THE FUTURE OF SCIENCE AT THE ALS

Developing a Strategic Vision for the 21st Century

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What is the strategic scientific vision at the ALS? At our present stage of development, this question comes to the fore. Now that we have brought the ALS into reliable, routine operation that meets or exceeds its design specifications, with users producing a wealth of scientific results, what directions will be most important to this facility over the next 10 to 20 years?

Understanding Complex Systems

We believe that four major scientific areas will be preeminent in the twenty-first century: (1) life science, (2) nanoscience, (3) environmental science, and (4) information science. These choices reflect a shift in emphasis away from the reductionist science that has dominated the twentieth century (e.g., what are the ultimate elementary particles?) and toward the understanding and manipulation of complex systems. These areas are also responsive to societal needs, an important consideration given the changed funding climate in the post–Cold War era. Are the users of the ALS likely to be major players in this new scientific dispensation, and if so, what strategic actions should we be taking now to redirect our emphasis?

In the area of life science, we have growing programs in protein crystallography, x-ray biomicroscopy, and spectroscopy on metallo-organic systems. In nanoscience, we are very strongly positioned. The extremely high brightness of the ALS translates into high spatial resolution, and the various x-ray microprobes and microscopes operating at the micron- and nanometer-length scales at the ALS match the analytical needs of the microelectronics and magnetic recording industries. In environmental science, we have a modest program at present, but we expect this to grow. Recent workshops have exposed a national need for chemical and structural "speciation" spectroscopy and biomicroscopy in the soft x-ray region, and we have pending a major initiative to build out a sector of the ALS storage ring for this purpose. The area of information science is software-dominated, but has a hardware component, specifically semiconductor microelectronics and magnetic recording media. It is in these vital fields that we expect to have considerable impact through our contributions to nanoscience in collaboration with companies such as Intel and IBM.

Basic Research Still a Priority

High brightness also translates into high spectral resolving power, and this is what drives our basic research. Programs in chemical dynamics, atomic and molecular physics, and condensed-matter physics are already benefiting from the unprecedented energy resolution available at the ALS. Thanks to a much-needed boost from the DOE Scientific Facilities Initiative, approved by Congress for 1996, which funded an increase in both facility operations and user equipment, we are adding new programs, such as spin-resolved photoemission studies of magnetic and highly correlated materials, to our growing portfolio of research.

The following pages highlight a selection of ALS research covering the period from 1996 to mid-1997. We have also added a new feature to this year's Activity Report, two perspectives on growing areas of study by leaders in those fields. Together, the highlights and perspectives demonstrate our intention to exploit the high brightness of the ALS by advancing into the twenty-first-century themes enumerated above while maintaining our commitment to basic research. Of course, highlights never tell the whole story. For a much more complete, and more technical, overview of the ALS scientific program, the interested reader should consult our annual compendium of user abstracts and technical reports.