current events

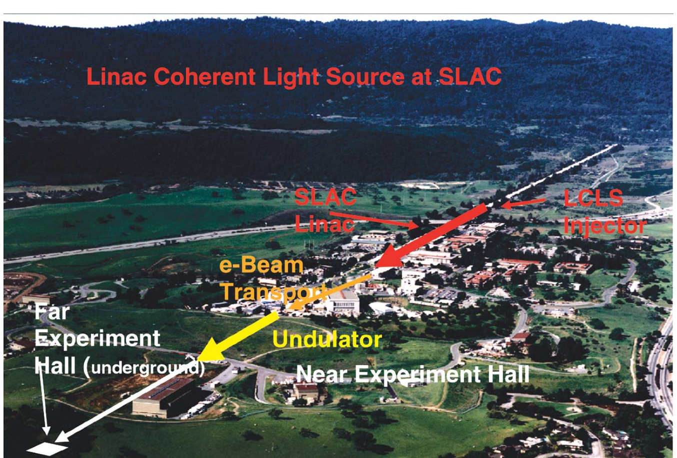
This section carries events of interest to the synchrotron radiation community. Works intended for this section should be sent direct to the Current-Events Editor (s.hasnain@dl.ac.uk).

Stanford receives USD 379M for Coherent Light Source

An idea brought forward in 1992, for an X-ray laser at Stanford Linear Accelerator Center, has grown to become the latest major project to be funded by the Department of Energy's Office of Science. The Linac Coherent Light Source (LCLS) is a DOE Basic Energy Sciences initiative to convert the last kilometer of the SLAC linear accelerator (linac) into a free-electron laser producing 800–8000 eV X-ray pulses of duration 230 fs and less. Pulses of X-rays, produced at a rate of 120 Hz, will each deliver 10^{12} photons to one of six experiment stations to be built for the project. The USD 379M project budget covers materials and labour for initial R&D, construction, specialized spares and commissioning/start-up activities. DOE has provided USD 54M for construction and R&D in fiscal year 2005, which will be used to acquire the injector linac, selected accelerator components and the major components of the undulator magnets. First attempts to operate the laser are scheduled for the middle of 2008, and the facility will begin its users operation in March 2009. An experimental station for atomic physics research, funded as part of the LCLS project, will be ready to start operation at this time.

Plans for an additional four or five experimental stations are developing rapidly, with the aim of developing unique experimental capabilities in chemical dynamics, X-ray photon correlation spectroscopy, plasma dynamics and imaging of atomic clusters or complex molecules.

The last third of the SLAC accelerator will supply 14 GeV electrons to an undulator magnet, which will be located in an underground hall about 300 m east of the linac. The output of the 135 m-long undulator will be transported 100 m to the first three experiment stations in the Near Experiment Hall. Located 250 m beyond the Near Experiment Hall are the three experiment stations of the Far Hall, located in a cavern 33 m below the ground. The ground breaking is scheduled to take place in 2006. While other laboratories around the world are working to make similar X-ray lasers, Stanford has an edge because it can utilize the existing linear accelerator facility at SLAC, thus saving time and money. Other institutions will have to build a linear accelerator before being able to construct the equivalent light source. The Japanese facility at SPring-8 are discussing coming on-line in 2010, and an effort in Hamburg, Germany, which is expected to be a European effort, is not expected to be completed until 2012. 'Stanford has a real opportunity to develop its program and bring in first-rate top-notch people', said Chemistry Professor Keith Hodgson, Director of the Stanford Synchrotron Radiation Laboratory. John Galayda, the Project Director of LCLS said that "this is an exciting, very significant addition to SLAC's research capabilities. It's a turning point in synchrotron radiation research at SLAC and in the world." These X-ray laser sources will allow biologists to study the make-up of macromolecules, such as protein and DNA particles, without necessarily crystallizing them in three dimensions. Further information may be found at the Linac Coherent Light Source web site, http://www-ssrl.slac.stanford.edu/lcls/.



A view of the Linac Coherent Light Source at SLAC.

