J. B. Bell, C. M. Malone, & R. J. Orvedahl  
2013, ApJ, 764, 97.



31. *High-Resolution Simulations of Convection Preceding Ignition in Type Ia Supernovae Using Adaptive Mesh Refinement*,  
A. Nonaka, A. J. Aspden, M. Zingale, A. S. Almgren, J. B. Bell, & S. E. Woosley  
2012, ApJ, 745, 73.
30. *The Convective Phase Preceding Type Ia Supernovae*,  
M. Zingale, A. Nonaka, A. S. Almgren, J. B. Bell, C. M. Malone, & S. E. Woosley  
2011, ApJ, 740, 8.
29. *Multidimensional Modeling of Type I X-ray Bursts. I. Two-Dimensional Convection Prior to the Outburst of a Pure He Accretor*,  
C. M. Malone, A. Nonaka, A. S. Almgren, J. B. Bell, & M. Zingale  
2011, ApJ, 728, 118.
28. *CASTRO: A New Compressible Astrophysical Solver. I. Hydrodynamics and Self-Gravity*,  
A. S. Almgren, V. E. Beckner, J. B. Bell, M. S. Day, L. H. Howell, C. C. Joggerst, M. J. Lijewski, A. Nonaka, M. Singer, & M. Zingale  
2010, ApJ, 715, 1221.
27. *MAESTRO: An Adaptive Low Mach Number Hydrodynamics Algorithm for Stellar Flows*,  
A. Nonaka, A. S. Almgren, J. B. Bell, M. J. Lijewski, C. Malone, & M. Zingale  
2010, ApJS, 188, 358.
26. *Low Mach Number Modeling of Type Ia Supernovae. IV. White Dwarf Convection*,  
M. Zingale, A. S. Almgren, J. B. Bell, A. Nonaka, & S. E. Woosley  
2009, ApJ, 704, 196.
25. *A New Low Mach Number Approach in Astrophysics*,  
A. S. Almgren, J. B. Bell, A. Nonaka, & M. Zingale  
2009, CiSE, 11, 24.
24. *Turbulence-Flame Interactions in Type Ia Supernovae*,  
A. J. Aspden, J. B. Bell, M. S. Day, S. E. Woosley, & M. Zingale  
2008, ApJ, 689, 1173.
23. *Low Mach Number Modeling of Type Ia Supernovae. III. Reactions*,  
A. S. Almgren, J. B. Bell, A. Nonaka, & M. Zingale  
2008, ApJ 684, 449.
22. *Propagation of the First Flames in Type Ia Supernovae*,  
M. Zingale and L. J. Dursi  
2007, ApJ, 656, 333.

21. *Low Mach Number Modeling of Type Ia Supernovae. II. Energy Evolution*,  
A. S. Almgren, J. B. Bell, C. A. Rendleman, & M. Zingale  
2006, ApJ, 649, 927.
20. *Low Mach Number Modeling of Type Ia Supernovae. I. Hydrodynamics*,  
A. S. Almgren, J. B. Bell, C. A. Rendleman, & M. Zingale  
2006, ApJ, 637, 922.
19. *Three-Dimensional Numerical Simulations of Rayleigh-Taylor Unstable Flames in Type Ia Supernovae*,  
M. Zingale, S. E. Woosley, C. A. Rendleman, M. S. Day, & J. B. Bell  
2005, ApJ, 632, 1021.
18. *Validating an Astrophysical Simulation Codes*,  
A. C. Calder, L. J. Dursi, B. Fryxell, T. Plewa, V. G. Weirs, T. Dupont, H. F. Robey, R. P. Drake,  
B. A. Remington, G. Dimonte, J. Hayes, J. M. Stone, P. M. Ricker, F. X. Timmes, M. Zingale,  
& K. Olson  
2004, CiSE, 6, 10.
17. *Direct Numerical Simulations of Type Ia Supernovae Flames II: The Rayleigh-Taylor Instability*,  
J. B. Bell, M. S. Day, C. A. Rendleman, S. E. Woosley, & M. Zingale  
2004, ApJ, 608, 883.
16. *Direct Numerical Simulations of Type Ia Supernovae Flames I: The Landau-Darrieus Instability*,  
J. B. Bell, M. S. Day, C. A. Rendleman, S. E. Woosley, & M. Zingale  
2004, ApJ, 606, 1029.
15. *On the Nonlinear Evolution of Wind-driven Gravity Waves*,  
A. Alexakis, A. C. Calder, L. J. Dursi, R. Rosner, J. W. Truran, B. Fryxell, M. Zingale, F. X. Timmes,  
K. Olson, & P. Ricker  
2004, Phys. of Fluids, 16, 9, 3256.
14. *Adaptive Low Mach Number Simulations of Nuclear Flames*,  
J. B. Bell, M. S. Day, C. A. Rendleman, S. E. Woosley, & M. Zingale  
2004, JCP, 195, 2, 677.
13. *A Comparative Study of the Turbulent Rayleigh-Taylor Instability Using High-Resolution Three-Dimensional Numerical Simulations: The Alpha-Group Collaboration*,  
G. Dimonte, D. L. Youngs, A. Dimits, S. Weber, M. Marinak, S. Wunsch, C. Garasi, A. Robinson,  
M. J. Andrews, P. Ramaprabhu, A. C. Calder, B. Fryxell, J. Biello, L. Dursi, P. MacNeice,  
K. Olson, P. Ricker, R. Rosner, F. Timmes, H. Tufo, Y.-N. Young, & M. Zingale  
2004, Phys. of Fluids, 16, 5, 1668.

