

New NSF-Columbia Project For Planning Russian-English Dictionary

During and since World War II, according to an announcement from the National Science Foundation, an expansion of the Russian scientific and technical vocabulary has led to a need for more adequate specialized Russian-English scientific dictionaries than are now available. A series of studies which will include a systematic survey of existing Russian-English and English-Russian dictionaries are being undertaken in New York City by Columbia University under contract with the Foundation, and it has been suggested that the program may eventually lead to the compilation of a new dictionary to satisfy the needs of English-speaking scientists. The Foundation has allocated \$39,300 for the Columbia project, which is described as being only one phase of a larger NSF program to facilitate the translation and distribution of Russian scientific information among scientists in the United States.

Methods for compiling lists of words for which definitions are required and for obtaining scientific and linguistic accuracy in defining them will be developed; these methods will subsequently be tested through preparation of special manuscripts on mathematical and metallurgical subjects. The project will also draft a comprehensive plan for compiling a full-scale dictionary, covering all fields of science, including estimates as to size and scope of the project, recommended procedures, staff requirements, and costs.

In undertaking the project Columbia University has established a steering committee consisting of Ernest J. Simmons, professor of Slavic languages; Philip E. Mosely, director of the Russian Institute; Nobel Laureate I. I. Rabi, professor of physics; John Turkevich, professor of chemistry at Princeton University; and V. Rojansky, professor of physics at Union College. Professor Rojansky, who will be on leave of absence from his regular post for several months, has assumed active direction of the project.

Caltech's Synchrotron Electrons Accelerated to Record Energies

Preliminary operation of the new synchrotron at the California Institute of Technology has been announced by R. F. Bacher, chairman of the Caltech physics division and director of the eight-man team cooperating on construction of the machine under contract with the Atomic Energy Commission. Electrons have already been accelerated to 460 Mev, and when a lead plate was put in the path of the electron beam for test purposes, x-rays of the same energy were obtained. The previous high in electron energies was between 325 and 340 Mev produced by synchrotrons at the University of California at Berkeley, Cornell University, and the Massachusetts Institute of Technology, and by the betatron at the University of Illinois.

Next stages of work on the synchrotron will involve raising its output somewhat above 500 million volts

and preparing it for research expected to begin sometime this fall. Later, its output is to be increased to around one billion volts. Two other high energy electron machines are under construction—a linear accelerator at Stanford University and a nonferromagnetic synchrotron at the General Electric Co., Schenectady.

At 460 Mev electrons are more than 900 times heavier than electrons at rest, in accordance with Einstein's relativity principle, and travel only one-tenth of a mile per second (or 60-millionth of one percent) slower than light. Electrons must be taken to higher speeds than the 1840-times heavier protons, which are positively charged in order to reach great energies. The proton-accelerating cosmotron at Brookhaven National Laboratory, Long Island, achieved energies of 2.2 billion volts in June by speeding up protons to 177,000 miles per second.

Caltech's synchrotron is located in what used to be the Astrophysics Optical Shop where the 200-inch mirror for the Hale Telescope at the Palomar Observatory was ground and polished. Members of Dr. Bacher's synchrotron team are Robert V. Langmuir, associate professor of electrical engineering; Matthew Sands and Robert L. Walker, assistant professors of physics; and Vincent Z. Peterson, John G. Teasdale, and Alvin V. Tollestrup, research fellows in physics, in addition to Chief Engineer Bruce H. Rule, also chief engineer for the Palomar Observatory. In particular, Dr. Bacher said, the Caltech group will try to find out what particles are created when nuclei are bombarded with very high energy x-rays. These may include a number of particles produced by cosmic radiation, although which particles the synchrotron will be able to produce, beyond the relatively lightweight pi meson, is completely an open question, he added. An attempt will also be made to determine the photo-meson cross section for hydrogen—or the probability of meson production from hydrogen nuclei by energetic x-rays. Although the proton has long been considered a fundamental particle in nature, mesons weighing about one-tenth as much as a proton can be produced by bombarding such nuclei, and a further study at higher energy promises to be illuminating in understanding the proton and its structure. The photo-meson cross section for deuterons will also be studied.

The synchrotron will operate at the 500-million volt level for perhaps a year or two while the Caltech scientists put their major efforts into physical experiments at this stage. At the same time they will be conducting tests to determine what changes will be needed in the instrument to take it beyond 500 million volts toward their ultimate goal of one billion volts. The machine is built in the shape of a race track whose outside diameter is 36 feet. The 140-ton electromagnet which keeps the electrons in their orbits as they are accelerated to ever higher speeds is divided into four quadrants. Each quadrant contains 18 roughly rectangular segments weighing almost two tons apiece surrounding a one-by-three-foot vacuum chamber. The quadrants are separated by five-foot straight sections.

