



The Center for Astrophysical Thermonuclear Flashes

FLASH

July 26, 2010
Klaus Weide



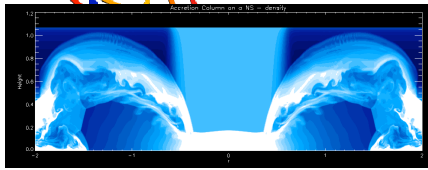
An Advanced Simulation & Computing (ASC)
Academic Strategic Alliance Program (ASAP) Center
at The University of Chicago



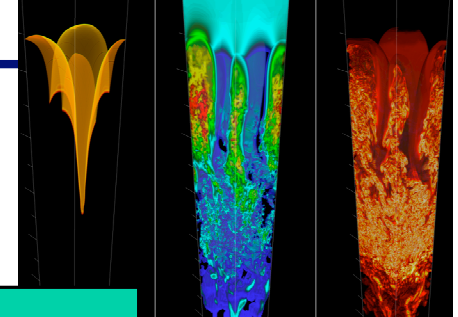
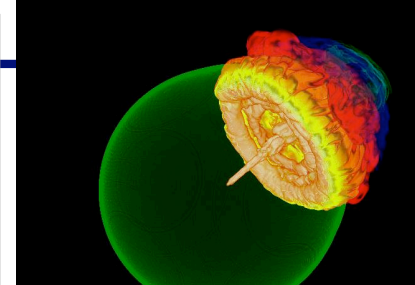
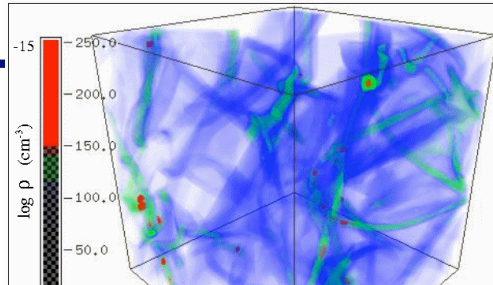


FLASH Capabilities Span a Broad Range...

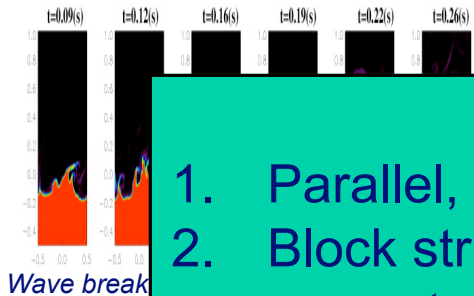
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Shortly: Relativistic accretion onto NS

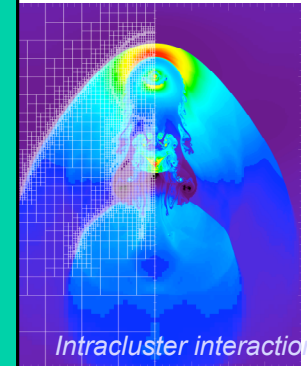


clear Burning

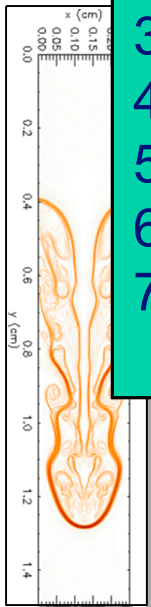


Wave break

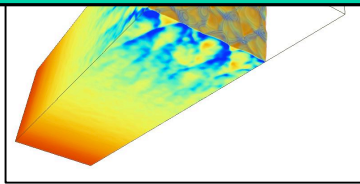
- ### The FLASH code
1. Parallel, adaptive-mesh refinement (AMR) code
 2. Block structured AMR; a block is the unit of computation
 3. Designed for compressible reactive flows
 4. Can solve a broad range of (astro)physical problems
 5. Portable: runs on many massively-parallel systems
 6. Scales and performs well
 7. Fully modular and extensible: components can be combined to create many different applications



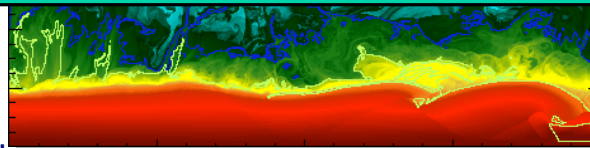
Intracluster interactions



Magnetic Rayleigh-Taylor



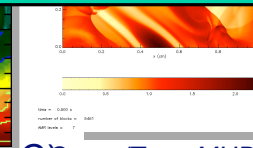
Cellular detonation



Advanced Simulation & Computing (ASC) Orszag/Tang MHD

Helium burning on neutron stars

Academic Strategic Alliance Program (ASAP) Center
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vortex

AS



Richtmyer-Meshkov instability



Flash Center

- ❑ CS/Applications Group (code group)
 - ❑ Develops code
 - ❑ Implements algorithm
 - ❑ Integrates and maintains contributions
 - ❑ Testing and Debugging
 - ❑ Supports internal and external FLASH users
- ❑ Astrophysics Group
 - ❑ Runs large simulations
 - ❑ Scientific Discovery using the FLASH code
- ❑ Visualization Group
 - ❑ Serves some in-house visualization needs
 - ❑ Preparation of presentations and movies
 - ❑ Cannot support all day-to-day viz needs



Some Simulations of Interest

- ❑ Supernova Ia
 - ❑ Full-star 3D simulations of deflagration & detonation
- ❑ 3D Turbulent Nuclear Burning
- ❑ External users: Galaxy cluster collisions, etc.

- ❑ In Future: High-Energy-Density Physics
 - ❑ E.g., simulation of shock experiments at Omega or NIF



Visualization needs

- ❑ For debugging!
 - ❑ Small test problems
 - ❑ Scientists or code developers
 - ❑ Use “xflash3” (IDL based), VisIt
- ❑ For “regular simulations”
 - ❑ Day-to-day use of visualization for scientists “to see what is going on” in a simulation
 - ❑ Mostly use VisIt
- ❑ For preparing publications
 - ❑ Or movies etc.
 - ❑ Use VisIt, or specially developed tools



FLASH Output

- ❑ Plot files
 - ❑ Input for visualization
- ❑ Checkpoint files
 - ❑ Also can be input for visualization
- ❑ Particle files
 - ❑ Need visualization
 - ❑ Need post-processing code (developed in house)
- ❑ Other simulation-specific files (lower volume)

- ❑ We have defined FLASH data formats for
 - ❑ HDF5 (supported by VisIt)
 - ❑ Pnetcdf



Future

Greatest Problems right now:

- ❑ Reliably and quickly deal with very large files
Should not slow down too much for > 250 GB files

For Future:

More data, Larger files

Convenient and fast zooming in, slices

In situ?

(unforeseen things)