The Beams and Applications Seminar Series

LBNL Design Concepts for a VUV-soft X-ray FEL Facility

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Bldg. 401, Rm. B4100
Thursday, December 13, 2:00 pm
(please note special day, time and room)

Host: Ali Nassiri, ASD

Scientific challenges of the future include answering fundamental questions about material properties arising from processes with intrinsic time scales ranging from femtosecond to attosecond. The need to directly probe electronic structure and dynamics demand a focus on the VUV and soft x-ray regions, and the creation of experimental facilities that complement those being constructed with hard x-ray capabilities. At LBNL we are developing concepts for a seeded FEL-based light source that is responsive to the scientific needs for time-resolved experimentation in the VUV to soft x-ray regime. The FEL process increases radiation flux by many orders of magnitude above existing incoherent sources, and offers additional enhancements attainable by optical manipulations of the electron beam; control of the temporal duration and bandwidth of the coherent x-ray output, controlled utilization of harmonics to attain shorter wavelengths, reduced gain length in the FEL, and precise synchronization of the x-ray pulse with laser systems. We describe an FEL facility concept based on a high repetition rate RF photocathode gun, followed by a relatively low energy (~2.5 GeV) CW superconducting linac, feeding an array of FELs each independently operating at a repetition rate of ~100 kHz, providing high average flux and brightness. The wavelength range would be ~200–1 nm. An attractive feature of the proposed machine is that it can simultaneously support complementary beamlines offering: (1) *short x-ray pulses* (1–100 fs); (2) *high energy resolution* with longer pulse duration (100-1000 fs); (3*) attosecond x-ray pulses* (0.1 fs). While the required technologies appear to be close to demonstration, a program of accelerator R&D required to realize the full potential for such future light sources is outlined.

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