12. *On Heavy Element Enrichment in Classical Novae*,  
A. Alexakis, A. C. Calder, A. Heger, E. F. Brown, L. J. Dursi, J. W. Truran, R. Rosner, D. Q. Lamb, F. X. Timmes, B. Fryxell, M. Zingale, P. M. Ricker, & K. Olson  
2004, ApJ, 602, 931.
11. *Morphology of Rising Hydrodynamic and Magneto-hydrodynamic Bubbles from Numerical Simulations*,  
K. Robinson, L. J. Dursi, P. M. Ricker, R. Rosner, A. C. Calder, M. Zingale, T. Linde, A. Caceres, B. Fryxell, K. Olson, K. Riley, A. Siegel, J. W. Truran, & N. Vladimirova  
2004, ApJ, 601, 621.
10. *Parallel netCDF: A High-Performance Scientific I/O Interface*,  
J. Li, W.-k. Laio, A. Choudhary, R. Ross, R. Thakur, R., W. Gropp, R. Latham, A. Siegel, B. Gallagher, & M. Zingale  
2003, technical paper, SC2003.
9. *The Response of Astrophysical Thermonuclear Flames to Curvature and Stretch*,  
L. J. Dursi, M. Zingale, A. Calder, B. Fryxell, F. X. Timmes, N. Vladimirova, R. Rosner, A. Caceres, D. Q. Lamb, K. Olson, P. M. Ricker, K. Riley, A. Siegel, & J. W. Truran  
2003, ApJ, 595, 955.
8. *Mapping Initial Hydrostatic Models in Godunov Codes*,  
M. Zingale, L. J. Dursi, J. ZuHone, A. C. Calder, B. Fryxell, T. Plewa, J. W. Truran, A. Caceres, K. Olson, P. M. Ricker, K. Riley, R. Rosner, A. Siegel, F. X. Timmes, & N. Vladimirova  
2002, ApJS, 143, 539.
7. *On Validating an Astrophysical Simulation Code*,  
A. C. Calder, B. Fryxell, T. Plewa, R. Rosner, L. J. Dursi, V. G. Weirs, T. Dupont, H. F. Robey, J. O. Kane, B. A. Remington, R. P. Drake, G. Dimonte, M. Zingale, F. X. Timmes, K. Olson, P. Ricker, P. MacNeice, & H. M. Tufo  
2002, ApJS, 142, 201.
6. *A Case Study in Application I/O on Linux Clusters*,  
R. Ross, D. Nurmi, A. Cheng, & M. Zingale  
2001, technical paper, SC2001.
5. *Helium Detonations on Neutron Stars*,  
M. Zingale, F. X. Timmes, B. Fryxell, D. Q. Lamb, K. Olson, A. C. Calder, L. J. Dursi, P. Ricker, R. Rosner, P. MacNeice, & H. Tufo  
2001, ApJS, 133, 195.

