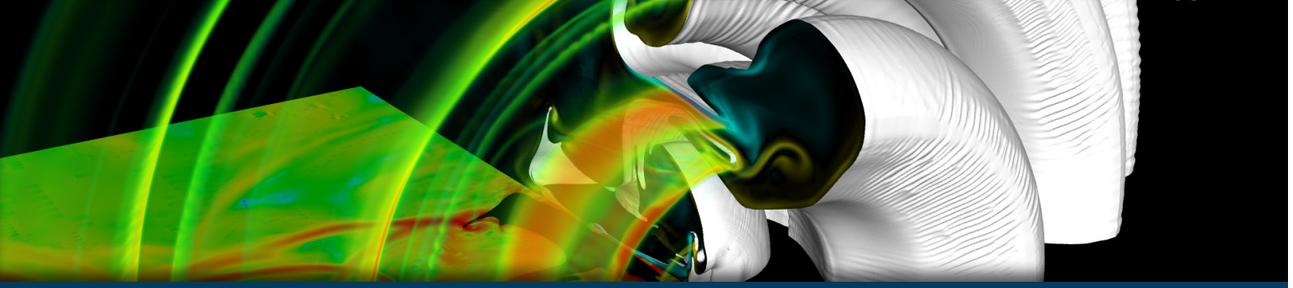
Los Alamos National Laboratory

Where Should You Begin Your Career in Computational Physics?

At the Birthplace of Computational Physics!

Learn about Opportunities for Graduate Students and Postdocs at Los Alamos National Laboratory



Computational Physics at Los Alamos National Laboratory

What do we do?

The X Computational Physics Division (XCP) develops and uses multiphysics simulation codes, as well as underlying physics models and numerical algorithms, to support basic science and applications in national nuclear security. We take advantage of some of the world's fastest and most advanced computing platforms running state-of-the-art simulation codes to study a variety of complex physics problems.

Who are we?

XCP Division employs more than 120 scientists from a diverse set of technical backgrounds, including physics, nuclear engineering, mechanical engineering, aeronautical science, and applied mathematics. Scientists and engineers at various stages in their careers contribute to the work of our division, including students, postdocs, and full staff members. Eighty-seven percent of our technical staff has earned a PhD, 39% of our full staff members began as postdocs, and 23% were students at Los Alamos National Laboratory (LANL). Many of our scientists are internationally recognized within their technical fields.

Why work with us?

Working in XCP Division provides you the opportunity to interact with multiple scientific disciplines to pursue basic science while solving complex problems relevant to national security. We collaborate extensively with other organizations at LANL, with our sister national laboratories, and with colleagues throughout the US and internationally. Such interactions create a challenging, enriching, and unforgettable learning experience.

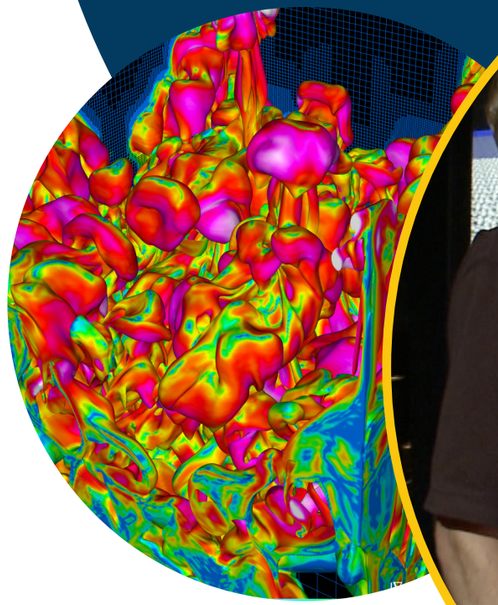
Taking the next step

We are seeking graduate students and postdoctoral candidates with expertise related to specific research areas. Take a look at those areas and see what piques your interest, and send your resume and a cover letter to the contact person shown.

The Los Alamos Dual Career Services program

The program offers employee spouses and partners help with job searches, which includes making network contacts and providing guidance with applying for job openings at the Laboratory

For more information, contact them at dualcareers@lanl.gov.



