Major facilities for physics research

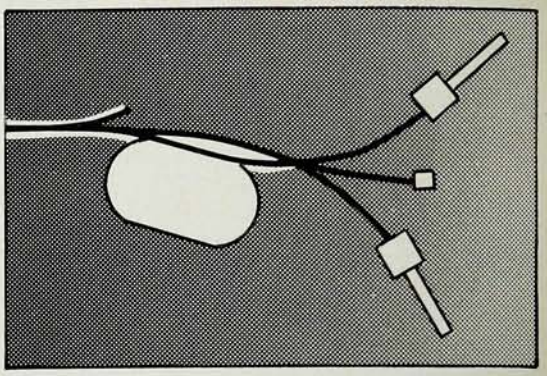
High-resolution spectrometer (80 keV at 800 MeV) and polarized target at LAMPF is used to measure spin-dependent properties in proton–proton scattering in the energy range 500–800 MeV. The white semicircular dipole magnet with field strength as high as 12 kG, has a uniformity of 1 part in 10^4.

The idea for a special issue of PHYSICS TODAY on major physics research facilities originated at a meeting of the APS Executive Committee in June 1984 during discussion of a report presented by L. Charles Hebel, Chairman of the APS Panel of Public Affairs, recommending what APS could do for the physics community about several proposals to the Federal government for the construction of large and expensive research facilities. The editors of PHYSICS TODAY enthusiastically reacted to the APS suggestion, and this special issue became a cooperative endeavor. Hebel's article, beginning on page 25, is based on that POPA report.

The most dramatic proposal for a new, very expensive research facility is the Superconducting Super Collider for high-energy physics. The article (page 28) by Sheldon Glashow of Harvard University, and Leon Lederman, director of Fermilab, describes the physics that could be done with the SSC, why the parameters of the accelerator were chosen, and the latest information on the design of this accelerator.

Nuclear physics was the first subdiscipline to require large and expensive facilities to advance its intellectual progress. In recent years the Nuclear Science Advisory Committee has prepared reports for the Federal government establishing priorities for new facilities for nuclear physics research. Gordon Baym of the University of Illinois, who has been active on NSAC study groups, wrote the article on new and large facilities for nuclear-physics research, beginning on page 40.

Plasma physics research, which has as one of its major objectives the design and construction of a controlled thermonuclear power plant, has always required large facilities for experimentation and tests. Harold Furth, director of the Princeton Plasma Physics Laboratory, describes (see page 52) the new facilities that will be needed to further



that field and ultimately obtain the information necessary to design a controlled thermonuclear power plant.

Condensed-matter research traditionally has not required large and expensive facilities. The field is characterized by research by relatively small groups in university, national and industrial laboratories. Often these groups build their own equipment and perform the experiments in a traditional laboratory setting. However, developments over the past two decades have shown that the intensity of electromagnetic radiation from electron synchrotrons is orders of magnitude larger than can be produced by smaller apparatuses in individual laboratories. By now many experiments in condensed-matter and atomic physics are conducted in the style of user groups at large and expensive facilities. Martin Blume, deputy director of Brookhaven National Laboratory, and David Moncton of Brookhaven have been prominent and active in this field for many years. Their article, "Major research facilities for condensed-matter research" begins on page 68.

A large fraction of the new discoveries and developments come out of small research groups. In fact, small-group research was traditionally the mode by which physics research was done before large accelerator facilities were constructed. Daniel Kleppner of MIT has long been a defender of the small research group, and he has contributed the article "Research in small groups," presented on page 78.

An editorial (see page 184) by Mildred S. Dresselhaus, President of The American Physical Society in 1984, describes what scientific societies and physics institutions can do about large and expensive research facilities.

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