In three of these are attachments for the pumping system that maintains an almost perfect vacuum in the chamber through which the electrons travel. In the fourth straight section is a radio-frequency cavity. Electrons, shot into the synchrotron by an external electron gun driven by a high voltage pulse transformer, pass through an accelerating tube immersed in oil and are injected into the vacuum chamber with an energy of about one million volts. Their velocity then is roughly 175,000 miles a second, or about 94 percent that of light. The electrons move clockwise around the synchrotron. Each time they reach the radio frequency cavity they get a 250-volt boost in energy. In one-fourth of a second they will have traveled some 46,000 miles—almost twice around the earth—to reach an energy of one-half billion volts.

At these speeds a powerful magnetic field which increases as their speed increases must be used to keep the electrons from flying out of their orbit. Power for the electromagnet which does this job is supplied by a 7,500 kilowatt motor-generator. As each burst of electrons is shot into the synchrotron the magnetic field is produced by a current which rises steadily from zero to 3,000 amperes in one-quarter second, then decays again to zero as the current flows back through mercury arc rectifiers. These convert electrical energy to mechanical energy which is stored in a large motor-driven flywheel until the process is repeated—at the rate of about 70 times a minute. When the radio frequency cavity is turned off at peak magnetic field the electrons leave their orbit and strike the target.

Construction of the machine was speeded up by the fact that Caltech secured the vacuum pumping system and iron for the magnet from the University of California. They had been used for a pilot model of the six-billion volt proton accelerator now under construction at Berkeley.

Aeronautical Structures

New Laboratory Established at Columbia

An Aeronautical Structures Laboratory will be established at Columbia University during the next academic year, according to John R. Dunning, dean of Columbia's School of Engineering. Designed primarily as a clearing house for information on high-speed rockets and aircraft research, the laboratory will be under the supervision of the department of civil engineering and will be directed by J. M. Garrelts, professor and head of that department. In its research the laboratory will be able to make use of the facilities of the university's physics, mathematics, and other departments as well as such installations as the cyclotron laboratory at Irvington-on-Hudson and the Materials Testing Laboratory.

New Hopkins Astrophysics Lab

Modern APL Building Also Planned

A new laboratory of astrophysics and physical meteorology has been established at The Johns Hopkins University under the direction of John D. Strong, pro-

fessor of experimental physics. A study of the spectra of planetary atmospheres is currently under way, according to Dr. Strong, and it is hoped that astrophysical measurements can be extended from the visible region of the electromagnetic spectrum to the longer wavelengths including the far infrared. Other aspects of the laboratory's research program will include investigations of the behavior of atmospheric pressure and certain optical studies of interest in astrophysical work, with special emphasis to be placed on lens and mirror coatings. The laboratory will also train graduate students working toward the doctor's degree in astrophysics.

At the same time, the university has announced that a firm of New York City architects has been assigned to proceed with final plans for construction of the new Applied Physics Laboratory, which will be located on a newly purchased 205-acre tract about fifteen miles from the present APL site at Silver Spring. According to APL Director R. E. Gibson, construction of the entirely air-conditioned laboratory building is expected to begin early next year.

High Altitude Research

The Mauna Loa Observatory, Hawaii

According to a recent communication from R. H. Simpson of the U. S. Department of Commerce Weather Bureau in Washington, D. C., another high altitude laboratory should be added to the list of such stations given in the May 1952 issue of *Physics Today* (p. 28). A new geophysical observatory, he points out, has been established at the summit of Mauna Loa (altitude 13,453 ft) on the island of Hawaii. Equipped at present as a weather observatory, it is attended by U. S. Weather Bureau personnel stationed at Hilo, Hawaii.

Meteorological instruments are of the recording type and are capable of operating as long as three months without attention. Continuous records of wind direction and speed, sunshine, rain and snowfall, temperature, humidity, and pressure are now recorded at the observatory and it is planned to install additional equipment including a Dobson ozone recorder and a water vapor absorption spectrometer. It is also hoped that a two-way radio system can be installed which will be suitable for collecting meteorological data from the observatory at Hilo through a push button relay process.

The single structure at the observatory site includes accommodations for two or three observers to remain overnight. The observatory is connected to Hilo, the principal city on the island of Hawaii, by a fifty-nine mile stretch of road which runs from sea level through the dense rain forest of Kulani, above the timberline, and across endless fields of lava formations. The last fifteen miles of the journey must be made by a four-wheel drive vehicle but plans call for the completion of a passenger sedan road within the next seven months.

The Mauna Loa Observatory, one of the highest elevation weather stations in the world, is well exposed to prevailing winds and is perhaps the only spot on