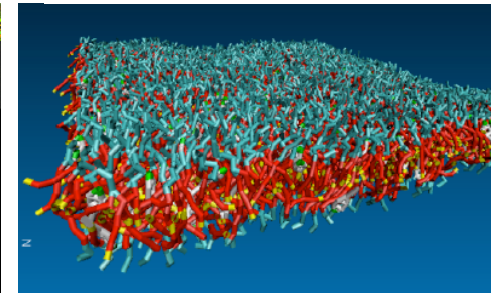
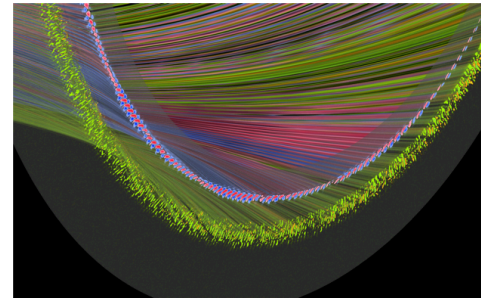
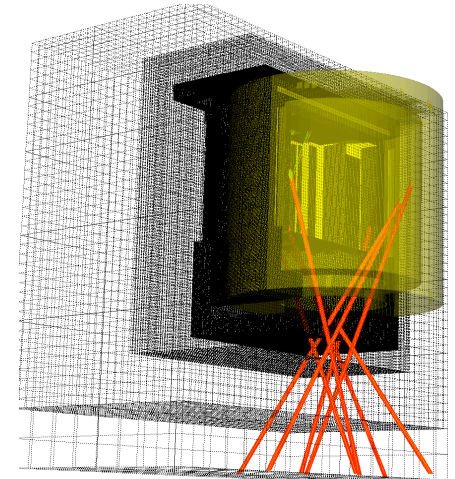
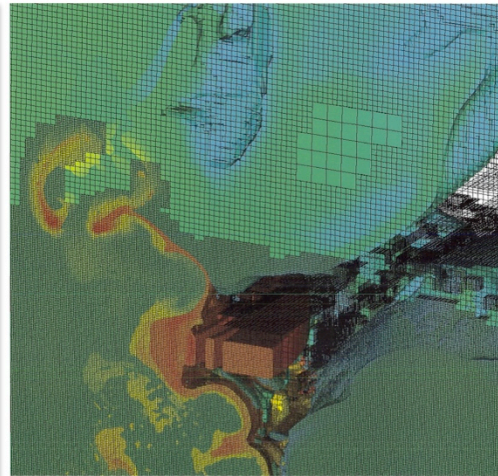


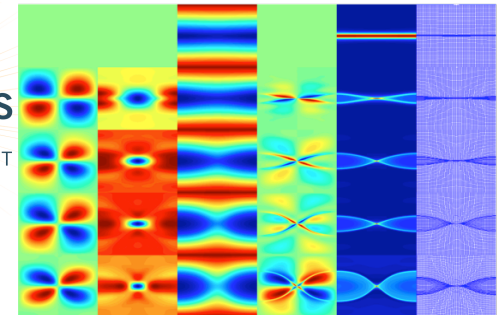
UCLA
Institute for Pure and
Applied Mathematics

Research Careers in
Government Laboratories



Alice E. Koniges
Lawrence Berkeley National Laboratory

April 8-11, 2015
Latinos in the Mathematical Sciences
UCLA Institute for Pure and Applied Mathematics



U.S. DEPARTMENT OF
ENERGY

Office of
Science



Some stuff about me

- **1st Woman to get a PhD in Applied Mathematics at Princeton**
- **Approximately 100 Papers and 1000 Citations**
- **PI on a few million dollars of research grants**
- **Raised 3 Kids, have a physicist spouse (34 years)**
- **Worked part time a bit – but don't tell anyone 😊**
- **Had 9 post-docs in last 6 years**
- **Try to make time to – ride my horse, do an occasional sprint triathlon, play piccolo**