4. *High-Performance Reactive Fluid Flow Simulations Using Adaptive Mesh Refinement on Thousands of Processors*,  
A. C. Calder, B. C. Curtis, L. J. Dursi, B. Fryxell, G. Henry, P. MacNeice, K. Olson, P. Ricker, R. Rosner, F. X. Timmes, H. M. Tufo, J. W. Truran, & M. Zingale  
2000, Gordon Bell Prize winner/Special category, technical paper, SC2000.
3. *On the Cellular Structure of Carbon Detonations*,  
F. X. Timmes, M. Zingale, K. Olson, B. Fryxell, P. Ricker, A. C. Calder, L. J. Dursi, J. W. Truran, & R. Rosner  
2000, ApJ, 543, 938.
2. *FLASH: An Adaptive Mesh Hydrodynamics Code for Modeling Astrophysical Thermonuclear Flashes*,  
B. Fryxell, K. Olson, P. Ricker, F. X. Timmes, M. Zingale, D. Q. Lamb, P. MacNeice, R. Rosner, & H. Tufo  
2000, ApJS, 131, 273.
1. *Flash Code: Studying Astrophysical Thermonuclear Flashes*,  
R. Rosner, A. Calder, J. Dursi, B. Fryxell, D. Q. Lamb, J. C. Niemeyer, K. Olson, P. Ricker, F. X. Timmes, J. Truran, H. Tufo, Y. Young, M. Zingale, E. Lusk, & R. Stevens  
2000, CiSE, 2, 33.

### Conference Proceedings

23. *Understanding Ignition in Type Ia Supernovae*,  
M. Zingale, A. Jacobs, A. S. Almgren, J. B. Bell, A. Nonaka, C. Malone, & S. Woosley  
2015, extended abstract for the 25<sup>th</sup> International Colloquium on the Dynamics of Explosions and Reactive Systems, Leeds, UK, Aug. 2–7, 2015.
22. *Low Mach Number Modeling of Stratified Flows*,  
A. S. Almgren, J. B. Bell, A. Nonaka, & M. Zingale  
2014, in Finite Volumes for Complex Applications VII: Methods, Theoretical Aspects—FVCA 7, Berlin, June 2014, ed. Fuhrmann, J., Oehlberger, M., & Rohde, C., 3–15  
Proceedings of the FVCA7 - The International Symposium of Finite Volumes for Complex Applications VII Berlin, June 15–20, 2014
21. *From Convection to Explosion: End-to-End Simulation of Type Ia Supernovae*,  
A. Nonaka, A. S. Almgren, J. B. Bell, H. Ma, S. E. Woosley, & M. Zingale  
2011, Proceedings of SciDAC 2011, Denver, CO, July 10–14, 2011, <http://press.mcs.anl.gov/scidac2011/>
20. *MAESTRO, CASTRO, and SEDONA — Petascale Codes for Astrophysical Applications*,  
A. Almgren, J. Bell, D. Kasen, M. Lijewski, A. Nonaka, P. Nugent, C. Rendlement, R. Thomas, & M. Zingale

- 2010, Proceedings of the 2010 Scientific Discovery through Advanced Computing (SciDAC) Conference. Chattanooga, Tennessee, July 11–15, 2010. Oak Ridge National Laboratory. <http://computing.ornl.gov/workshops/scidac2010/>
19. *Type Ia Supernovae: Advances in Large Scale Simulation*,  
H. Ma, M. Zingale, S. E. Woosley, A. J. Aspden, J. B. Bell, A. S. Almgren, A. Nonaka, & S. Dong  
2010, Proceedings of the 2010 Scientific Discovery through Advanced Computing (SciDAC) Conference. Chattanooga, Tennessee, July 11–15, 2010. Oak Ridge National Laboratory. <http://computing.ornl.gov/workshops/scidac2010/>
  18. *Type Ia Supernovae: Advances in Large Scale Simulation*,  
S. E. Woosley, A. S. Almgren, A. J. Aspden, J. B. Bell, D. Kasen, A. R. Kerstein, H. Ma, A. Nonaka, & M. Zingale  
2009, Proceedings of SciDAC 2009, Journal of Physics: Conference Series, 180, 012023.
  17. *Astrophysical Applications of the Maestro Code*,  
M. Zingale, A. S. Almgren, J. B. Bell, C. M. Malone, & A. Nonaka  
2008, Proceedings of SciDAC 2008, Journal of Physics: Conference Series, 125, 012013.
  16. *Type Ia supernovae*,  
S. E. Woosley, A. Almgren, J. B. Bell, G. Glatzmaier, D. Kasen, A. R. Kerstein, H. Ma, P. Nugent, F. Röpke, V. Sankaran, & M. Zingale  
2007, Proceedings of SciDAC 2007, Journal of Physics: Conference Series, 78, 012081.
  15. *MAESTRO: A Low Mach Number Stellar Hydrodynamics Code*,  
A. S. Almgren, J. B. Bell, & M. Zingale  
2007, Proceedings of SciDAC 2007, Journal of Physics: Conference Series, 78, 012085.
  14. *New Approaches for Modeling Type Ia Supernovae*,  
M. Zingale, A. S. Almgren, J. B. Bell, M. S. Day, C. A. Rendleman, & S. E. Woosley  
2006, Proceedings of SciDAC 2006, Journal of Physics: Conference Series, 46, 385.
  13. *Efficiency Gains from Time Refinement on AMR Meshes and Explicit Timestepping*,  
L. J. Dursi & M. Zingale  
2005, Adaptive Mesh Refinement—Theory and Applications, Proceedings of the Chicago Workshop on Adaptive Mesh Refinement Methods, Sept. 3–5, 2003 Series: Lecture Notes in Computational Science and Engineering, Vol. 41 Plewa, Tomasz; Linde, Timur; Weirs, V. Gregory (Eds.) 2005, XIV, 554
  12. *The Physics of Flames in Type Ia Supernovae*,  
M. Zingale, S. E. Woosley, J. B. Bell, M. S. Day, & C. A. Rendleman  
2005, Proceedings of SciDAC 2005, Journal of Physics: Conference Series, 16, 405.