Modeling and Simulation

The Lagrangian Codes and Eulerian Codes projects develop large-scale (~1M SLOC) production-quality, massively parallel, multiphysics simulation codes. As part of our recruiting efforts to fulfill long-term staffing needs, we have opportunities for graduate students and postdocs with experience and interest in code development, modeling, and the simulation of one or more of the following:

- Compressible hydrodynamics
- High-energy density physics
- Radiation hydrodynamics
- High explosives
- Computational geometry and mesh generation
- Solid mechanics
- Radiation and neutron transport
- Turbulent mixing
- Thermonuclear burn physics

Because of our focus on large-scale codes, we are especially interested in students and postdocs who have a strong interest in software development appropriate for high-performance computing, especially as we begin evolving our codes from an “MPI-everywhere” approach to one more conducive to new computing architectures such as the Intel MIC and GPGPUs.

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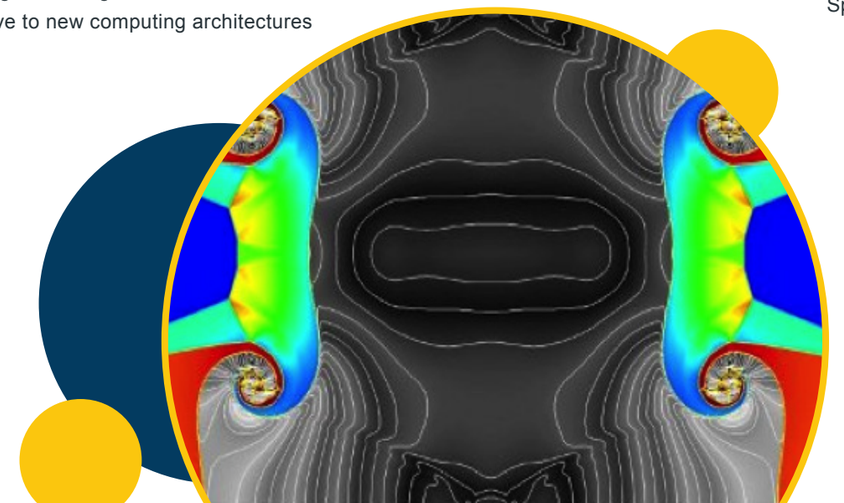

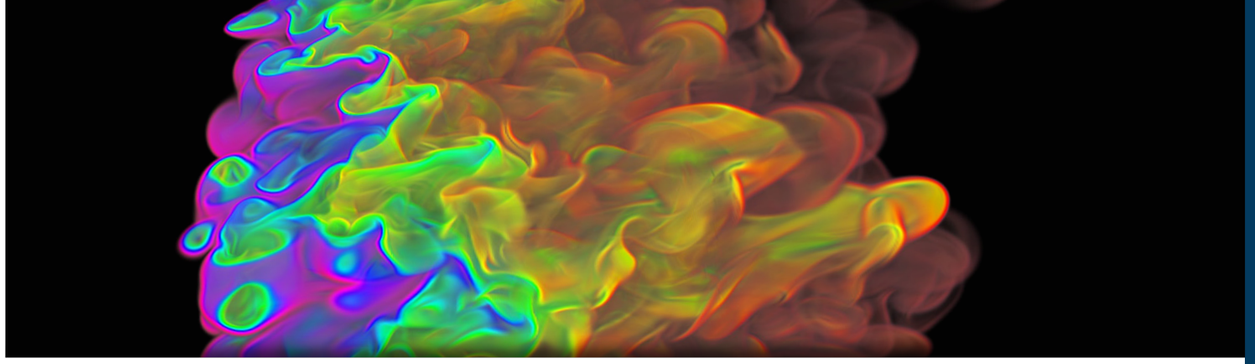

Computational Methods, Algorithms, and Physical Models

Postdoctoral candidates with an interest in computational methods and algorithms will find research opportunities involving the development of algorithms and physics-based models. Of particular current interest are multiscale algorithms, multiphysics coupling methods for exascale computing, shock hydrodynamics, strength of materials, reactive flow, instabilities and turbulence mixing, interfacial dynamics with heat and mass transfer. Interested applicants must have a strong command of Fortran and/or C/C++ programming languages, as well as excellent communication and writing skills.

