NUCLEAR PHYSICS

Source of Cosmic Rays

The sun, magnetic dust between stars, or the explosions of stars called supernovae, are some of the proposed energy-sources for cosmic radiation.

➤ WHAT big guns of the universe bombard the earth with the powerful but invisible cosmic particles? The sun, the dust between the stars or even far away in cosmic space, are possible origins of cosmic rays described to the University of Denver International Cosmic Ray Symposium in Idaho Springs, Colo.

A few years ago there was no satisfactory explanation of the birth of these radiations. Now, scientists have the choice of two or more ways the rays can get started and pick up the immense energies they carry to earth.

Picture great clouds of dust in motion in the vast spaces between the stars, clouds so diffuse that they could never be seen if man were there to view them. These clouds set up magnetic fields that travel along with the dust particles. When a bit of dust collides with a cosmic ray particle the particle may disappear. But if a particle gets around in this region safely, it picks up energy as it leaves and in many collisions gets energy as great as the cosmic rays need to plunge, as they do, into the earth's atmosphere. This birth process may go on for millions of years.

Dr. John A. Wheeler of Princeton discussed at the Symposium this theory for which Dr. Enrico Fermi of the University of Chicago is largely responsible. New ideas that the Swedish astronomer, Dr. Hannes Alfven, has put forth on energy in magnetic dust clouds have helped to produce this picture.

The sun, from which almost all other earth-received radiation comes, is the birthplace of most cosmic radiation as well, Dr. Edward Teller of the University of Chicago urged at the meeting. This allows the projectiles to get their energies closer to the earth. The radiation seems to come into the earth as it does because of the magnetic field of the earth.

To make the Teller theory work, it is necessary to have a sort of squashed-down magnetic field of the sun strongest in the plane of the revolving planets.

Still another theory is that the energy comes from tremendous explosions of stars called supernovae. Dr. Lyman Spitzer, Princeton astronomer, visualizes these explosions as shooting out immense amounts of radiation which strike the cosmic particles in such fashion as to give them the billion electron volts they need per unit particle in heavy atoms.

If the Fermi and Spitzer theories were both operated, they might explain everything, as the cosmic magnetic dust birthplace is reasonable for the protons (hearts of hydrogen atoms) that arrive from outer space, and the Spitzer theory makes possible the hearts of heavy elements that have recently been found.

These cosmic rays can be thought of as messages from the parts of the universe that human beings can never hope to visit. They are another way of looking into the depths of the universe, supplementing the giant telescopes which receive a different sort of radiation for astronomers to study.

It is a toss-up as to what is more important, discovery of what the cosmic rays are and do, or discovery from the radiation of how the universe and matter are put together.

Science News Letter, July 9, 1949

NUCLEAR PHYSICS

Find Big Atomic Showers

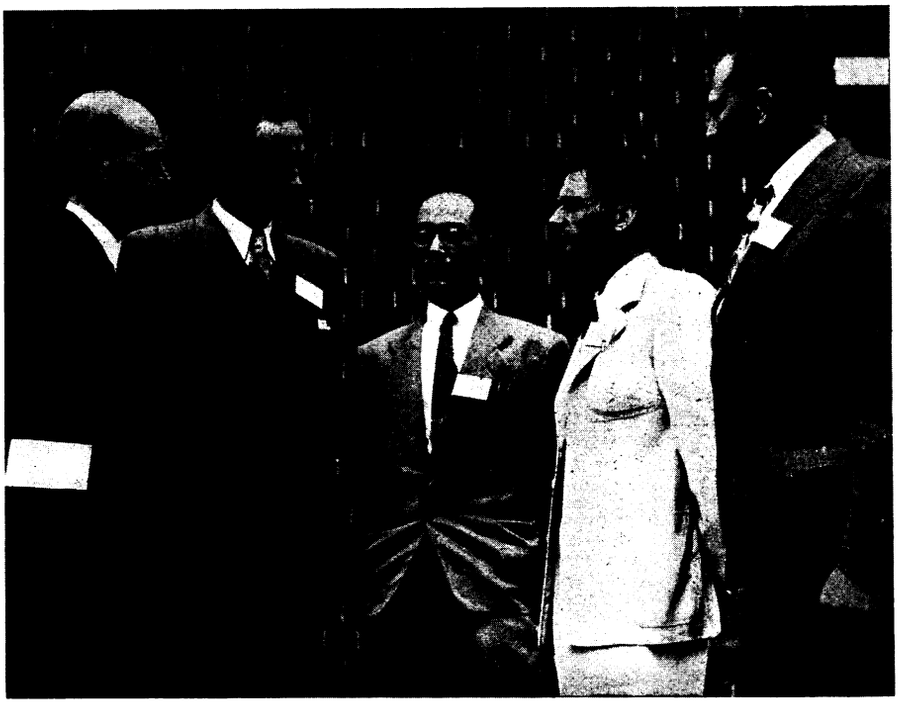
➤ IMMENSE explosive showers of atomic fragments, splattering 200,000,000 particles over hundreds of acres, have been discovered in the earth's atmosphere. Each shower is caused by a single atomic bullet from outer space.

