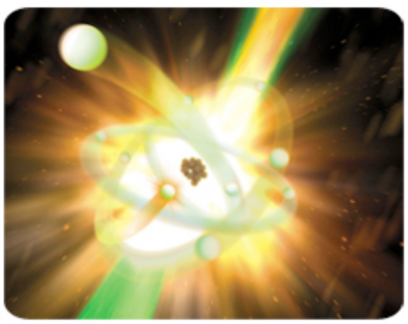
LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Jan. 23-27, 2012

POPSCI THE FUTURE NOW AT THE ATOMIC SCALE



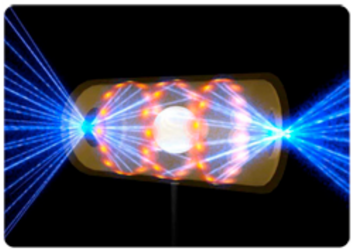
A powerful X-ray laser pulse from the Linac Coherent Light.
Illustration by Gregory M. Stewart/SLAC

Lab scientists and international collaborators have created the shortest, purest X-ray laser pulses ever achieved and have fulfilled a 45-year-old prediction and ultimately opened the door to new medicines, devices and materials.

X-rays give us a penetrating view into the world of atoms and molecules. Using the Linac Coherent Light Source (LCLS), located at the Stanford Linear Accelerator Center (SLAC), researchers aimed radiation from the LCLS at a cell containing neon gas, setting off an avalanche of X-ray emissions to create a new "atomic X-ray laser."

To read more, go to *Popular Science*.

SPACE.COM MIMING AN EXPLOSION



This artist's rendering shows a NIF target pellet inside a hohlraum capsule with laser beams entering through openings on either end.

Powerful lasers are imitating the effects of supernovae -- the cataclysmic death of a star – and are now helping reveal how the magnetic field of galaxies may have formed in the early universe.

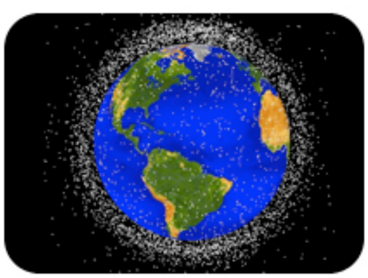
In this case, the lasers were in France, but soon the same kind of look into the cosmos could occur at the Laboratory in the National Ignition Facility, the largest laser available on Earth.

The NIF is expected to create fusion energy, the same power that fuels the sun and stars. Besides exploring astrophysical phenomena, scientists at NIF hope to use it as a demonstration project to create fusion as an endless source of clean energy.

Fusion experiments are set to begin this year.

To read more, go to *space.com*.

SPIE PREVENTING CLOSE ENCOUNTERS



A simulated snapshot of low Earth orbit debris. Image reproduced courtesy of the NASA Orbital Debris Program Office.

Thirty-five years of poor housekeeping in space plus accidental spacecraft collisions have created several hundred thousand pieces of space debris larger than one centimeter in diameter in low Earth orbit (LEO).

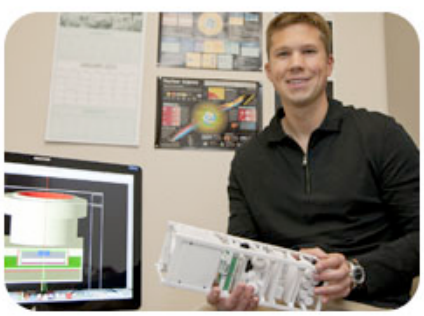
At typical relative velocities of 12 kilometers/second, pieces one centimeter in diameter could punch a hole in the International Space Station, while a 100-gram bolt would be lethal if it hit the crew compartment.

Help is on the way. The Laboratory, in collaboration with Los Alamos and Sandia national laboratories and the Air Force Research Laboratory, is working to improve the nation's capabilities for detecting and monitoring threats to U.S. space operations.

Since early 2008, a team of computational physics and engineering experts at Livermore has been designing a comprehensive set of analysis, modeling, simulation and visualization tools that together are called the Testbed for Space Situational Awareness (TESSA). The work stems from the Lab's longtime investment in advanced supercomputing capabilities necessary to perform its national security missions, as part the National Nuclear Security Administration's Advanced Simulation and Computing Program.

To read more, go to *SPIE*.

R&D IN SEARCH OF...



Postdoc Lance Simms holds components of a satellite similar to the one he developed for NASA's Cosmic X-Ray Background Nanosatellite.

Most astrophysicists stare at the night sky and look at stars. But Lance Simms looks at the blackness of night and knows there is something else there.

Simms, a postdoc in the Lab's Physics Division, has been working for a year on a NASA project called the Cosmic X-Ray Background Nanosatellite (CXBN). Set for an August launch, the breadbox-sized satellite -- built in conjunction with UC Berkeley, Sonoma State University and Morehead State University Space Science Center -- will gather X-ray data from the cosmos and beam it back to Earth.

Most X-ray telescopes aboard satellites use focusing optics to determine how much energy is emitted from a particular source or region, such as the Crab Nebula. The Crab Nebula is a supernova remnant that emits X-ray energies above 30 kilo-electron volts (keV) and is considered the strongest persistent source of X-rays in the sky.

CXBN, on the other hand, is not interested in examining particular regions, but instead will provide an improved measurement of the universe's X-Ray background -- which is coming from all directions in space -- and could help resolve a mystery in modern cosmology -- the origin of the cosmic X-ray background.

To read more, go to *R&D Magazine*.
