

## ABSTRACT

### LCLS: EXPERIMENTS AND CHALLENGES FOR ULTRAFAST X-RAY SCIENCE

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The Linac Coherent Light Source (LCLS) will be the world's first x-ray free-electron laser when it begins operations in 2009. Compared to synchrotrons, it will be about a billion times brighter, and pulses are expected to be about one thousand times shorter: approximately one millijoule of 8 keV photons in one hundred femtoseconds.

We have just completed a preparatory experiment at SLAC called the Sub-Picosecond Pulse Source (SPPS), which made and used 100 fs pulses of undulator x-ray radiation using the compressed SLAC electron bunch. Although we lacked the high brightness to reach a regime where we could probe strong field atomic physics, we learned much about how to make use of the capabilities of linac-based x-ray sources for high powered single-shot or pump probe experiments. I will describe some of the results from SPPS, and provide an update on the construction progress on LCLS. In addition, I'll summarize some of the opportunities and challenges for frontier experiments on LCLS.