To their credit, the staff at CHESS, MacCHESS and G-line consider it a natural part of every work day to be involved with the scientific community on campus as well as the public at large. Activities we host cover all ranges of ages and preparation, starting with an elementary school science club organized by Staff Scientist Ken Finkelstein, hosting summer projects for high school students and teachers, part-time undergraduate employment and mentoring, long-term graduate student training, and organizing weekly Journal Clubs. New this past year, we’re organizing a university-wide scientific lecture series on X-ray science in biology and environmental sciences (see preceding article on the FASR Lecture Series). This article highlights some of the people who have visited CHESS and projects that were carried out over the past year.

Each year we host high school teachers for an intense 6-week summer visit. These teachers are recruited through the NSF program “Research Experiences for Teachers” (RET) that tries to expose teachers from inner-city schools to the trials and tribulations of scientific research. We especially like this program because we feel that science teachers who become knowledgeable about scientific research will also become better motivated and able to convey to their students the excitement and benefits of careers in science. This past summer, John Salem (Cody High School, Detroit) spent his first RET summer as part of the CHESS computer group. His project was to evaluate, choose, and implement a prototype software batch control system for the MacCHESS Linux 128-node cluster computer. The cluster computers are tremendously powerful, but their productivity depends upon shared use and careful allocation of resources and jobs. John considered open source and commercial software packages and ended up installing and successfully testing the Moab commercial package. CHESS staff will be using the system this fall and outside user groups may use the system once fully tested.

Cornell undergraduate computer science major Ismail Degani, under supervision of staff scientist Richard Gillilan, has designed a remote crystal-centering software package that now allows beamline users to position protein crystals in the X-ray beam with a few clicks of the mouse. The high-resolution display uses state-of-the art streaming digital video that can be viewed on any computer console outside the experimental hutch, including remote sites. This system is not only faster than manual positioning, but also more accurate, allowing smaller protein crystals to be rapidly positioned for structural studies (see page 28 for details).

Cornell undergraduate Eric Angle led the design and construction of a novel high-pressure gas loading system for diamond anvil cell (DAC) specimen chambers. This work was done with Ernie Fontes, Dana Richter, and Chang-Sheng Zha. DACs are used to explore the properties of gases at pressures encountered deep within the outer planets, or for use as pressurization media for studies of minerals and metals deep within the earth. Loading the DAC with gases has historically been a major difficulty limiting many studies; this system overcomes this difficulty. The DAC gas loading system considerably extends capabilities in high-pressure science possible at CHESS (see page 62 for more information).
CHESS and G-line faculty, staff and graduate students participated in many outreach and educational K-12 activities over the course of the year. Among the programs organized on Cornell campus by other centers, G-line graduate students regularly participate in the “Career Explorations: Focus for Teens” program during the summer. Below is a photo of Aaron Fleet leading a hands-on lecture to a group of high school students on the subject of light, waves, and X-ray diffraction.

Cornell undergraduate Daniel Beer worked with CHESS electronics expert Tony Lloyd on a final project for their Electrical Engineering 476 coursework. They designed a new motor drive system, based on a flexible microcontroller, incorporating features needed by CHESS and also utilizing absolute position feedback to guarantee motor shaft positions. They communicate with the controller using the RS-485 protocol, making it possible to control motors at very long distances (from the CHESS Operations area) and still have good noise immunity. The demonstration unit was successful and further testing is in progress. Their project description can be reviewed online at http://instruct1.cit.cornell.edu/courses/ee476/FinalProjects/s2005/dbb28_aml54/index.htm.

Many staff members become involved in giving tours to various school and public interest groups, impressing them with how large and complicated the Wilson laboratory is, what types of science we do and what types of careers in science and engineering might be pursued. As part of the World Year of Physics events taking place in the community during the month of May, CHESS and LEPP worked with the Tompkins County Public Library to help organize a day of physics related demonstrations and hands-on activities. CHESS staff prepared posters and educational materials for distribution at the Library. Researcher Ken Finkelstein presented the activity “Why is the Sky Blue?”, where visitors were able to observe how the path of visible light is scattered in different media.

On June 11th, a special Wilson Laboratory Open House was organized by Lora Hine (LEPP) as part of an ongoing effort to encourage the general public to tour the Lab and learn about the fascinating science that takes place here. As announced to the public during the opening remarks, the science at the Lab depends critically on the formula $E = mc^2$, so recognition of Einstein’s contributions to the research conducted at Wilson thoughtfully meshed the celebration of the World Year of Physics with the festivities held at the Open House.

The Lab was open to visitors for over four hours, during which time attendees could wander the hallways and be both entertained and educated by Wilson staff hosting a variety of demonstrations and activities throughout the facility. Guided tours of the LEPP and CHESS research facilities were conducted on a continual basis. CHESS volunteers conducted a series of liquid nitrogen demonstrations, by far the “coolest” exhibit at the Open House! Irina Kriksunov, Richard Gillilan and Dan Sabol (LEPP) awed community members by explaining how cold liquid nitrogen really is, and how this extreme temperature affects the behavior of atoms, and illustrated these lessons by shattering and expanding (sometimes exploding!) various selected objects.

Kathy Dedrick and Virginia Bizzell ensured that the day’s events went smoothly by greeting and directing over 600 visitors, refueling refreshments and announcing door prize winners. Due to its tremendous success at the Library the month before, the demonstration “Why is the Sky Blue?” was conducted at the Open House. CHESS volunteers Arthur Woll and Dave Schuller taught about the frequencies of different colors of light, the interaction of light with atoms, and the scattering of light that occurs as waves pass through different media.

Thanks to the efforts of the numerous LEPP and CHESS volunteers, the Wilson Lab Open House was a tremendous success!