Matthew R. Terry, Ph.D.

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Objective

I am seeking a position involving the application of computational tools in the analysis and solution of scientific and technical problems.

Personal Information

- United States Citizen
- US Department of Energy "Q" Clearance

Education

- **University of Wisconsin-Madison**
  Ph.D. Nuclear Engineering
  Thesis: Effect of Different Charged Particle Stopping Power Models on ICF Ignition
  Advisor: Gregory A. Moses
- **University of Wisconsin-Madison**
  M.S. Nuclear Engineering
  Graduated May 2006, 3.53 GPA
- **Georgia Institute of Technology**
  B.S. Nuclear and Radiological Engineering with Honors
  Graduated May 2004, 3.77 GPA

Publications

Refereed Journals

[1] M R Terry, L.J. Perkins, and S. M. Sepke. Design of a DT-Ablator Shock Ignition Target for the National Ignition Facility. *Physics of Plasmas*, 2012.

[2] W M Stacey, V L Beavers, W A Casino, J R Cheatham, Z W Friis, R D Green, W R Hamilton, K W Haufler, J D Hutchinson, W J Lackey, R A Lorio, J W Maddox, J Mandrekas, A A Manzoor, C A Noelke, C D E Oliveira, M Park, D W Tedder, M R Terry, and E A Hoffman. A Subcritical, Gas-Cooled Fast Transmutation Reactor with a Fusion Neutron Source. 150(May), 2005.

Refereed Conference Proceedings

[1] Joseph Koning and Matthew Terry. Automation of Inertial Fusion Target Design with Python. In Stéfan van der Walt and Jarrod Millman, editors, *Proceedings of the 10th Python in Science Conference*, pages 1–5, 2011.

Invited Talks

[1] Matthew Terry. The Python Ecosystem or Scientific Computing. In *Guest Lecture at University of San Francisco*, 2013.

[2] Matthew Terry. Tamped Heavy Ion Targets. In *19th International Symposium on Heavy Ion Inertial Fusion*, 2012.

Ph.D. Thesis

[1] Matthew R Terry. *Effect of Different Charged Particle Stopping Power Models on ICF Ignition*. PhD thesis, University of Wisconsin-Madison, 2010.

Conference Proceedings

[1] Matthew Terry and John Perkins. Stability of Tamped Spherical Heavy Ion ICF Targets. In *Bulletin of the American Physical Society*, volume Volume 57,. American Physical Society, November 2012.

[2] Matthew Terry, John Perkins, and John Barnard. Directly driven, tamped heavy ion ICF targets. In *Bulletin of the American Physical Society*, volume Volume 56,. American Physical Society, November 2011.

[3] Matthew Terry and Gregory Moses. Comparison of Stopping Power Models in Shock Ignition Target Simulations. In *Bulletin of the American Physical Society*, volume Volume 55,. American Physical Society, November 2010.

[4] Matthew Terry and Gregory Moses. Sensitivity of Thermonuclear Burn to Charged Particle Stopping Power Models in NIF-like Targets. In *Bulletin of the American Physical Society*, volume Volume 54,. American Physical Society, November 2009.

[5] Matthew Terry and Ogden Jones. Modeling of Omega Thinshell Experiments. In *Bulletin of the American Physical Society*, 2004.

Technical Experience

Post-Doctoral Research

My post-doctoral research has focused on the design of novel inertial confinement fusion targets and on designing high energy density physics experiments. I developed a shock ignition target compatible with "day one" hardware on the recently completed National Ignition Facility (NIF) in Livermore, CA.
I developed a direct drive heavy ion driven ignition target that makes use of a long range heavy ion deposition and tamped ablation to achieve high drive efficiency. Additional work has expended into the design of laser driven hydrodynamics experiments intended to test the physics of the ion driven X-target.
My current research activities have focused on developing high power laser experiments on two high power laser systems: NIF (Livermore, CA) and Omega (Rochester, NY). These experiments are intended to measure the material properties of metals under high pressure ($10^5 - 510^6$ times atmospheric pressure). Specifically, I have helped design, specify, and analyze successful experiments over a broad range of conditions. Experiments include:

1. the measurements of the crystalline structure of thin (5 micron) Tantalum foils while subjected to 300 kBar shocks

2. testing of a high energy (22 keV) silver x-ray backlighter intended for radiography of Tantalum under high pressure (5 MBar)

3. the measurement of the growth of Rayleigh-Taylor unstable perturbations subject to a ramped pressure drive

Ph.D. Research

My Ph.D. research studied the effect of different charged particle stopping power models on the performance of inertial confinement fusion (ICF) targets. Much work went into the development of a library ("Deeks") that implements many different models and does extensive consistency checking between the model and the conditions to which it is applied. This library has been integrated into the pre-existing time dependent charged particle tracking (a Monte Carlo-like transport scheme) package in an existing multi-physics code ("Bucky"). The integration allows me to examine the effect of different transport models in integrated realistic simulations.