Specific topic areas for research include:

- High-order numerical methods for compressible flow
- Scale bridging algorithms and/or adaptive refinement techniques
- Interface treatment methods (conformal mesh, XFEM, VOF, front tracking, etc.)
- Numerical methods for fluid-structure interaction problems
- Physics models for multifluid/multiphase reactive flow
- Turbulence models (RANS, LES, hybrid RANS-LES)
- Models for detonation-to-deflagration transition and for detonation wave propagation in solid elasto-plastic porous medium

Marianne Francois
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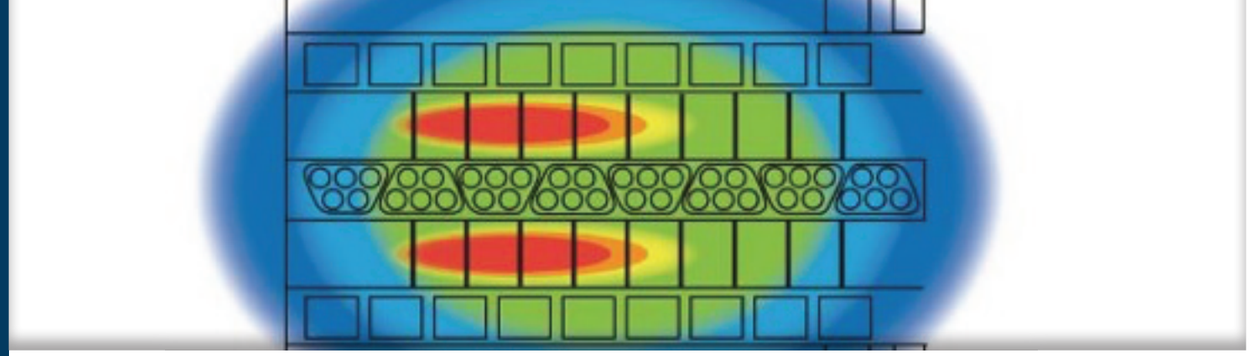

Monte Carlo Methods, Codes, and Applications

Our team delivers first-principles Monte Carlo methods for radiation transport, including charged particles, production-quality codes, and transport-based computational and experimental assessments that cover an array of DOE missions, including stockpile stewardship, global security, and criticality safety.

We are responsible for LANL's Monte Carlo radiation particle transport codes MCNP® and MCATK. Our expertise lies in developing production-quality Monte Carlo radiation transport software and its applications. These applications include simulations of experimental diagnostics, intrinsic radiation, radiation detection and measurement, criticality safety, nuclear threat reduction and response, radiation health protection, nuclear weapons effects, and nuclear forensics.

Interested graduate students and postdoctoral candidates should have backgrounds in nuclear engineering, physics, computer science, or mathematics and have produced high-quality, peer-reviewed publications in their specific area of study.

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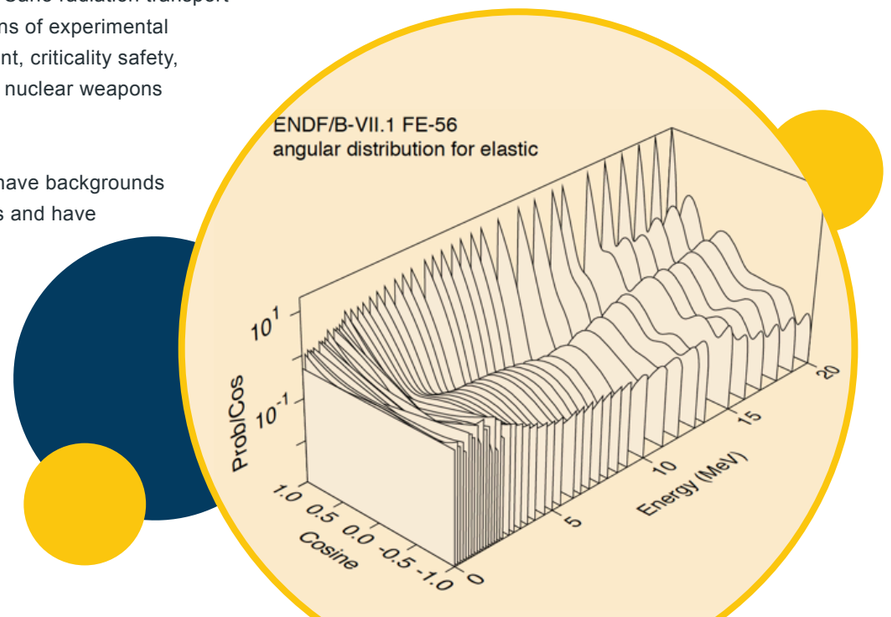

Nuclear Data Science and Engineering

We create and deliver general-purpose nuclear data libraries that are the heart of MCNP®, PARTISN, and other neutronics codes. We seek students and postdoctoral candidates interested in studying the applied physics and mathematics underlying nuclear data and in helping improve the quality of nuclear data used by all our applications.