Cornell gets the go ahead for prototyping energy-recovery linac light source

The National Science Foundation has awarded Cornell University USD 18M to begin prototyping critical technology for an extraordinary new kind of synchrotron radiation X-ray source, called an energy-recovery linac (ERL). Modern third-generation storage rings are at the point of diminishing returns with respect to brilliance and short pulse duration owing to fundamental limits inherent in equilibrium bunch storage. ERLs, which do not store equilibrium bunches, should be able to achieve roughly a factor of 1000 improvement in brilliance and short-pulse capability, thereby enabling investigations of matter that are impossible to perform with existing X-ray sources.

Cornell University constructed the world's first beamline to study synchrotron radiation back in the early 1950s. Today, Cornell operates one of five US national hard X-ray synchrotron radiation facilities, the Cornell High Energy Synchrotron Source (CHESS), which is funded by the National Science Foundation and the National Institutes of Health. CHESS and Cornell's Laboratory of Elementary Particle Physics (LEPP), which operates the storage ring that powers CHESS, have developed an impressive number of accelerator and X-ray technologies responsible for the present growth and utilization of synchrotron radiation. Data taken at CHESS by an international cadre of users have resulted in many 'firsts', ranging from the first structure of a mammalian virus (Rossmann and colleagues, Purdue University) to the discovery of magnetic scattering now used to probe magnetic materials (Blume, Gibbs & McWhan, Brookhaven National Laboratory), to the elucidation of the first potassium channel structure, for which MacKinnon (Rockefeller University) was awarded the 2003 Nobel prize in chemistry.

The current grant provides money to develop, build and test the critical injector and accompanying beam dump. It also provides resources for development of the linac and studies for utilization of the ultra-high-brilliance and ultra-short X-ray beams from future ERLs. Sol Gruner, CHESS Director and principal investigator of the project, said that 'Cornell plans to propose a full-scale ERL as an upgrade to the CHESS facility once the present prototyping is completed'. An attraction of ERL technology is that it allows

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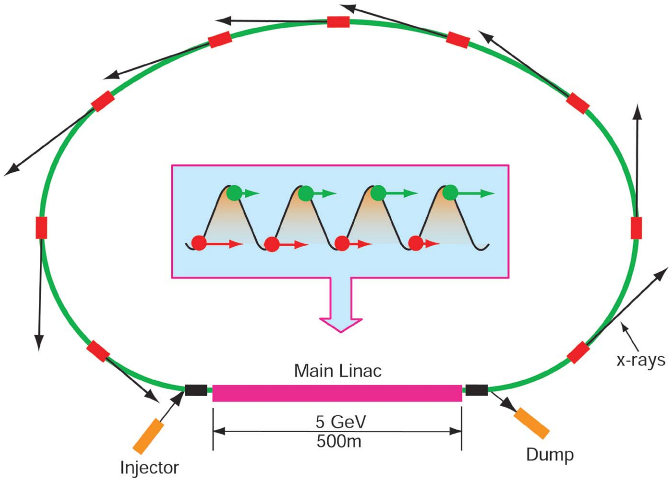

Schematic diagram of an energy-recovery linac source of synchrotron radiation. A bright electron source injects electron bunches at a rate of up to 1.3 GHz into a superconducting linac cavity that accelerates electrons to a full energy of 5 GeV (the green balls 'surfing' on the crest of the RF travelling wave). They circulate around a return arc producing brilliant X-ray beams in undulators (shown in red rectangles). The circumference of the arc is adjusted so that the pathlength of the electrons returning to the linac is 180° out of accelerating phase. Thus these (red balls) electrons ride in the trough of the RF wave and now give up their energy to the cavity. After being decelerated to low energy they are directed to a beam dump. Each electron makes one trip around the arc and its energy is recycled in the main linac, hence the name, energy-recovery linac. As opposed to storage rings, the bunch brilliance is primarily limited by the injector, not equilibration within the loop lattice. (Graphics provided by D. Bilderback.)

progressive upgrading of storage rings without requiring that the ring be completely rebuilt. Maury Tigner, LEPP Director and co-principal investigator said that 'the ERL will help Cornell to continue its historical role as a training ground for accelerator physicists and synchrotron radiation scientists'. More technical information on the ERL can be found at http://erl.chess.cornell.edu/.

