

2009

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Recommended Citation

Mitchell, Natalie (2009) "Worlds's Most Powerful X-Ray Laser Created," *Inquiro, the UAB undergraduate science research journal*: Vol. 2009: No. 3, Article 7.

Available at: <https://digitalcommons.library.uab.edu/inquiro/vol2009/iss3/7>

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World's Most Powerful X-ray Laser Created

Natalie Mitchell

Initial experimentation has begun using the world's most powerful X-ray laser, the Linac Coherent Light Source (LCLS). Located at the Department of Energy's SLAC National Accelerator Laboratory, the LCLS will provide researchers with the ability

to illuminate objects at extraordinary speed. The machine can resolve the size of atoms at ten billion times the brightness of any other X ray source.

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Nearly 40 years ago, a two mile linear accelerator (SLAC) was built to study the building blocks of the universe. With distinct modifications to this accelerator, the LCLS was formed and allows scientists to investigate energy science, structural biology, physics and assorted other fields.

After the SLAC Linac accelerates short pulses of electrons to 99.9999999 percent the speed of light, the LCLS takes them through a 100 meter stretch of alternating magnets that force the electrons to move back and forth emitting X-rays. The X-rays become synchronous with the electron pulses, resulting in the world's brightest X-ray laser pulse. The laser pulses combine as

many as 10 trillion X-ray photons into a pulse that is 100 femto-seconds in duration (the time it takes light to travel the width of a human hair). Experiments using this instrument have revealed aspects regarding the basics of atomic physics. Specifically, researchers have been able to completely strip neon atoms of all their electrons due to the extreme brightness of the laser beam.

Five other instruments are being planned for the LCLS to gain understanding of how ultra-bright beams interact with matter. Future experiments will create stop-action movies of molecules in motion. This will ultimately allow scientists to watch chemical bonds forming and breaking in real time.