

# 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 Uni-

versity, 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-