

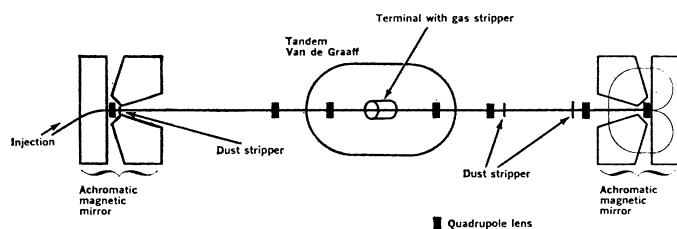
Physical Sciences Notes

ACCELERATOR PHYSICS

Potential Rival for Omnitron

A machine that can be a serious competitor of the Omnitron (SN: 3/18) for accelerating heavy ions is under development at High Voltage Engineering Corporation, Cambridge, Mass. The new design is built around readily accessible tandem Van de Graaff accelerators, while the Omnitron would be a first.

Gunther Hörtig of the Max Planck Institute for Nuclear Physics in Heidelberg proposed the design for the accelerator. It is based on the fact that, for a rather wide energy range, ions passing through a foil or dust stripper



will acquire on the average a greater positive equilibrium charge than ions passing through a gas stripper, the kind normally used in a Van de Graaff accelerator.

In Hörtig's design, ions injected (at left in the diagram) through a dust stripper will be attracted to the negatively charged terminal of a tandem Van de Graaff (SN: 2/11). Inside the terminal the ions pass through a gas stripper where their average positive charge is reduced by the addition of some negative charge.

As they leave the terminal and continue along the beam tube, they are decelerated by the charged terminal more weakly than they were accelerated going toward the terminal. The net result is a gain in energy.

The particles can be bent through 180 degrees with an appropriately designed magnetic mirror, repeating the process a number of times, with a net increase in energy each time.

Each leg of acceleration gives more energy and Hörtig estimates in the current *PHYSICS TODAY* that it may be possible to obtain uranium ions having energies of up to 10 Bev.

SOLAR SYSTEM ASTRONOMY

Asteroid Statistics by Computer

The distribution of asteroids has concerned a number of investigators in the past century. The existence of groups of asteroids that appear to have similar orbits was discovered about 50 years ago.

These asteroid families are believed to be either the result of collisions between larger parent bodies or to have developed due to attractive forces and perturbations by Jupiter. Astronomers have detected many thousands of asteroids, and orbits are known for some 1,650 of them.

Now three scientists from California Institute of Technology, Pasadena, Calif., have plotted a sky map of asteroid positions using a computer. The scientists, Drs. Harrison Brown, Irene Goddard and Julius Kane, con-

clude that this method of treating such a "large set of points is quite useful since it provides a clear picture of the total distribution."

The first group of plots, without analysis, is published in supplement 125 to *THE ASTROPHYSICAL JOURNAL*.

CRYOGENICS

Cooling by Helium 3

A new kind of refrigerator for cooling below one-tenth of a degree Kelvin holds great promise for cryogenics. Over the past year several groups have built apparatus that can cool samples continuously below two-tenths of a degree using helium 3.

Adiabatic demagnetization methods have traditionally been used to cool below three-tenths of a degree, but the new refrigerator is much simpler to use. The cooling occurs when helium 3 dissolves out of the pure phase into helium 4.

The latent heat absorbed as the helium 3 goes into solution does the cooling; the helium 4 acts only as a carrier. This procedure is a decided advance over a conventional evaporation refrigerator because the helium 3 vapor pressure decreases exponentially with decreasing temperature.

Both single-cycle and continuously operating refrigerators have been built using this method, it is reported in the current *PHYSICS TODAY*.

MATHEMATICS

Consequences of Algebraic Axioms

A computer has been programmed to derive meaningful consequences from algebraic axioms by a California Institute of Technology mathematician. He decided there should be a better way of doing this than "hit-and-miss investigation," and began thinking about teaching a computer to do it.

An axiom is a mathematical law assumed to be true for the purpose of deriving new laws or consequences from it. Dr. Donald Knuth, 29, has programmed an IBM 7094 computer to deduce the maximum number of consequences from any given set of algebraic equations.

Dr. Knuth's systematic method for a computer can also be used to determine what cannot be deduced from axioms. The young mathematician is hopeful his research on automated problem solving will shed new light on the general theory of algebraic axioms.

RADIOPHYSICS

Jungle Has Little Effect on Radio

There has been a recent interest in the manner in which radio waves propagate through or over jungle-covered terrain, especially in the very high frequencies covering distances of some tens of kilometers.

Dr. James R. Wait of ESSA's Institute for Telecommunication Sciences and Aeronomy in Boulder has worked out a new formula showing that the electrical characteristics of a jungle "do not differ markedly from free space." He reports in the July *RADIO SCIENCE*, an ESSA publication, that his results also have "application to high frequency radio propagation over smooth terrain with dense vegetation."