APS adopts European model on its 10th anniversary

In March 1995, the Advanced Photon Source (APS) recorded its first 4.5 GeV stored electron beam and demonstrated the generation of synchrotron radiation from a bending magnet. Ten years on, the top-up injection, 6 GeV beam and many beamlines have emerged and it has become a major centre of synchrotron radiation activity. Another change which has gradually happened in the last few years is that the APS has taken on increased responsibility for beamline operations, so that today the majority of the physical sciences beamlines are operated by APS for users. While this has brought challenges, especially increased resource demands and the retention of successful external partners, one of the very positive aspects of this transformation is just beginning to show, the optimization of beamlines. A larger number of dedicated beamlines are in the pipeline. The Collaborative Access Teams (CATs) model pioneered at APS had its advantages but in contrast to the European model suffered from a difficulty of how to avoid duplication of efforts. Many CATs ended up have multi-functional beamlines with some obvious compromises. Now, fully dedicated sectors are being planned, initially from the APS's own beamlines, *e.g.* sectors for small-angle scattering and for high-energy X-ray scattering. The so-called European model has been successfully practiced at SSRL from its inception and it will not be surprising if the APS community does embrace this change with enthusiasm now that the facility has moved into maturity.

Australians open synchrotron centre to public

The Australian synchrotron opened its doors on 20 March 2005 to the public and attracted over 10000 visitors of all ages. The construction of the Australian synchrotron is at an advanced stage. As can be seen from the photographs, the ring tunnel which would house the synchrotron is complete. The Australian synchrotron is the single largest science investment in Australia for some time and has caught the imagination of scientists and public alike. The 3 GeV third-generation synchrotron facility is due to come into operation in 2007. It is anticipated that some nine beamlines would come on-line in the initial phase which would steadily increase in numbers to some 30 beamlines covering all branches of sciences including more applied areas such as lithography and medical therapy. The Victorian government is keen to ensure that this investment is used to provide new capabilities for industrial and applied research across many sectors. In this context, a workshop took place on 4 April on Industrial Applications. A particular highlight was the combined microdiffraction and fluorescence mapping for characterizing materials.

Open day at the Australian synchrotron.

Canadian Light Source gets its first Director of Research

Leading infrared synchrotron researcher Dr Tom Ellis joined the Canadian Light Source (CLS) as its first Director of Research, a key appointment as the national facility at the University of Saskatchewan prepares to welcome scientists from around the world. “It is a tremendous coup for the CLS and the University of Saskatchewan to

Bill Thomlinson (right) with Tom Ellis, the Research Director of CLS.

have someone of Tom's calibre joining us", said CLS Executive Director Bill Thomlinson. "His contributions to Canadian synchrotron science are already extremely significant. I'm confident that he will lead the implementation of an excellent scientific program." As Director of Research at the CLS, Dr Ellis will be assuming a key leadership role, responsible for setting the synchrotron's research priorities and managing the facility's experimental program. He has been involved with the CLS since its inception. Dr Ellis also serves as national coordinator for the synchrotron's two infrared beamlines. His own research interests lie in materials science, including the surfaces of biological materials, dental materials and dental adhesives. He said, 'I look forward to working closely with a dynamic group of staff scientists who are building beamlines, promoting the applications of synchrotron research and ensuring that the facility is ready to handle the rapid growth in researchers coming to the CLS.' Tom gained his BSc in engineering physics from Dalhousie University and PhD in chemistry from the University of Waterloo in 1984. He also gained a post-doctoral fellowship at AT&T Bell Laboratory in New Jersey. Prior to his appointment at CLS, he was at Acadia University having spent 16 years at the Université de Montréal where he helped establish the Laboratory for the Characterization of Materials.