

RESEARCH FACILITIES AND PROGRAMS

Superconducting linac

Successful operation of a 4-in superconducting linear accelerator section has been announced by H. Alan Schwettman, professor of physics at Stanford University. Schwettman and two colleagues, Perry B. Wilson and William M. Fairbank, did the work with the assistance of graduate students L. Michael Axford, John M. Pierce, and John P. Turneaure.

The object is a cylindrical copper cavity, 4 in long and $3\frac{1}{2}$ in in diameter, filled with disks about 1 in apart. A 1-in hole through the disk centers channels an electron beam. Inside surfaces are coated with lead, which becomes superconducting at very low temperatures.

Superconductivity is maintained by keeping the cavity in a liquid-helium bath at 1.8°K. Liquid nitrogen surrounds the helium, and the whole is contained in an insulating vessel. The remaining components (at normal room temperature) are similar to nonsuperconducting linacs. Power comes from klystrons, and injection is by an electron gun.

The machine has already acceler-

ated electrons at a rate of 4 MeV/ft or about the maximum obtained in present linacs. Theoretically, it should be able to go to 10 MeV/ft, but up to now it has been limited by electrical breakdown caused by microscopic whiskers on the lead surfaces. Elimination of the whiskers and other technological improvements should raise the energy increment per foot.

A Q ratio (energy stored to energy lost) of five billion has been achieved with the superconducting prototype. This is 100 times better than previous achievement and 100 000 times the Q of copper at room temperature. With 99 percent of the power going into acceleration and no resistance in the cavity, there would be little heating in a full-sized superconducting linac. Therefore, pulsing of the power input would be unnecessary, and electrons could be accelerated in steady streams instead of in short bursts. The duty cycle would be 1000 times longer than present linacs. The resolution would be better than with present machines.

The Stanford group hope to develop a machine capable of research. It would take five years, they figure.

Electron linac at Oak Ridge

Money has been appropriated for construction of a 140-MeV electron linear accelerator at Oak Ridge National Laboratory. The new facility will cost \$4.8 million; design work has begun and a contract for architect engineering services has been let to Charles T. Main, Inc., of Boston.

The main purpose of the new machine is to produce short-duration, high-intensity (15-A) electron bursts, which will be used to produce intense neutron bursts for time-of-flight spectroscopy. An area for experiments in electron scattering and photonuclear reactions will also be provided.

The linac is a joint project of the Oak Ridge Physics and Neutron Physics Divisions. J. A. Harvey of Physics and F. C. Maienschein of Neutron Physics will be codirectors.

The rotation of Mercury

The planet Mercury does not have a rotation period equal to its orbital period. The aesthetically satisfying belief that the planet was gravitationally locked in so that it always turned the same face to the sun has been received doctrine for more than 80 years and is enshrined in almanacs and reference books. It is not so according to work done during the past year. Both radar and optical observations now appear to agree on a rotational period somewhere around 58 days or about two thirds of the orbital period (88 days). This kind of ratio, which means that Mercury turns opposite faces to the sun at successive perihelion passages, is unique so far in the solar system. Lately a theory has been put forward to explain the stability of the ratio 1 : 2/3.

The tale begins with radar observations carried out at Arecibo during the last inferior conjunction of Mercury in April 1965. G. H. Pettengill and R. B. Dyce observed the limb-to-limb Doppler shift of signals reflected from the planet on April 6, 10, 12, and 25. They concluded (*Nature*,



Three Stanford professors display the superconducting linac section they have built. Left to right: Perry Wilson, Alan Schwettman, and William Fairbank.