News and views

New Brookhaven Accelerator

25 Bev Alternating Gradient Synchrotron

The U. S. Atomic Energy Commission has approved design and construction at Brookhaven National Laboratory of an ultra-high-energy particle accelerator for nuclear research. The new machine, an alternating gradient synchrotron, will be designed to produce beams of protons of energies ranging up to 25 billion electron volts. The synchrotron will use a series of alternate strongly converging and diverging magnetic fields to confine a proton beam in a tube of relatively small cross section. This focussing effect allows the production of high-energy beams with smaller electromagnets and related equipment than would otherwise be possible.

Cost of design and construction of the new accelerator is estimated at $20 000 000. Design work will start at Brookhaven in the near future and it is expected that the machine can be completed in 5 or 6 years. Once in operation, it will be available to scientists wishing to collaborate in Brookhaven research programs or to carry out independent programs. As a means of producing nuclear reactions under controlled conditions on a laboratory scale, the AEC notes, particle accelerators have played an important role in the advancement of nuclear science and have contributed much of the fundamental scientific information used in the design of nuclear reactors. The energy of the particle beams produced by accelerators bears a direct relationship to the nuclear phenomena that can be studied. As higher energy levels have been attained in laboratory machines, new sub-nuclear particles have been discovered and new nuclear phenomena observed.

The most powerful accelerator now in operation is the Brookhaven Cosmotron, which has accelerated protons to energies of 2.3 billion electron volts. The Bevatron, under construction at the University of California Radiation Laboratory at Berkeley, is expected to accelerate particles into the 5 to 7 billion electron volt range. By providing particles with energies as high as 25 billion electron volts, the Brookhaven alternating gradient synchrotron is expected to contribute important new knowledge of the fundamental nature of matter.

Brookhaven National Laboratory, a research center equipped with facilities which no single university could afford to build or support, is operated for the AEC by Associated Universities, Inc., a corporation formed by nine northeastern universities. The institutions represented are Columbia University, Cornell University, Harvard University, Johns Hopkins University, Massachusetts Institute of Technology, Princeton University, University of Pennsylvania, University of Rochester, and Yale University.

Fuzzy Nuclei

Stanford Scattering Experiments

Present concepts of nuclear structure may undergo some revision in the light of recent experiments performed at Stanford University and reported in the November 15th *Physical Review*. According to R. Hofstadter, H. R. Fechter, and J. A. McIntyre, authors of the paper, "the charge distribution in heavy nuclei tentatively suggested by this work differs rather seriously" from the model usually accepted.

At first glance it would seem that the mutual repulsion of identical charges should lead to a concentration of charge on the outer surface of a nucleus, where it is less densely distributed; or the charge could be spread evenly throughout the volume of the nucleus. In either case there is a distinct "edge" to the charge distribution. Ordinary light waves are diffracted at sharp edges, and, analogously, diffraction effects might be expected if a fast electron having a de Broglie wavelength of the order of the nuclear dimension passes near a nucleus. A series of maxima and minima in the angular distribution of elastically scattered fast electrons is predicted by theory, and these were looked for at Stanford. Electrons of energies of 125 and 150 Mev from a linear accelerator were used in the experiment, with thin foils of gold, lead, tantalum, and beryllium providing the scattering nuclei. The results: "there is no pronounced evidence of diffraction minima or maxima. . . . The absence of pronounced diffraction peaks suggests that, from the viewpoint of the Born approximation, heavy nuclei do not have sharp boundaries." To account for this unexpected effect calculations were made of the scattering that would be produced by exponential, half-uniform and half-Gaussian, Gaussian, and uniform charge distributions. For gold, lead, and tantalum the experimental data agreed best with the exponential form, while for the very light element beryllium any of the calculated distributions could be made to agree with the data.

Other work on scattering (by B. L. Cohen and R. V. Neidigh, as yet unpublished) employing 22 Mev protons was cited as showing the presence of diffraction peaks, in contrast to the Stanford results. Hofstadter *et al.* suggest that "the difference between the nuclear diffraction patterns observed in the scattering of 22 Mev protons and the electron scattering results reported here may perhaps reflect the facts that nuclei interact with protons through short-range forces (also to a lesser extent through Coulomb forces) and are not transparent to protons of 22 Mev energy, while nuclei interact with electrons through long-range Coulomb forces and are transparent to electrons. Hence, the elastically-scattered protons interact effectively only with the outer edges of the nucleus giving the impres-

sion of a sharp boundary. Electrons interact with the entire nuclear volume."

