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Donald E. Willcox

ACADEMIC GOALS

I am pursuing a career in computational astrophysics studying supernovae and their progenitors at either a national laboratory or research university upon completion of the Ph.D. program in Physics and Astronomy at Stony Brook University.

EDUCATION

Stony Brook University – Stony Brook, NY, USA

Ph.D. Candidate in Physics and Astronomy (Expected May 2017)
Field: Nuclear Astrophysics
Overall GPA: 3.66

LeTourneau University – Longview, TX, USA

B.S., Engineering Physics, May 2011
B.S., Electrical Engineering, May 2011
Minors: Mathematics, Applied Sciences
Overall GPA: 3.92

CAREER DEVELOPMENT

October 2015: Participated in OpenACC Hackathon hosted by Oak Ridge National Laboratory.

August 2015: Attended the Argonne Training Program on Extreme-Scale Computing (ATPESC).

June 2014: Attended the JINA TALENT Course on Nuclear Theory for Astrophysics at Michigan State University.

August 2014: Attended the MESA Summer School for simulating massive stars, accreting white dwarfs, stellar mixing processes and more at UC Santa Barbara.

RESEARCH

2014-present: Type Ia Supernovae: C, O, Ne Hybrids and the Urca Process
(Stony Brook University, Stony Brook, NY)

I am currently completing a project using the FLASH code for simulating the thermonuclear runaway of a predicted class of ^{20}Ne-rich white dwarf stars as Type Ia supernovae. I characterized the nuclear burning via detonation structure calculations and adjusted the flame model in FLASH accordingly before performing and analyzing a suite of explosion simulations.

Next, I am using MAESTRO to model the Urca process, the as-yet incompletely studied interplay between weak nuclear reactions and convective flow within simmering white dwarf stars. Determining the resulting white dwarf structure and energetics will remove a significant source of uncertainty from studies of dark energy and the expansion of the universe.

2013: Numerical Simulation of a Yb Fiber Laser
(Stony Brook University, Stony Brook, NY)

Using the absorption and emission spectrum of Yb, I developed a simulation of laser dynamics in a fiber amplifier for high harmonic generation, a technique for measuring high-frequency molecular dipoles.

2010: W-boson Helicity Studies for the ATLAS collaboration
(Georg-August Universität, Göttingen, Germany)
> I explored the sensitivity to W-boson helicity of the invariant mass of the b-quark and charged lepton in the semileptonic top-quark decay channel using template fits to simulated events.

2010: Analysis of a Resonant Cavity for 21cm Astronomy
(LeTourneau University, Longview, TX)
> Using a finite-difference time-domain analysis, I characterized the frequency response of an electromagnetic cavity resonator as a feed horn in a radio telescope for 21cm astronomy.

2009-2010: Implementation of a Digital Radio Mondiale Receiver
(LeTourneau University, Longview, TX)
> I led a five-person team developing digital filtering and demodulation software and hardware implementing the Digital Radio Mondiale standard.

PUBLICATIONS Willcox, Donald E., Dean Townsley, Alan Calder, Pavel Denissenkov, and Falk Herwig. Type Ia Supernova Explosions From Hybrid Carbon-Oxygen-Neon White Dwarf Progenitors. (Submitted to ApJ)

(Poster) Willcox, Donald, Dean Townsley, Alan Calder, Pavel Denissenkov, and Falk Herwig. Thermonuclear Supernova Explosions From Hybrid White Dwarf Progenitors. 227th AAS Meeting. January 2016.

(Poster) Willcox, Donald, Dean Townsley, Alan Calder, Pavel Denissenkov, and Falk Herwig. A Comparison of Type Ia Supernovae with C-O and Hybrid C-O-Ne White Dwarf Progenitors. F.O.E. Fifty-One Erg International Workshop, North Carolina State University, NC. June 2015.

(Poster) Willcox, Donald, Dean Townsley, and Alan Calder. A Study of Steady-State Detonation Structures for Hybrid C, O, Ne White Dwarf Models. International Conference: "Type Ia Supernovae: Progenitors, Explosions, and Cosmology," University of Chicago, IL. September 2014.

(Poster) Willcox, Donald, Melanie Reber, Yuning Chen, Karabi Halder, and Thomas Allison. Imaging Molecular Structure With High Harmonics. Chemistry Research Day, Stony Brook University, NY. 2013.

(Poster) Reber, Melanie A., Yuning Chen, Donald Willcox, and Thomas Allison. Cavity-Enhanced Transient Absorption Spectroscopy. Chemistry Research Day, Stony Brook University, NY. 2013.

Willcox, Donald E., Joonwan Kim, and John Wineman. Implementation of Digital Radio Mondiale receiver Part II. IEEE 43rd Southeastern Symposium on System Theory, Auburn, AL. March 2011.

Willcox, Donald E., Joonwan Kim, Chris Loewen, and John Wineman. Implementation of Digital Radio Mondiale Receiver - Part I. IEEE 42nd Southeastern Symposium on System Theory, Tyler, TX. March 2010.

Leiffer, P., Joonwan Kim, R. William Graff, and Don Willcox. Diversity Receiver for Digital Radio Mondiale - a multi-year design project. ASEE 2010 Annual Conference & Exposition, Louisville, KY. June 2010.

COURSEWORK I have completed graduate coursework in solid state physics, particle physics, quantum field theory, general relativity, and cosmology in addition to traditional core courses. As of Fall 2014, I satisfied all course requirements for the Physics Ph.D.

TEACHING   **Stony Brook University**
- *IACS Computes!* (Summer 2015) Taught as a TA for the Stony Brook Institute for Advanced Computational Sciences summer Python programming workshop for high school students.
- *Astronomy* (Spring 2014) Assisted for a course on astronomy for undergraduates majoring in physics and astronomy.
- *Modern Physics* (Spring 2013) Instructed undergraduate lab for a course on relativity and quantum mechanics for physics undergraduates.
- *CSTEP Introduction to Calculus II* (Summer 2012) Instructor for a 3-week summer course introducing incoming freshman students to integral calculus.
- *Introductory Physics* (2012) Taught undergraduate lab exercises in electricity and magnetism.

LeTourneau University
I taught recitation sessions emphasizing concepts and solution techniques for the following undergraduate physics courses.
- *Electricity and Magnetism* (Fall 2008, Fall 2009, Fall 2010)
- *Classical Mechanics* (Spring 2010)