Our application libraries support a wide range of defense programs, global security, nuclear medicine, and criticality safety missions at LANL and around the world. We work with experimentalists and theorists to craft the next generation of evaluated data, code developers to ensure the desired physics is correctly implemented and our end users to validate their use in application. Opportunities exist to collaborate within this broad spectrum of activities.

Interested applicants should have a background in physics, nuclear engineering, computer science or mathematics, have experience with scientific programming, and a strong capability to communicate the results of their work. Prior knowledge of the ENDF format is desired.

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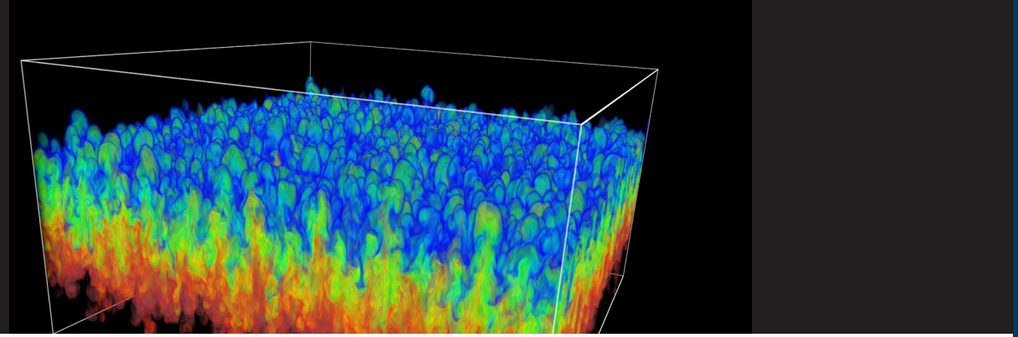

Computational Fluid and Solid Dynamics

We seek postdoctoral candidates with an interest in reconnection-based multimaterial computational fluid and solid dynamics. Expertise should fall into the following areas:

- Voronoi meshing for nonconvex and nonsimply connected domains in 2D and 3D
- Cell-centered and staggered discretization of fluid and solid dynamics equations on general polygonal and polyhedral meshes
- Remapping (data transfer) between two arbitrary polygonal or polyhedral meshes
- Multimaterial interface reconstruction
- Closure models for multimaterials, including cells with voids
- Slide lines and slide surface-contact mechanics

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Equation of State

The equation of state embodies material properties that are a key input to a broad range of application codes that are used, for example, in the modelling of inertial confinement fusion experiments, dynamic compression experiments, astrophysics, and the study of extreme states of matter. It plays a vital role in Los Alamos' national security mission. Our equation of state team works on problems ranging from fundamental science to applied physics. We design physics models, develop computer code, use and analyze cutting edge experimental and computational data, generate equations of state and participate in their applications.

We are seeking candidates interested in a broad range of fields such as

- Thermodynamics and statistical mechanics
- Atomistic and condensed matter modeling
- Dense plasmas
- Chemistry of reactive materials

Interested applicants should have a background in physics, chemistry, materials science, or a related field, and experience in scientific programming. We provide a small and diverse team environment, working closely with the rest of the Laboratory and with academic institutions. We offer numerous opportunities for professional development, including participating in international and national conferences, publishing in scientific journals, and achieving technical leadership.

Kevin Honnell
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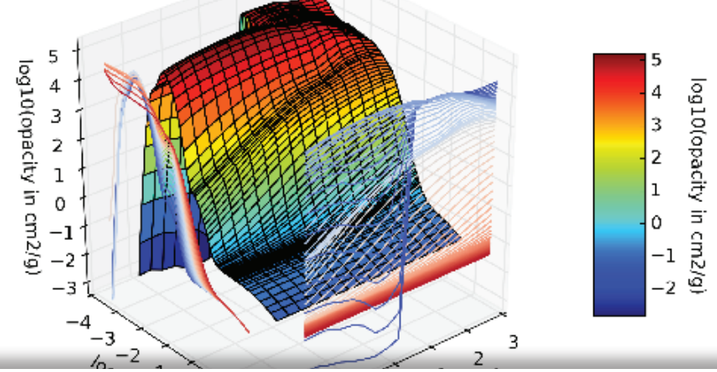