Careers in Government Research Laboratories

- how do graduates find careers in government agencies? (Postings, Networking, Conferences)
- how can one best prepare for a job in government agencies? Often PhD, Math, Physics, Chem, Bio
- what are typical days at work? See slides
- how much autonomy does one have in the job (I.e. Are the projects assigned or chosen)? If you get money thru grants, you choose.
- Government Labs – the fastest computers, the largest experiments, big impact on society

Mathematics + Algorithms for a new Multiphysics Simulation Code applied to large experiments



Neutralized Drift Compression Experiment (NDCX-II)



CYMER EUV Lithography System



Laser Specifications

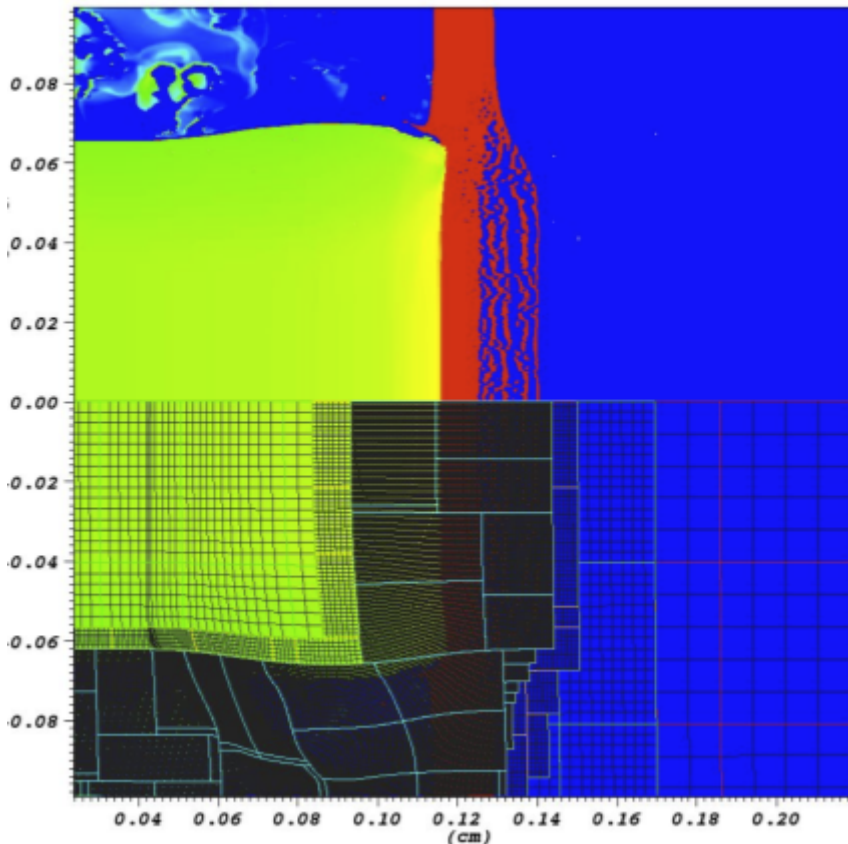
192 Laser Beams

Energy \Rightarrow 1.8 MJ

Power \Rightarrow 750 TW

Led a project to design a new 3D multimaterial ALE + AMR code including substantial new physics

Simulation of soft x-rays striking foil



ALE-AMR is an open science code that runs at various computing centers including NERSC and has no export control restrictions

- 3D ALE hydrodynamics
- AMR (use 3X refinement)
 - With 6 levels, vol ratio 10^7 to 1
- Multi-Material (interface reconstruction)
- Anisotropic stress tensor
- Tabulated EOS and opacities
- Material failure with history
- Laser ray trace and deposition
- Ion deposition
- Thermal conduction
- Radiation diffusion
- 2D Axisymmetric capability
- AMR with 3X in only 1 direction
- Surface tension

Multimaterial ALE + AMR; including anisotropic stress tensor

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \vec{v}) = 0$$

Continuity equation

$$\rho \frac{\partial \vec{v}}{\partial t} = \nabla p + \nabla \cdot \Sigma' + \rho \vec{b}$$

