CHESS Director's Report

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Transition to Dedicated Operations: CHESS is at the verge of the most important transition in its 22 year history. Beginning January 2003, the CESR storage ring will be operated in a mode that alternates dedicated use of the ring for x-ray and High Energy Physics (HEP) science. The HEP program for the next several years calls for examination of the tau resonance, which requires running CESR at too low an energy (1.8 to 2.4 GeV per beam) for useful x-ray production. The x-ray and HEP programs on CESR are both important and scientifically productive in their own realms; hence, alternating dedicated operations. CHESS is grateful for the enlightened view taken by our HEP colleagues and their supporters at the NSF since, obviously, the HEP program could proceed more quickly if x-ray operations were to simply cease.

The present HEP program will be completed in about 5 years, after which CESR would be available for full-time dedicated x-ray use. This would be a wonderful opportunity for the scientific community. Synchrotron radiation utilization is still growing rapidly – see Figure 1.

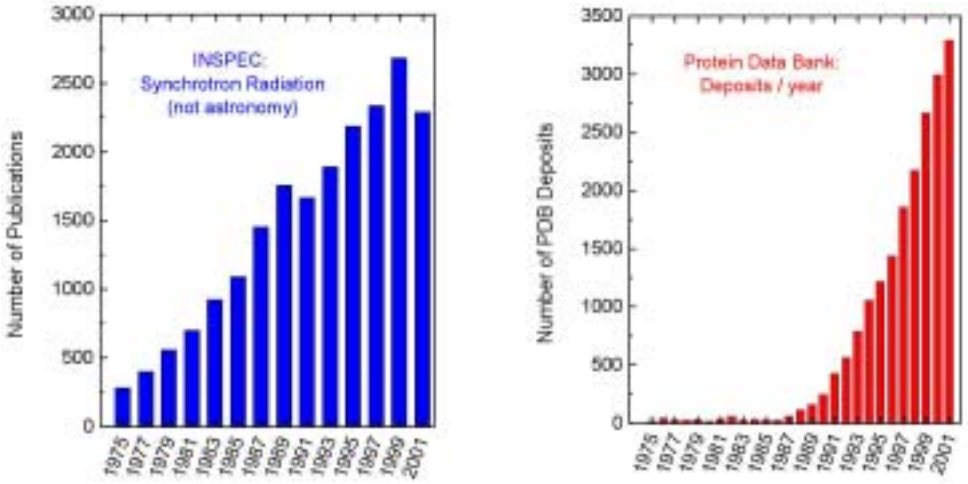

Fig. 1 Growth in synchrotron radiation science shows no signs of slowing. a) INSPEC data base entries for synchrotron radiation (SR - note that 2001 data are incomplete). b) Protein data bank deposits/yr (mostly from SR, 2001 data are incomplete).

In about five years, we expect that all spare storage ring capacity at existing sources would be fully utilized and the nation will be seeking additional synchrotron resources. CESR is a very powerful ring and, with appropriate modifications, can be reconfigured to 3rd generation standards, supporting between 6-8 APS-like sectors at the southern arc of the ring. Moreover, this can be done at a cost that is far less than building even a modest-energy new ring.

Overview of the Past Year: We have experienced a productive year of CHESS operations. So far in the January through October 2002 period, we have had 545 unique users at the facility working under 180 proposals (program, regular, express mode, and feasibility study) for 142 days of actual operation. The laboratory is turning out about one to two publications per each day of beam time. In this process many students receive their PhD degrees from work done at CHESS and on the average there are 80 PhD theses in progress at any one time.

CHESS conducted its 15th annual CHESS Users' Meeting at Cornell University on June 18 & 19, 2002. The meeting highlighted first experimental x-ray data from the new G wiggler stations, first x-ray data on narrow bandpass multilayers, and a new kind of video based beam position monitoring system built upon helium optical luminescence. In addition, there were two

concurrently running workshops, titled "New Technology and Innovative Applications of Small Angle X-ray Scattering" (Sol Gruner, organizer) and "High-Throughput Crystallography and Complementary Methods" (Quan Hao and Richard Gillilan, organizers). The meeting was attended by about 125 individuals.

Trends: We have observed a number of significant trends within the labaoratory that illustrate how the laboratory is changing and constructively developing. First, we are growing and the new CHESS Center activities that tie CHESS, MacCHESS, and now G-line together are the evidence of this growth. At this point our staffing numbers are 32 full-time equivalent employees for CHESS, 13 for MacCHESS, and 2 for G-line (+12 graduate students). A weekly directors meeting is used to coordinate the activities of these groups. Another trend is how CCD x-ray detectors are continuing to have an increasingly high impact on experimental x-ray science programs. MacCHESS statistics show the biggest impact, with these detectors helping users to collect data much quicker than with image plates. Over the course of the last 8 years the average MacCHESS user hours per visit has fallen by a factor of two, from 86 hours to about 44 hours. CCDs are increasingly in use to rapidly record small-angle x-ray scattering images and to record diffuse and specular x-ray reflectivity changes dynamically as thin films are grown in real-time growth chambers. All these data quickly rolling out of detectors have taxed our station computers, networks, and ability to process data. Thus, we have been making continued investments in hardware, networks, and supercomputers. In the x-ray optics arena, the focus has been on deploying multilayer optics to as many beam lines as can really use the 20 to 100-fold intensity gain over higher resolution Si 111 crystal optics. At present, 5 of our 12 stations (42%) of our stations are regularly using multilayers. We are also investigating how to make efficient optics with 0.1 to 0.2% bandwith multilayers to better fill in the bandwidth gap between crystals and the usual 1% bandwidth type of multilayer.

To help with all the changes that these and other issues bring, we have organized the laboratory into "teams" to better support the scientific and technical needs of the facility, covering the range from computers, electronics, vacuum, mechanical design, to safety, administration, etc. We are grateful for the many talented individuals and leaders who really make up the "heart and soul" of CHESS and who try to seamlessly provide the best beam and experimental conditions for the users - and succeed most of the time!

Promising Long-term Outlook: We are also very excited about future long-term prospects. Renewal proposals to the NSF for the next five years of CESR and CHESS operations have been submitted and were enthusiastically recommended for funding by the review committees. (The CHESS proposal review also involved both the National Institutes of General Medical Sciences and Research Resources. Both NIGMS and NCRR have been important components of support at CHESS.) A proposal to the NIH-NCRR for the next five years of MacCHESS operation has also been submitted and is slated for review in early 2003. In addition, a proposal to the NSF for the development at Cornell of a new next-generation Energy Recovery Linac (ERL) x-ray source (refer to ERL article on page 32) has also been recommended for funding by the review committee. We are optimistic that these proposals will all be funded and that CHESS will continue to be a growing, active part of the synchrotron community into the foreseeable future.