

Donald E. Willcox / Curriculum Vitæ

Computational Research Division
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Present Position:

2018– *Postdoctoral Researcher*, Computational Research Division, LBNL

Research Interests and Expertise:

In my graduate research at Stony Brook University I focused on large scale low Mach hydrodynamics simulations of convective white dwarf interiors and developed code support for general reaction networks. In my postdoc at LBNL, I continue to develop reaction network solvers for GPUs. I also work on a broader set of computational astrophysics interests as part of the Exastar collaboration within the DOE's Exascale Computing Project. My research includes nuclear reactions in X-ray bursts, scalable numerical general relativity solvers, radiation hydrodynamics for core-collapse supernovae, and neutrino quantum kinetics.

Professional Preparation:

Stony Brook University – Stony Brook, NY, USA

Ph.D., Physics, August 2018

LeTourneau University – Longview, TX, USA

B.S., Engineering Physics, May 2011
B.S., Electrical Engineering, May 2011
Minors: Mathematics, Applied Sciences

Large Computer Time Allocations:

2019 Senior Investigator on a NERSC 2020 Allocation, *Three-dimensional studies of white dwarfs, massive stars, and neutron star systems* (30 M MPP hours)

2019-2020 Co-Investigator on an INCITE 2019 award 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)

2018 Senior Investigator on a NERSC 2018 Allocation, *Three-dimensional studies of white dwarf and neutron star systems* (20.8 M MPP hours)

2018 Co-Investigator on an INCITE 2018 award at OLCF, *Approaching Exascale Models of Astrophysical Explosions* (40 Mh)

Synergistic Activities:

- Developed and presented tutorials for the mesh refinement library AMReX at the 2019 & 2020 Argonne Training Program on Extreme Scale Computing.
- Mentor for NSF MSGI program (2020).
- Referee for the *Astrophysical Journal*, *Communications in Applied Mathematics and Computational Science*
- Core developer of the **Castro** simulation code for astrophysical radiation-hydrodynamics on adaptive meshes, <https://github.com/amrex-astro/Castro>
- Core developer of the **Starkiller Microphysics** code, a collection of publicly-available astrophysical microphysics routines and network integrators, <https://github.com/starkiller-astro/Microphysics>
- Co-developer of **pynucastro**, a publicly-available Python interface to the JINA Reaclib nuclear reaction rate database for rate visualization and ODE right hand side generation, <https://github.com/pynucastro/pynucastro>

Selected Publications:

1. *Preparing Nuclear Astrophysics for Exascale*
M. Katz, A. Almgren, M. Barrios Sazo, K. Eiden, K. Gott, A. Harpole, J. Sexton, D. Willcox, W. Zhang, & M. Zingale
Accepted to Supercomputing 20.
2. *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, *Astrophysical Journal*, 894, 1
3. *SN Ia Explosions from Hybrid Carbon-Oxygen-Neon White Dwarf Progenitors That Have Mixed During Cooling*
C. N. Augustine, D. E. Willcox, J. Brooks, D. M. Townsley, & A. C. Calder
2019, *Astrophysical Journal*, 887, 2
4. *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
2019, arXiv 1910.12578, Submitted to proceedings of Astronom 2019.
5. *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, 012024