Equations of motion

$$\rho \frac{\partial e}{\partial t} + p \nabla \cdot \vec{v} = 0$$

PdV work

$$\Sigma^{n+1} = f(\Sigma^n, \rho, e, \vec{v}, p, T, \vec{h})$$

Material Stress Update

$$p = p(\rho, e)$$

•EOS tables

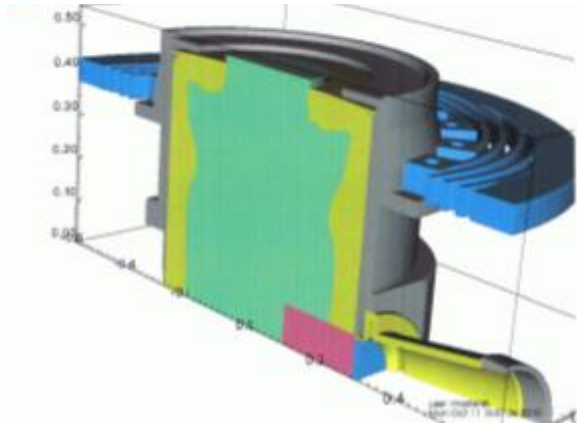
$$T = T(\rho, e)$$

•Various gas laws

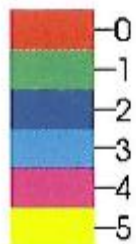
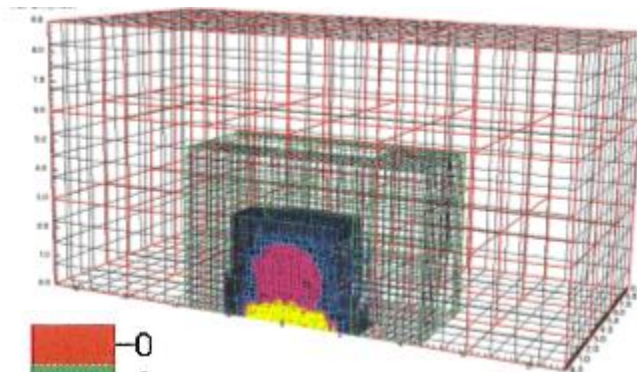
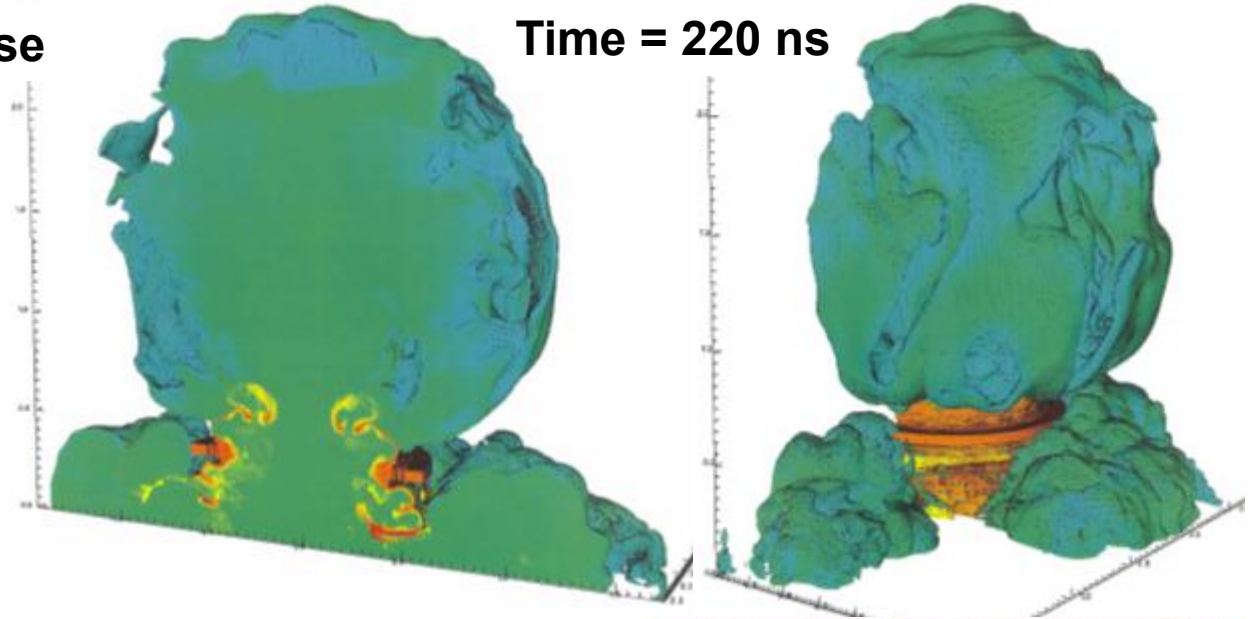
Radiation Diffusion added via an operator splitting method

