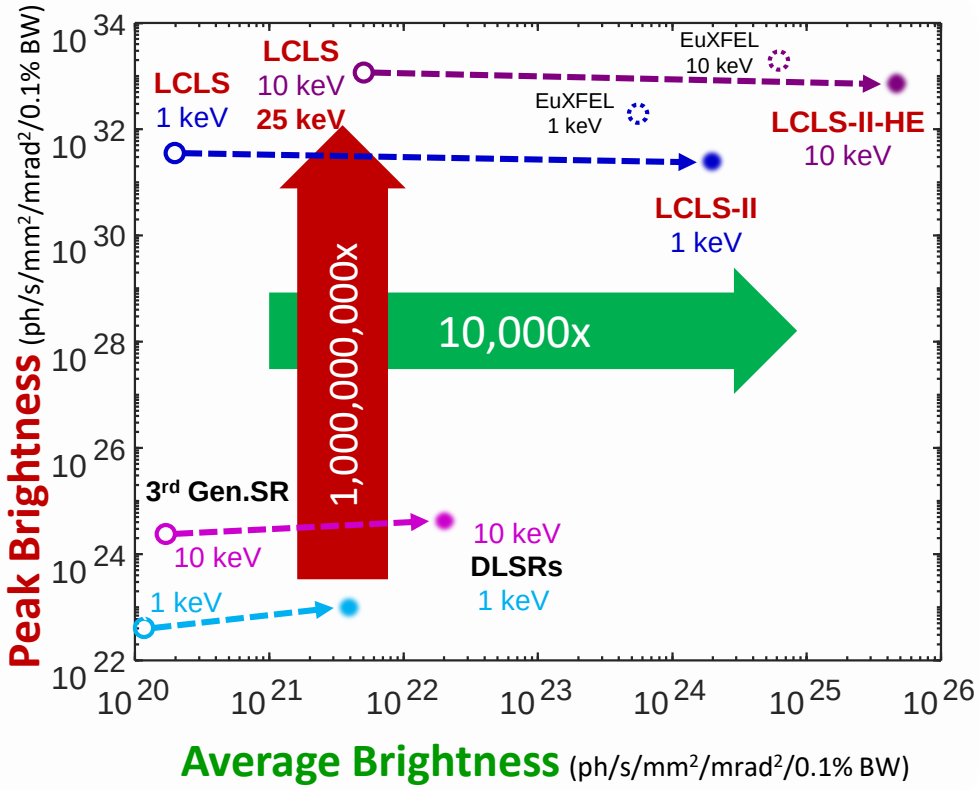
Scientific Opportunities for the

Dynamic X-ray Scattering (DXS) Instrument at LCLS-II-HE

LCLS Facility Development Plan & Science Opportunities



Phase 1: 2020 (complete!)

- **0.25 to 25 keV (fundamental) at 120 Hz**
- XLEAP pulse(s) at 200-400 attoseconds
- 2 LCLS-II variable gap undulators

Phase 2: 2022

- **0.25 to 5 keV at 1 MHz** (CW, programmable)
- LCLS-II 4 GeV CW SCRF accelerator
- 5 new endstations

Phase 3: 2026/2027

- **0.25 to >15 keV at 1 MHz**
- LCLS-II-HE 8 GeV CW SCRF accelerator
- 5 new or upgraded endstations

Phase 4: 2026/2027

- **MEC Upgrade**
- 1 PW at 10 Hz, plus 1 kJ
- Dedicated experimental cavern

The leap from 120 Hz to 1 MHz will transform the breadth and depth of LCLS science

Charge and Objectives for Workshop Series

- Identify the most compelling (transformative) science drivers for the DXS instrument - particularly areas that can exploit the unprecedented average spectral flux (photons/s/meV). *What will be the impact if the proposed research is successful?*
  - Consider ideas consistent with Day-1 DXS and LCLS-II-HE capabilities
  - Also consider longer-term ideas with high potential science impact that might exploit advanced performance, e.g. higher photon energies, higher average spectral flux from seeding etc.
- Outline the proposed experimental method(s) and key requirements. This should clarify:
  - Capabilities of LCLS-II-HE and DXS that are essential for this science
  - Essential incident X-ray parameters (focus, BW, tunability, polarization etc.)
  - Sample environment requirements (pressure, temperature, applied fields etc.)
  - Conventional laser requirements (wavelength, pulse energy etc.)
  - Essential spectrometer and detector requirements
- Consider the cross-over between IXS (energy-domain) and XPCS (time-domain) approaches
  - Are IXS or XPCS methods clearly preferred for particular science opportunities (and why), and what opportunities might fall in areas that might be accessible with either method?

Nov. 17: Plenary Kick-off. Subsequent meetings will explore promising science areas in detail

Agenda: Plenary Kick-off Meeting

Wednesday, November 17, 2021

Start Time	Presenter(s)	Presentation
06:00–06:10	Robert Schoenlein (SLAC)	Welcome/Charge
06:10–06:30	Hasan Yavaş (SLAC)	DXS Instrument Overview
06:30–06:40	Massimo Altarelli (Max Planck Society - Hamburg)	Introduction & Motivation
06:40–07:10	Venkatraman Gopalan (Pennsylvania State University)	Fluctuations, Emergence and Dynamics of Non-Equilibrium Phases
		Break (10 min)
07:10-07:40	Maurits Haverkort (University of Heidelberg)	TBD
07:40-08:10	Thomas Devereaux (SLAC, Stanford)	Why Time-Resolved X-rays for Quantum Materials May Interest You
08:10-09:00		**Discussion - Moderator: Massimo Altarelli**

What are the most promising areas to explore and discuss in future meetings in this workshop series?