Associate Director's Message

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We have completed another year of successful operations at CHESS and have just now begun a construction/upgrade period that should culminate in further enhanced performance of CHESS and CESR (Cornell Electron Storage Ring) by the end of the summer. Over the past year we have seen the beam currents double from 80 to 160 mA, a good precursor to CESR upgrades where we expect to see beam currents increase over the next 3 to 4 years to 500 mA, along with a corresponding increase in the x-ray flux produced by the ring.

The staff and users of CHESS have continued to conduct x-ray experiments that impact many fields of science and technology. In this newsletter you can read about how CHESS x-rays probed the alignment of liquid crystals in electric fields, a subject of interest to computer display manufacturers; of the continuing impact of structural crystallography to chemistry and molecular biology; of hysteresis effects discovered in the hydration of montmorillonite clays that have implications for companies trying to extract oil and water from the earth; and of *in-situ* x-ray measurements of the increasing surface area of cements as they cure (which is correlated to their increase in strength) on time scales of a few minutes to years; etc.

Congratulations are due to two individuals from the CHESS community who received special recognition for their research work. Prof. Mike Bedzyk of Northwestern University received the Warren Prize in 1994 for his work, while he was a staff scientist at CHESS, on using long-period x-ray standing waves as a molecular yardstick. Prof. Arthur Ruoff of Cornell University, one of the founding members of our CHESS high-pressure facility, received the Bridgman Award in 1994 for developments in the field of high-pressure research.

This has also been a year when the innovative CCD x-ray area detectors, produced by Eric Eikenberry (Rutgers) and Sol Gruner's group (Princeton), have been a key element in determining rapidly a large number of monochromatic and MAD crystal structures in collaboration with our macromolecular crystallography group, MacCHESS. See the MacCHESS Director's report for a discussion of these particular developments.

CHESS Upgrade Plans. The challenge over the next few years is to optimize the operation of beamlines to provide unprecedented high flux x-ray beams. This should benefit a good number of experiments where, for instance, the samples sizes are modest, but the highest fluxes are required for best temporal resolution in time-resolved x-ray experiment or best signal-to-noise for weakly interacting systems such as magnetic x-ray scattering, etc.

During this summer shutdown there are many projects in place to make CHESS a better place to work. And although we have to wait until October for x-rays, the good news for CHESS users is that we should be operating at the 200-300 mA level in the near future. These projects include:

Shielding wall reconstruction. Thicker, heavy concrete walls are replacing ordinary concrete walls in the B, C, and D-line areas (See page 59).

High heat load developments. The increased source flux can be passed on to the experiment only if the optics can "take the heat." Tests at 250 mA showed that the F1 crystallography station could withstand the 24-pole wiggler beam and put out a proportionally stronger monochromatic beam (see page 57). New, better-cooled crystals for the more sensitive double crystal monochromators are now being designed and fabricated (see page 60).

Renovate B-line. The B1 hutch is being slightly lengthened to allow for a side-bounce monochromator for angle dispersive powder diffraction. B2 is being setup for EXAFS and other experiments requiring a highly tunable x-ray beam.

Rebuild C-line. C-line is being rebuilt with two monochromators, one double crystal unit and a second horizontal focusing crystal that will make feasible time-resolved absorption spectroscopy (see page 46).

A Unique Opportunity. A fraction of the synchrotron x-ray community is presently designing or working on third generation sources to exploit the advantages of brilliance. We suggest that similar advantages might accrue for experiments optimized for high flux applications. Because of the nature of the upgraded CESR source, CHESS is in a favorable position to make this exploration. The rewards in this undertaking promise not only to be new scientific results and better cooled beamline components, but a more complete understanding of how to design x-ray experiments whether they are brilliance or flux driven.

Closing Thoughts. With your partnership, CHESS can continue to have a significant role in synchrotron radiation research out of proportion to its size. Together we can keep CHESS an optimal place to conduct research with high flux, high-energy x-ray beams.