In a companion paper L. I. Schiff, also of Stanford, discusses in somewhat greater detail the theoretical interpretation of the electron scattering experiments, with substantially the same conclusions. The explanation for nuclear charge distributions that appear to taper off smoothly from a central peak remains to be found, but certainly some changes from current ideas on the structure of the nucleus can be anticipated.

It might be mentioned that recent work performed at Columbia by Fitch and Rainwater on the proton density distributions inside nuclei, described in the November 1, 1953, *Physical Review*, are in general agreement with these results.

Scientific Manpower

First Year of the SMC

The Scientific Manpower Commission held its first annual meeting in late November 1953. The Commission, it will be recalled, was established by a number of groups of scientific societies, including the AIP, to unite the forces of science in attacking numerous problems under the heading of Manpower. These include the betterment of science teaching in high schools, the dissemination of vocational information, fact-finding on supply and demand, pertinent representations to the public and the government on UMT, Selective Service, the Armed Forces Reserves and, indeed, anything national in scope which may help assure to the nation adequate resources of scientific personnel. It was agreed that nothing less than a major effort, in which all fields of science would unite and then join with the engineers, could hope to make real progress in rectifying the present unsatisfactory manpower situation.

A new President was elected, namely, M. T. Carpenter, Administrative Director, Standard Oil Company of Indiana. A member of the Commission upon nomination by the American Chemical Society, Dr. Carpenter succeeded Howard A. Meyerhoff, the Commission's first President. Dr. Meyerhoff, a member of the Commission upon nomination of the American Geological Institute, will continue to direct SMC activities under the title of Executive Director. As Vice-President, John S. Nicholas of Yale, nominated by the American Institute of Biological Sciences, will succeed E. G. Begle of Yale, nominated by the Policy Committee for Mathematics. The new Secretary-Treasurer is Dael Wolfle of the NRC Commission on Human Resources and Advanced Training, a member upon nomination by the American Psychological Association. He succeeds Milton O. Lee of the Federation of American Societies of Experimental Biology.

There are now 16 members of the Commission, two each from the American Association for the Advancement of Science, American Chemical Society, American Geological Institute, American Institute of Biological Sciences, American Institute of Physics, American Psychological Association, Federation of American Societies for Experimental Biology, and Policy Committee for Mathematics. Those nominated by the AIP are George R. Harrison, who was re-elected at the meeting for a term to December 31, 1956, and Henry A. Barton, whose present term continues to December 31, 1955. Among other members are Detlev W. Bronk, director of the Rockefeller Institute for Medical Research and President of the National Academy of Sciences, Wallace R. Brode, Associate Director of the National Bureau of Standards and Editor of the *Journal of the Optical Society of America*, Leonard Carmichael, Secretary of the Smithsonian Institution, and other scientists well know to many physicists.

At the Annual Meeting, the Commission voted to enter an arrangement for close cooperation with the Engineering Manpower Commission established several years ago by the Engineers Joint Council, acting for its various member societies. There will be close cooperation in informing the public, school authorities, students, government officials, and others about the manpower situation in science and technology. Fund raising to meet the expenses of such work will also be coordinated by the two organizations.

A basis has already been laid for cooperation with manpower divisions in the Office of Defense Mobilization and the Department of Defense. Contacts with the Selective Service System and the Office of Education have been made. Special research facilities have been made available by the Library of Congress. The Commission is in close touch with the National Science Foundation. M. H. Trytten, Director of the Office of Scientific Personnel of the National Research Council, which has pioneered much of the current effort of scientists to emphasize the importance of professional manpower problems, is in constant consultation.

Among the first specific activities carried on with the initially restricted budget, the following may be mentioned: A survey has been made of vocational guidance literature with an eye to giving students more adequate information for their choice of a career. Cooperation is being extended in this respect to the National Science Teachers Association. An SMC Special Panel on Scientific Personnel has been called into conference and has accepted an assignment to estimate the immediate and future demand for scientists, first in industry and then, as the study progresses, in education and government. Some information has been gathered by the National Science Foundation on government appropriations for research and this is helpful in estimating demand. Conferences have been held with key government officials to urge that deferments for graduate students in science be liberalized and that the call-up of reserve personnel be regulated by a competent board not in the Department of Defense. The Commission has also collaborated with the National Science Foundation and the National Research Council in arranging symposia on manpower problems at the Boston meeting of the AAAS.

The above incomplete list illustrates moves under way to develop the true manpower story of science and then