Atomic and Plasma Physics

We seek graduate students and postdoctoral candidates with a background in atomic or plasma theory, with an emphasis on spectral modeling. Our research interests include the use of fundamental atomic theory, the development of large-scale collisional-radiative codes, the calculation of radiative opacities, and modeling a broad range of plasmas. Applications include low-, mid-, and high-density plasmas, such as those occurring in the following examples:

- Astrophysics (e.g., light curves of supernovae and neutron star mergers, and helioseismology)
- Space missions (e.g., spectral diagnostics in support of the Mars Rover ChemCam measurements)
- Inertial confinement fusion (in support of Omega and the National Ignition Facility)
- Modeling of material properties (e.g., molecular opacities for high explosives)

Successful applicants will work closely with a small team of physicists engaged in collaborations throughout the Los Alamos community and the academic community. There will also be opportunities to access advanced computing platforms.

Peter Hakel
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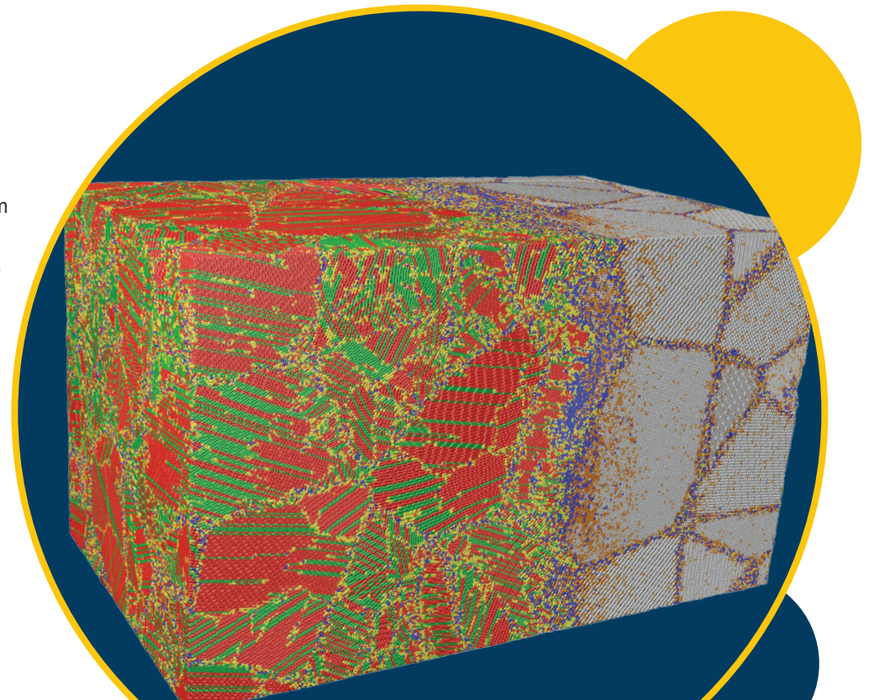
Materials Modeling under Extreme Conditions

A background in physics, materials science, or engineering will allow successful postdoctoral candidates to assist with developing models of dynamic material response for our large-scale computer simulations. Our modeling areas of interest include the following:

- Plastic deformation of metals and alloys at strain rates from quasi-static to rates of order 10^{12} s^{-1}, strains to several hundred percent, pressures from ambient to 100 GPa, and temperatures from zero up to melt
- Solid-liquid and solid-solid phase transformation kinetics
- Material damage and failure of both ductile and brittle metals and of alloys
- Nonequilibrium thermodynamics



Len Margolin
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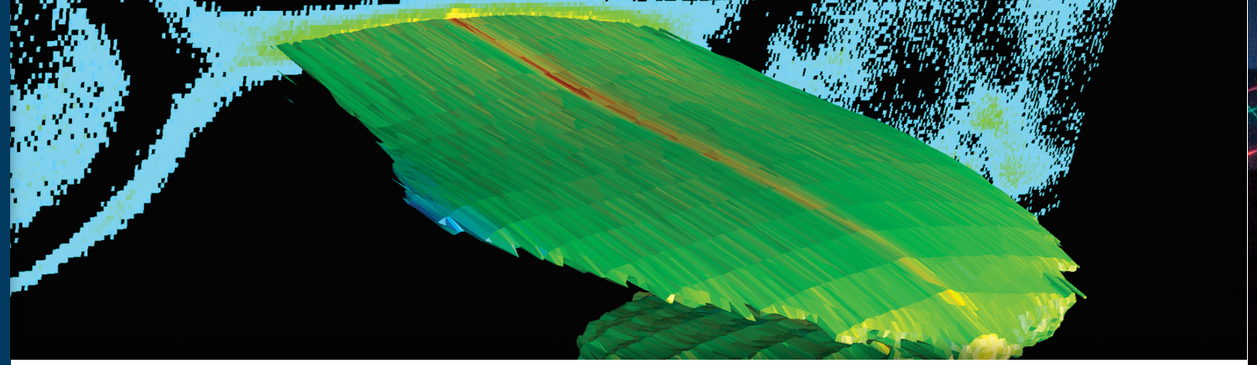

