

CHES Director's Report

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This has been a very exciting year. For almost a quarter century CHES has run parasitic on High Energy Physics (HEP) use of the CESR storage ring. Beginning in 2003, LEPP (Laboratory of Elementary-Particle Physics), has alternated running CESR between dedicated HEP use and dedicated x-ray use. The reason for alternating operations is that the electron and positron beam energies required for x-rays and for the current HEP experiment are too different for simultaneous use. From an x-ray point of view, the need to collide electrons and positrons for HEP experiments limited the fill length and minimum ring emittance (the figure of merit that leads to brilliance), and resulted in x-ray beam instabilities as the ring was constantly tuned for optimum particle collisions. In contrast, under dedicated x-ray operation, the beam conditions are dramatically improved: fills are now many hours long and the x-ray beam stability has been excellent. CHES and LEPP have been experimenting with different CESR lattices to reduce both emittance and the size of the electron and positron beams at the source points. This has had the advantage of increasing the number of x-rays focused onto the sample per unit ring current. Operating the ring at slightly lower currents than in the past greatly reduces heat loads on the x-ray optics, thereby improving reliability, without compromising much of the x-ray intensity on the sample. Further improvements are expected over the next year as CHES and LEPP learn to better optimize CESR for dedicated x-ray use.

It is especially rewarding to observe the award-winning work of CHES users. Some examples include the 2003 Protein Society's Irving Sigal Young Investigator Award to Yigong Shi (Princeton University) for mechanisms of

apoptosis and TGF- β signaling, the 2003 Margaret Oakley Dayhoff Award and the 2002 New York Academy of Sciences Mayor's Young Investigator Award for Excellence in Science and Technology to Hao Wu (Weill Medical College, Cornell University) for work on protein signaling and cell death, and the 2003 Avanti Award in Lipids to John Nagle and Stephanie Tristam-Nagle (Carnegie-Mellon University) for work on lipid physics. And, of course, we were thrilled that Rod MacKinnon (Rockefeller University) was co-recipient of the 2003 Chemistry Nobel Prize for work on ion channels. The x-ray data for Rod's original K⁺ channel structure (Doyle *et al.*, Science, 1998, 280:69) was entirely acquired at the CHES A1 station. Over subsequent years Rod's group laid open the mechanisms of a variety of biomembrane ion channels. Most of this work was done at CHES, though other sources, most notably the NSLS, were also heavily utilized.

How about the future? Final modifications to CESR for HEP have been completed in Spring 2004, allowing us to settle into a regular schedule of user operations. The final G-line x-ray optics, also installed in Spring 2004, significantly expand the resources of the CHES Center. Cornell is also heavily engaged in a project to develop a next generation Energy Recovery Linac source that promises to outperform all storage rings. Literally, the future looks bright!



Tour group from the "Bridge to Medicine" program. The students for this program are selected from Queens, New York High Schools.