Announced to the University of Denver International Cosmic Ray Symposium in Idaho Springs, Colo., by Dr. Kenneth Greisen of Cornell University, these showers were detected by coincidental effects upon 200 Geiger counters in experiments at the Inter-University High Altitude Laboratory at Echo Lake, Colo., two miles above sea level.

Only about once a week do such gigantic showers, approximately a mile across, get detected in one place, but smaller bursts occur about every second, probably causing the streaks of particles that are the cosmic rays detected.

"We are dealing with the highest energy ever discovered in individual atomic particles, a billion times greater than the energy that is let loose by the fission of a single uranium atom," Dr. Greisen explained.

The actual amount of the energy in the particle that enters the earth's at-



COSMIC RAYS ARE INTERNATIONAL—At the symposium in Colorado (left to right) Dr. Manuel Sandoval Vallarta of Mexico, Dr. Hugh Carmichael of the Canadian National Research Council, Dr. H. Yukawa of Japan, Dr. Oreste Piccioni of Brookhaven National Laboratory, Dr. Byron E. Cohn of University of Denver, host institution.

mosphere and sets off a big shower is actually small and could hardly be felt if it were concentrated on one's head (a hundreth of a foot-pound). It is not useful, like the energy in the explosion of the atomic bomb, because there is no known way to concentrate and control the cosmic ray energies. But Dr. Greisen explains that discovery of the fission of this single uranium atom had to precede that great chain reaction that makes possible the atomic bomb.

The big showers happen in about 40 millionths of a second, and the entering particle is probably a proton, or heart of a hydrogen atom. The particles that are produced include all the fundamental particles, known as protons, electrons, neutrons, photons, various mesons, and neutrinos—the latter never actually discovered except by mathematical inference.

A husband-wife team of Italian scientists, Drs. G. Cocconi and V. Tongiorgi (Mrs. Cocconi, now at Cornell) collaborated with Dr. Greisen in his research.

Another husband-wife pair of experimenters upon cosmic ray showers who reported their findings was Dr. and Mrs. C. G. Montgomery of Yale University. Other cosmic ray experts reporting on showers were Dr. Lloyd G. Lewis of Princeton and Drs. W. W. Brown and A. S. McKay of Cornell.

Science News Letter, July 9, 1949

CHEMISTRY

New Rat-Killing Chemical

➤ A NEW rat-killing chemical, that does rodents to death by causing internal bleeding, has proved up well in field tests conducted by the U. S. Fish and Wildlife Service at the University of Florida, reports H. J. Spencer, Survey biologist. The 100% kill obtained earlier under laboratory conditions has been practically duplicated in the larger-scale tryouts.

The new compound, at present known simply as Compound 42, is a chemical relative of dicoumarol, the substance found in spoiled sweet clover that prevents the clotting of blood. It has a similar physiological effect, and thus starts and maintains fatal bleeding in the rats' abdominal areas.

Compound 42 does not kill at a single dose, as most other rodenticides do; four or five successive feedings are required. However, the effect is cumulative, and once a rat has eaten enough of it he is a "goner." Rats do not learn to avoid it, nor do they develop any tolerance.

Most effective mixture was found to be 46 grams—slightly more than one and one-half ounces—in 100 pounds of solid food. Four or five feedings of this mixture, over as much as a 12- to 15-day period, produced a practically total kill.

Field tests were made on both the common brown rat and the scarcer black rat. The black rat, though a smaller species, had four times the resistance of the brown rat, but the recommended mixture was sufficient to kill both species. Mr. Spencer is now testing Compound 42 on the house mouse.

Unlike the highly dangerous poison known as 1080, used in professional rat-eradication programs, Compound 42 is not harmful to larger animals or to human beings in the dosage recommended for rodents. Moreover, whereas 1080 has no antidote, the action of Compound 42, if accidentally swallowed in dangerous quantity, can be checked. This can be accomplished either by blood transfusion or by the administration of clot-promoting vitamin K.

Compound 42 was first isolated in 1943, in a search for anti-coagulant derivatives of dicoumarol. Shelved for five years, it was again picked up in 1948 and subjected to extensive laboratory tests to determine its value as a rodenticide.

Science News Letter, July 9, 1949

Question Box

CHEMISTRY

How does a new rat-killing chemical work? p. 20.

ENGINEERING

How can we achieve security? p. 22.

MEDICINE

How can bee stings and insect bites be relieved? p. 28.

How may pregnant women be saved from a dangerous disease? p. 27.

What have tests with Chinese drugs revealed? p. 23.

What kind of blood cells have been found in atom-smasher workers? p. 25.

METEOROLOGY-ENGINEERING

What facts may be learned with a new fog machine? p. 23.

NUCLEAR PHYSICS

How could atomic casualties be cut in event of war? p. 28.

What are some possible origins of cosmic rays? p. 19.

Photographs: Cover, Dr. Edward Ney and Mrs. Phyllis Freier; p. 19, p. 21, University of Denver; p. 22, Naval Ordnance Laboratory; p. 23, University of California.

● RADIO

Saturday, July 16, 3:15 p.m., EDST

"Adventures in Science" with Watson Davis, director of Science Service, over Columbia Broadcasting System.

Dr. Robert A. Millikan and Dr. Carl D. Anderson, Nobelists in physics at the California Institute of Technology, and other cosmic ray experts will talk about "The Mystery of Cosmic Rays."

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