Plasma Theory and Applications

Postdoctoral candidates with a background and training in theoretical and computational plasma physics will have the opportunity to conduct groundbreaking research in plasma theory and computational modeling of plasmas in a broad range of applications important to LANL and the nation. Areas of particular interest include the following:

- Inertial confinement fusion and high-energy density physics (on the OMEGA and NIF lasers)
- Large-scale plasma simulations
- Modeling and technique development (explicit and implicit particle-in-cell methodology and hybrid methods)
- Pulse-power modeling and applications (capacitor, high-explosive and Z-pinch driven)
- Intense charged particle beam generation and applications
- Advanced laser-driven particle accelerators
- Fast/hybrid ignition
- High-power and high-energy electromagnetic sources
- Magnetohydrodynamics
- Space plasmas and magnetic reconnection

Paul Bradley
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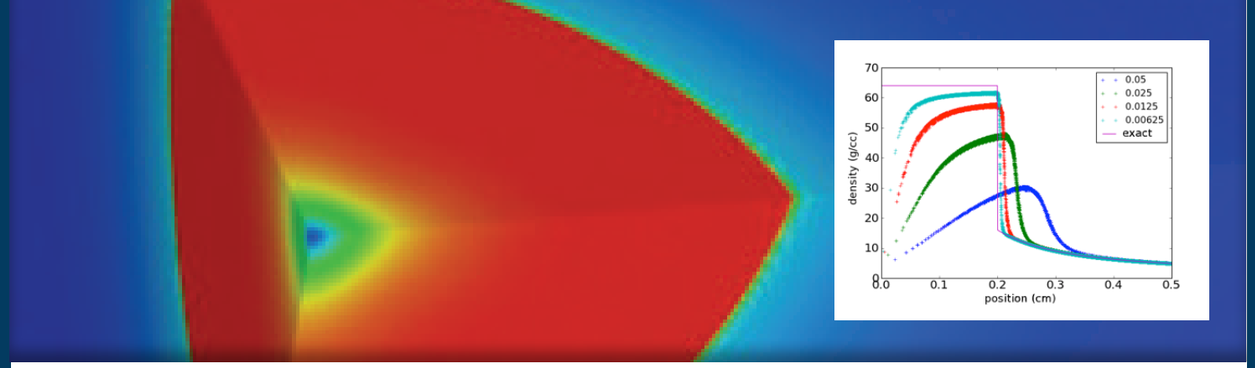
Successful applicants will work with our staff in performing simulations of experiments, developing computer models, or designing and analyzing experiments.



Multi-Physics Verification, Validation & Uncertainty Quantification

We seek graduate students and postdoctoral candidates interested in research and applications in code and solution verification, model validation using small-scale experiments, and development and application of methods for uncertainty quantification, all applied to computational multiphysics codes. Specific topic areas for research include the following:

- Advanced code and solution verification methods, especially extensions to the method of manufactured solutions
- Estimating bounds on physical uncertainties for multiphysics calculations
- Understanding uncertainty in small-scale experimental data across physical regimes and complexity
- Development of tools and methods to support suites of verification and validation tests
- Inference of verification and small-scale validation results to understand code and model credibility for integral multiphysics calculations
- Interpretation of simulations of complex systems to provide support for decision-making

Our technical focus areas include hydrodynamics, material strength and damage, equation of state, reactive flow, high-energy density physics, instabilities and turbulence, radiation transport, and criticality.

Aaron Koskelo
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Our primary mission is to develop multiphysics simulation codes that support national nuclear security applications.

Read more about our research at our website:
http://www.lanl.gov/org/padwp/adx/computational-physics/index.php

Search the complete Laboratory database for Undergraduate, Graduate and Postdoctoral appointments:
http://www.lanl.gov/careers/career-options/jobs/index.php

Some postdoctoral appointments and technical staff jobs require a Department of Energy security clearance. Except in very limited circumstances, security clearances are granted to US citizens only.

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