ALE-AMR was used to model the late time properties of HEDLP targets shot for National Ignition Campaign (450 M\$ per year, 4B\$ to construct)

Materials at end of laser pulse

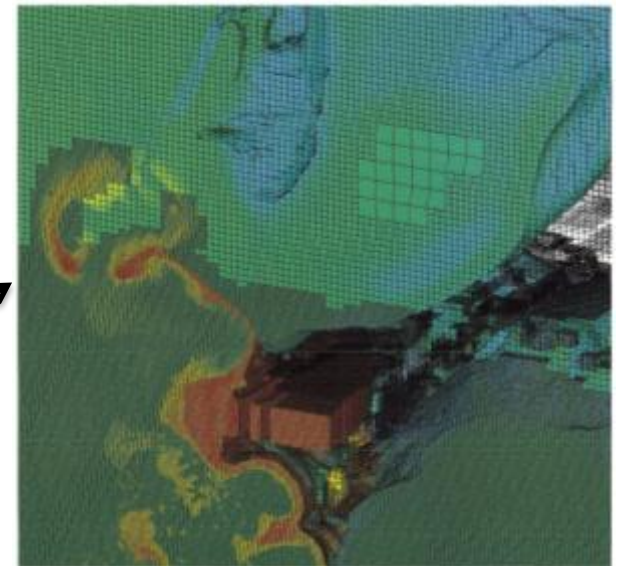
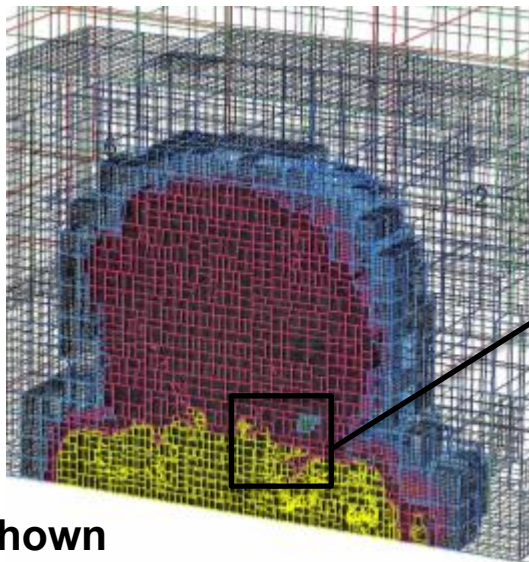


