THE ADVANCED LIGHT SOURCE

D. Chemla, B. Feinberg, G. Krebs, Z. Hussain, J. Krupnick,
H. Padmore, A. Robinson, and N. Smith
Lawrence Berkeley National Laboratory, Berkeley CA 94720 USA

The Advanced Light Source (ALS) is a third-generation synchrotron source at the Lawrence Berkeley National Laboratory, which operates the ALS as a U.S. Department of Energy national user facility open to scientists from academic, industrial, or government laboratories who submit peer-reviewed proposals. Based on a 1.9-GeV, low-emittance storage ring with long straight sections for insertion devices, the ALS is optimized for the highest brightness in the soft x-ray and vacuum ultraviolet spectral regions from undulator sources. Owing to the high brightness, which translates into a high flux of useful photons onto samples, the ALS is also a world-class source of shorter wavelength "intermediate-energy" x rays with both wiggler and bend-magnet sources. Infrared is also available from some bend-magnet ports.

Of the ten straight sections available for insertion devices, one is occupied by a new elliptically polarizing undulator (EPU), five by planar undulators, and one by a multipole wiggler. With construction of one additional EPU beamline just under way, that leaves two full straight sections available for new insertion devices. However, to enhance the utilization of the straight sections, the EPUs and other future undulators will be shorter than the early devices, thereby permitting two in each straight section. Retrofits of existing straight sections with shorter undulators are also being considered. A new program to replace the existing normal bend magnets in three sectors with superconducting dipoles will further extend the ALS spectral range to about 30 keV without sacrificing the brightness at lower photon energies or using up valuable straight sections. Though applications will not be limited to protein crystallography, these "superbends" will permit a large expansion of the highly successful program now operating on the wiggler beamline.

With operation for users beginning in late 1993, the ALS is still a growing facility with a lengthening portfolio of beamlines and scientific programs. The count of experimental station ports stands at 37, including undulator, wiggler, bend-magnet, and infrared beamlines, although not all can operate simultaneously. Five more beamlines are either under construction or just about to be. Collectively, these facilities are applied to a wide range of scientific programs. For the purposes of reporting, the ALS breaks down these programs into the following: Complex materials, magnetism and magnetic materials; polymers, biomolecules, and soft matter; nanostructures and semiconductors; environmental and earth sciences; macromolecular crystallography; soft x-ray microscopy; biological and chemical x-ray spectroscopy; atomic and molecular physics; and chemical dynamics. In addition, there are technology-oriented programs, including a major industry-funded effort in EUV metrology (scattering, interferometry, and mask inspection) and a smaller program in semiconductor characterization.

A major, multi-pronged effort to develop state-of-the-art capabilities in the production and use of sub-picosecond x-ray pulses has been developed over the past several years. Production of 300 fsec pulses and detection of time structure at the psec level has been reported, as has the use of such systems for ultra-fast structural dynamics. Presently based on bend-magnet sources, this program will be extended in capability using an in-vacuum x-ray undulator.

Submitting author: A. Robinson, email: alrobinson@lbl.gov, FAX: 1-510-495-2111