COCKCROFT INSTITUTE SEMINAR

LBNL design concepts for a VUV-soft x-ray FEL facility

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This talk will also be video linked to Diamond Ring MR 1.132

Abstract:: 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 Lawrence Berkeley National Laboratory 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) ultra-short x-ray pulses (~0.1 fs); (2) short x-ray pulses (~1–100 fs); (3) high energy resolution with longer pulse duration (~100-1000 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.

Biography:: John Corlett joined the Lawrence Berkeley National Laboratory (LBNL) in 1991, after serving for five years as an accelerator physicist at the Synchrotron Radiation Source, at Daresbury Laboratory in England. Prior to this he had worked in the microwave electronics industry. While at Daresbury Laboratory, he worked on beam impedance and instabilities, commissioning and accelerator physics studies for the Daresbury SRS and the HELIOS compact source for lithography, and in design of new storage-ring light source concepts. At LBNL he has contributed to several accelerator-based science projects, including the Advanced Light Source (ALS) at Berkeley, the PEP-II B-factory at SLAC, damping rings for a linear collider, RF structures for muon cooling systems, and design of nextgeneration synchrotron radiation facilities. He currently leads the Center for Beam Physics in accelerator physics and technology development for high-energy physics and synchrotron radiation source applications.