11. *Simulations of Rising Hydrodynamic and Magnetohydrodynamic Bubbles*,  
P. M. Ricker, K. Robinson, L. J. Dursi, R. Rosner, A. C. Calder, M. Zingale, J. W. Truran,  
T. Linde, A. Caceres, B. Fryxell, K. Olson, K. Riley, K. A. Siegel, & N. Vladimirova  
2004, Proceedings of The Riddle of Cooling Flows in Galaxies and Clusters of Galaxies, held  
in Charlottesville, VA, May 31–June 4, 2003, Eds. T. Reiprich, J. Kempner, and N. Soker.
10. *Investigations of Pointwise Ignition of Helium Deflagrations on Neutron Stars*,  
M. Zingale, S. E. Woosley, A. Cumming, A. Calder, L. J. Dursi, B. Fryxell, K. Olson, P. Ricker,  
R. Rosner, & F. X. Timmes  
2002, 3D Stellar Evolution, ASP Conference Proceedings, Vol. 293, 22–26 July 2002 at UC  
Davis, Livermore, CA, Ed. by S. Turcotte, S. C. Keller, & R. M. Cavallo.
9. *Onset of Convection on a Pre-Runaway White Dwarf*,  
L. J. Dursi, A. C. Calder, A. Alexakis, J. W. Truran, M. Zingale, B. Fryxell, P. Ricker, F. X. Timmes,  
& K. Olson  
2002, Classical Nova Explosions: International Conference on Classical Nova Explosions.  
AIP Conference Proceedings, Vol. 637. Sitges, Spain, 20–24 May, 2002. Edited by M. Hernanz  
& J. Jose
8. *Mixing by Non-linear Gravity Wave Breaking on a White Dwarf Surface*,  
A. C. Calder, A. Alexakis, L. J. Dursi, R. Rosner, J. W. Truran, B. Fryxell, P. Ricker, M. Zingale,  
K. Olson, F. X. Timmes, & P. MacNeice  
2002, Classical Nova Explosions: International Conference on Classical Nova Explosions.  
AIP Conference Proceedings, Vol. 637. Sitges, Spain, 20–24 May, 2002. Edited by M. Hernanz  
& J. Jose
7. *Mixing by Wave Breaking at the Surface of a White Dwarf*,  
J. W. Truran, A. Alexakis, A. C. Calder, L. J. Dursi, M. Zingale, B. Fryxell, P. Ricker, F. X. Timmes,  
K. Olson, & R. Rosner  
2002, Proceedings of the 11th Workshop on “Nuclear Astrophysics”, Ringberg Castle, Te-  
gernsee, Germany, February 11–16, 2002 / Wolfgang Hillebrandt and Ewald Mäijller (Eds.).  
MPA/P13, Garching b. München, Germany: Max-Planck-Institut für Astrophysik, 186.
6. *Numerical Simulations of Thermonuclear Flashes on Neutron Stars*,  
B. Fryxell, M. Zingale, F. X. Timmes, D. Q. Lamb, K. Olson, A. C. Calder, L. J. Dursi, P. Ricker,  
R. Rosner, J. W. Truran, P. MacNeice, & H. Tufo  
2001, Nuclear Physics A, 688, 172.
5. *Quenching Processes in Flame-Vortex Interactions*,  
M. Zingale, J. C. Niemeyer, F. X. Timmes, L. J. Dursi, A. C. Calder, B. Fryxell, D. Q. Lamb,  
K. Olson, P. Ricker, R. Rosner, J. W. Truran, & P. MacNeice  
2001, 20th Texas Symposium on Relativistic Astrophysics, Austin, Texas, 10–15 Dec. 2000,  
Melville, NY: AIP Conference Proceedings, Vol. 586. Edited by J. C. Wheeler & H. Martel.

