PHYSICS

Key to Atom Secrets Seen

By using the Mossbauer effect, Einstein's general theory of relativity was recently tested conclusively. Three Los Alamos scientists have now found another material with the same effect.

LOW ENERGY gamma rays given off by the exploding atoms of certain radioactive elements hold the key to discovering many of the remaining secrets of atoms.

They also provide the most precise nuclear clock yet available, one that might keep time accurately within at least a hundredth of a tick in a million million.

Scientists know this new discovery as the "Mossbauer effect," after the German physicist, Prof. R. L. Mossbauer, now at California Institute of Technology. With a device using this effect, two Harvard University physicists recently made a conclusive test of Einstein's general theory of relativity. They found that the principle of equivalence is true for electromagnetic waves such as radio and light.

According to the principle of equivalence, there is no detectable difference between the force of gravity and the force produced by acceleration outside a gravitational field.

To confirm this gravitational red shift, the Harvard scientists, Prof. Robert V. Pound and Glen A. Rebka Jr., measured the change in frequency of gamma rays given off by iron-57 as the radioactive source was moved up and down a 70-foot column.

Now three scientists at the Los Alamos Scientific Laboratory in New Mexico report in Nature, 186:703, 1960, that they have found another material, zinc-67, that appears to exhibit the "Mossbauer effect" at a level some three times that of iron-57.

The gamma ray radiation involved in the Mossbauer effect has a frequency that is very much more stable than that now available from the best atomic clocks. The electromagnetic waves involved have frequencies of some million million million cycles per second, so ordinary radio methods for observing their frequency stability do not work.

However, Prof. Mossbauer discovered that he could use an absorber that was similar to the radioactive source to detect the frequency change.

Prior to the discovery of the Mossbauer effect, scientists thought the best way to check the gravitational red shift predicted by Einstein's general theory of relativity would be to put an atomic clock in an earth satellite.

The Mossbauer effect was discovered only recently because certain secondary effects made it quite difficult to observe the nuclear resonance involved.

The Los Alamos scientists who report the gamma ray resonance of zinc-67 are Drs. D. E. Nagle, P. P. Craig and W. E. Keller.

Now that one important relativity question is settled, scientists are testing for other experiments that capitalize on this very precisely defined electromagnetic frequency. The Mossbauer effect has provided them with a powerful tool for the exploration of many of the remaining secrets of atomic physics, Dr. Winston E. Kock of Bendix Corporation's research laboratories in Detroit, reports in Science 131:1588, 1960.

Science News Letter, June 11, 1960

PHYSICS

Atomic Experimental Hall

ONE OF THE LARGEST and strangest classrooms on any campus is nearing completion. To be shared by the Massachusetts Institute of Technology and Harvard University, it is as large as a football field and resembles a railroad roundhouse.

Into it electrons will be shot with more energy than ever was imparted to them before by man-made machinery.

This "experimental hall" is being erected alongside the new $12,000,000 Cambridge electron accelerator scheduled to begin operation next year.

The accelerator will be underground, in a circular subway 236 feet in diameter. Sixty times a second, the accelerator is expected to spurt out a pulse of 100 billion electrons with 99.9999996% of the speed of light and 12,000 times their rest mass. If pitted against bursts of light in a race around the world, these electrons would cross the finish line only four inches behind the light.

They will be used by Harvard and M.I.T. physicists to study the smallest known particles of matter. Larger devices have been built to accelerate protons, but this six-billion-electron-volt machine will be the world's most powerful accelerator of electrons. Its beam will give the physicists an ultra-sharp tool with which to dissect stable particles and produce an abundance of short-lived particles.

Construction of this mammoth facility for M.I.T. and Harvard began in 1956. A new four-story building is occupied now by its staff, headed by Prof. M. Stanley Livingston, a member of the faculty of both schools. The accelerator, technically known as an alternating gradient synchrotron, is being assembled in the circular tunnel that has been built beneath a parking lot.

To hold the electrons in their place while they are being accelerated, four dozen huge magnets will be used. Each is 12 feet long and weighs eight tons. The electrons will travel in an oval tube between the poles of these magnets, and energy will be imparted to them by a radio-frequency system comparable to that of one of the largest search radar systems.

"We expect these high-energy electrons to produce heavy mesons, negative protons, and other new unstable particles with energies higher than can now be obtained in any machines now in use," Prof. Livingston reports in The Technology Review, edited at M.I.T. "They should appear in numbers sufficient for important new experiments."

Science News Letter, June 11, 1960

PHYSICS

Standard Radiation Symbol Adopted

A THREE-BLADED, purple propeller on a yellow background, the symbol now used by the Atomic Energy Commission and many state health agencies to warn of the presence of radiation, has been adopted as the official radiation symbol of the American Standards Association.

The symbol is intended for use on signs at the entrance to rooms or areas where sources of radiation are present; on bottles, containers and packages of radioactive materials; on X-ray equipment and other machines that generate radiation, and on materials or apparatus contaminated with radioactive substances.

Science News Letter, June 11, 1960

ATOMIC RAILROAD—A sample of pure nickel, fastened on top of a two-inch high railroad engine, is irradiated with neutrons in the tunnel in the concrete block shielding of a nuclear reactor at the University of Michigan. Paul Treado, graduate student, checks the level of radioactivity in these nuclear studies sponsored by the Atomic Energy Commission.