More specifically, my research involves studying the effect collision operators have on transport properties of the plasma. Due to the particularly high densities of ICF plasmas, this requires a careful, combined treatment of both the collisional and dielectric properties of the plasma, that is use of so-called "convergent" kinetic theories. I have implemented stopping power models by Landau; Spitzer; Jackson; Brysk; Skupsky; Kihara and Aono; May and Cramer; Li and Petrasso; and Brown, Preston, and Singleton. In my own research, I have derived and implemented Fermi-degenerate extensions of the Landau and Li and Petrasso models. I am currently composing papers for publication on my Fermi-degenerate extension work and another on my analysis of the applicability of existing stopping power models in ICF ignition experiments.

Software Development

Over the course of my research, I have developed a significant amount of scientific software. I am a skilled Python developer, with 8 years of experience with NumPy, SciPy, Matplotlib, Cython, PyTables, etc. I am proficient in Fortran, C, and C++ and have experience working in parallel environments. I am a vim, git, and LaTeXuser and am at home with the command-line.

The computing aspect of my Ph.D. research required the integration of a library written in C++ (Deeks) with an existing Fortran program (Bucky). Data analysis in compiled languages is overly time intensive, so I developed Python interfaces to both codes. The flexibility provided by the Python interface enabled the rapid development of an automatic shock tuner for Bucky. The tuner completely automates a previously labor and analysis intensive process. What once took a week, can now be accomplished in hours.

Undergraduate Research at LLNL

- Summers 2003, 2004 - Worked with Ogden Jones on the analysis of ICF thinshell symmetry experiments using view-factor codes and radiation hydrodynamics code Hydra.

- Summer 2002 - Worked with Dmitri Ryutov on magnetic islands in SSPX

Professional Societies

- The American Physical Society

Technical Leadership

Propsal Writing

I am the LLNL Primary Investigator for a 3-year, $6M proposal the US DoE Office of Science to. The proposal seeks funding to experimentally investigate the physics of shock reflection and the evolution of the Kelvin-Hemholtz instability in conditions relevant to an ion driven fusion energy target design. If funded, I would be responsible for directing as $1.1M in funds over three years and managing a group of senior research scientists. The proposal is in collaboration with scientists at Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, and the Princeton Plasma Physics Laboratory.

Scientific Programming in Python Program Committee 2012-2013

The Program Committee for the Scientific Programming in Python Conference is responsible for reviewing and selecting talks from submitted proposals. Committee is also responsible for reviewing submitted papers submitted to the conference proceedings.

The Hacker Within 2008-2011, Software Carpentry 2012-present

The Hacker Within (THW) is a student-led, skill sharing interest group for scientific software development. It was founded in 2008 by two colleagues and myself. We hold bi-weekly meetings and hold occasional "boot camps," highly focused multi-day workshops. Our most recent boot camp on the Python programming language (`http://python.hackerwithin.org`) had more than 70 attendees from 20 departments and included more than 18 hours of instruction. In addition to organization, I was responsible for teaching the sessions "Modules, Scripts, Packages and Classes," "Graphing with MatPlotLib," "Extending python with C/C++ using SWIG," and "Batteries Included - The Python Standard Library." The Hacker Within collaborates with Software Carpentry to teach THW-style workshops at universities and laboratories across the US and Europe.

Community Leadership

The Journey Community Church Council

From 2009-2010, I was been one of 5 members of The Journey Community's Church Council. Members of the council, are responsible for overseeing the church's finances. They are responsible for setting the budget for the church and making financial decisions for the church. Additionally, they oversee the finances of Beautiful Child, a charity that sponsors an orphanage in Jacmel, Haiti.

Jumptown

From 2002-2004 I was president of a swing dancing club. I was responsible for organizing weekly classes, monthly dances and semesterly workshops. Under my supervision the club grew from about 20 people to more than 100 and oversaw a budget of several thousand dollars.

Awards

- National Physical Sciences Consortium Fellowship in conjunction with Sandia National Laboratories 2007-2010
- James Poukey Fellowship 2006
- National Academy for Nuclear Training Scholarship 2002-2004
- American Nuclear Society Scholarship 2002-2003