4. *Simulations of Astrophysical Fluid Instabilities,*

A. C. Calder, B. Fryxell, R. Rosner, L. J. Dursi, K. Olson, P. M. Ricker, F. X. Timmes, M. Zingale, P. MacNeice, & H. M. Tufo

2001, 20th Texas Symposium on Relativistic Astrophysics, Austin, Texas, 10–15 Dec. 2000, Melville, NY: AIP Conference Proceedings, Vol. 586. Edited by J. C. Wheeler & H. Martel.

3. *Adaptive Mesh Simulations Of Astrophysical Detonations Using the ASCI Flash Code,*

B. Fryxell, A. C. Calder, L. J. Dursi, D. Q. Lamb, P. MacNeice, K. Olson, P. M. Ricker, R. Rosner, F. X. Timmes, J. W. Truran, H. M. Tufo, & M. Zingale

Proceedings of the VII International Workshop on Advanced Computing and Analysis Techniques in Physics Research (ACAT 2000), Fermilab, October 16–20, 2000.

2. *Large-Scale Simulations of Clusters of Galaxies,*

P. M. Ricker, A. C. Calder, L. J. Dursi, B. Fryxell, D. Q. Lamb, P. MacNeice, K. Olson, R. Rosner, F. X. Timmes, J. W. Truran, H. M. Tufo, & M. Zingale

Proceedings of the VII International Workshop on Advanced Computing and Analysis Techniques in Physics Research (ACAT 2000), Fermilab, October 16–20, 2000.

1. *Helium Detonations on Neutron Stars,*

B. Fryxell, M. Zingale, F. X. Timmes, D. Q. Lamb, K. Olson, A. C. Calder, L. J. Dursi, P. Ricker, R. Rosner, J. W. Truran, P. MacNeice, & H. Tufo

Proceedings of the 10th Workshop on “Nuclear Astrophysics”, Ringberg Castle, Tegernsee, Germany, March 20–25 2000.

## White Papers

2. *Modeling Astrophysical Explosions with Sustained Exascale Computing,*

M. Zingale, A. C. Calder, C. M. Malone, & F. X. Timmes

2015, Response to RFI NOT-GM-15-122: *Science Drivers Requiring Capable Exascale High Performance Computing*

1. *The LOFT perspective on neutron star thermonuclear bursts,*

J. J. M. in 't Zand, D. Altamirano, D. R. Ballantyne, S. Bhattacharyya, E. F. Brown, Y. Cavecchi, D. Chakrabarty, J. Chenevez, A. Cumming, N. Degenaar, M. Falanga, D. K. Galloway, A. Heger, J. José, L. Keek, M. Méndez, S. Mahmoodifar, M. Linares, C. M. Malone, M. C. Miller, F. B. S. Paerels, J. Poutanen, A. Różańska, H. Schatz, M. Serino, V. F. Suleimanov, T. E. Strohmayer, F.-K. Thielemann, A. L. Watts, N. N. Weinberg, S. E. Woosley, W. Yu, S. Zhang, & M. Zingale

2015, White Paper in Support of the Mission Concept of the Large Observatory For x-ray Timing

**Invited Lectures / Seminars / Colloquia**

- 01/22/2016 Seminar at the U. S. Naval Research Laboratory, *Computational Challenges of Modeling X-ray Bursts and Type Ia Supernovae* (upcoming)
- 08/02/2015 Invited talk at the *International Colloquium on the Dynamics of Explosions and Reactive Systems (ICDEERS)*, 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 Dartmouth, *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](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.