Time = 220 ns

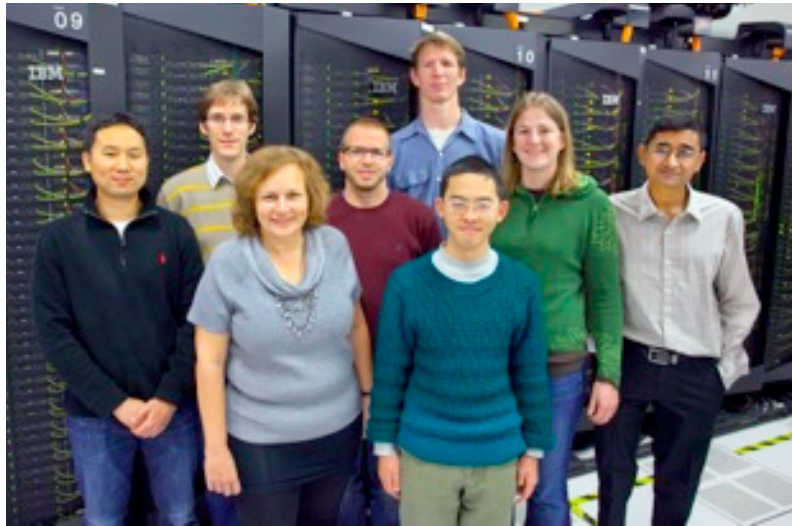


Refinement
Levels

Patch boundaries shown



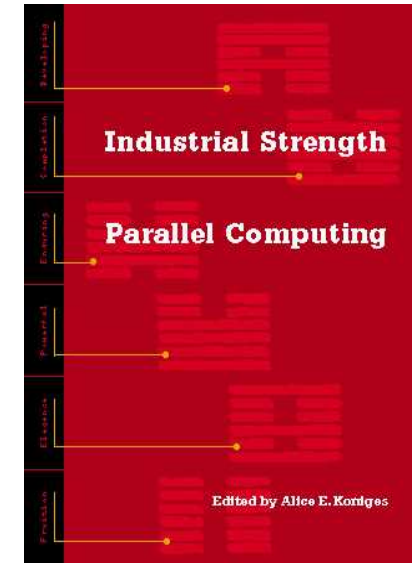
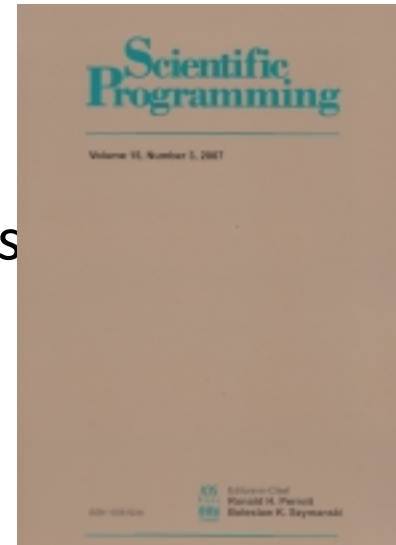
Leader/PI, Petascale Initiative in Computational Science and Engineering



Project:	Post Doc	Start Date	Eduction (PhD)
EFRC: Q-Chem parallelization and GPU Optimization	J Kim	Oct-09	Univ. IL Urbana-Champaign
Fusion: GTS for ITER-Scale; Programming Models	R Preissl	Feb-10	J. Kepler Univ. (Austria)
Multiphase Flow in Porous Media for Carbon Sequestration	K Fagnan	Mar-10	Univ. of Washington
Modeling for Next Generation Advanced Light Source	B Austin	Jun-10	UC Berkeley
Advanced Light Source and Geophysical Imaging with GPU's	F Maia	Jul-10	Uppsala Univ. (Sweden)
Benchmarking and Optimization of Energy-Related Applications	P Narayanan	Sep-10	Univ. of Maryland
ARRA-funded LBL NDCX-II modeling with ALE-AMR	W Liu	Jan-11	UC Los Angeles
Linear Solvers and Hybrid Programming	X Yuan	Mar-11	Columbia University
Poission Solver for Nano-Control EFRC	C Kavouklis	Jun-11	Univ. of Texas Austin

Working in the community

- **Scientific Programming**
 - Special Issue: Guest Editor: Gabriele Jost and Alice Koniges
- **Computational Science and Engineering**
 - Invited Lead-off chapter
- **International Journal of High Performance Computing**
 - Associate Editor





Teaching, mentoring, and public outreach



Program Committees and Tutorials



GRACE HOPPER CELEBRATION of **WOMEN in COMPUTING**



IEEE Cluster 2015

Sep. 8-11, Chicago, IL, USA



Lawrence Berkeley
National Laboratory

Collaborations require travel



**Barcelona Supercomputing
Center located in a medieval
church in Spain**



**Grace Hopper Celebration
of Women in Computing
with Daughters**



**Rhodes Island Greece with
colleagues for EuroPar2012**



SC14 in New Orleans



**Alice and Emily in Japan
following Exascale
Computing Meeting**

What are your questions?

- Grad school or not?
- Family issues
- Mentoring issues

Berkeley Lab still has some openings
for Summer Students

Feel free to email me (ASAP):
aekoniges@lbl.gov