PHYSICS

Design Atomic Speed Trap To Solve Cosmic Ray Puzzles

Pair of Superposed Cloud Chambers With Lead Plates Will Slow Down and Possibly Destroy Fast Particles

SCIENCE took another stride toward understanding the ever-present cosmic ray with the discovery at Harvard University that many of the strange new particles found in the rays last year are destroyed in a split-second cataclysm which, without leaving a shred of evidence, explodes their million-volt energies.

The particles, found independently by Prof. Jabez C. Street and Dr. Edward C. Stevenson, of Harvard, and Drs. Carl Anderson and Seth Neddermeyer of California Institute of Technology, are unlike any other fundamental bits of matter. They are the most penetrating projectiles known to man. Tearing earthward from outer space at energies ranging up to hundreds of billions of volts, they can easily blast through several inches of dense, solid lead.

Energy Dribbles Off

According to Prof. Street and Dr. Stevenson, however, many of these particles dribble off energy as they collide with atoms in the atmosphere, apparently reaching a critical stage at which one single collision will stop them in their tracks and completely dissipate their great store of remaining energy.

Just when this stage is reached, why one smash-up should wreck these pile-driver projectiles, the two Harvard physicists are not prepared to say, nor are they certain exactly how these catastrophes occur. The cataclysms follow no known physical laws and are entirely unpredictable.

To answer these and other puzzling questions the pair have designed a new type of cosmic ray "telescope" and atomic "speed trap" which will soon be put into operation for better observation of the cataclysm. An automatic recording device is already photographing the paths of some fifty cosmic ray particles daily for them.

Preliminary experiments indicate that the new-found particle has an electric charge about equal to that of the ordinary atomic building blocks, the proton and the electron. Its mass, however, is about 130 times as great as that of the electron and just about one-fourteenth that of the proton. Its tremendous penetrating power, of course, also marks it off from other particles of matter. Indeed it was this stupendous force which led to its original discovery.

As Prof. Street and Dr. Stevenson visualize the cosmic ray bombardment, one of the small particles might start from outer-space with an energy of billions of electron-volts. Small amounts of this energy are probably lost through collisions with air molecules or even solid material as the particle shoots toward earth. A head-on smash-up with a lead plate might cost it a few million volts of energy per centimeter, a noticeable but by no means large loss.

Down to a certain critical energy value —possibly at several hundred million volts—the particle's energy loss apparently proceeds with fair regularity. At some as yet not accurately determined critical energy range, however, the chances are that one single collision may stop the particle altogether, exploding all its remaining energy in one lightning holocaust. This range probably extends from zero up to about four hundred million electron volts.

May Stop at Thin Plate

Thus a particle which has easily smashed through several inches of lead plate may, in this critical energy range, succumb to a sheet of lead only a third of an inch thick or even less. This has been the most puzzling aspect of the discovery for this energy loss is entirely out of proportion to other earlier energy losses by the particle. In attempting to unravel the mystery, the two scientists have been looking for possible products of the catastrophe but thus far they have been unable to find any.

The proposed attack on the problem, to be made with the new cosmic ray telescope, involves a study of the mathematical probabilities for occurrence of the cataclysm at various ranges of the particle's energy content. The two are also trying to produce one of the cataclysms right in front of a camera so that if there are any disintegration products they can be photographed.

The new "telescope" uses equipment familiar to research workers in this field although it is arranged in a significantly different way. Outstanding is the set-up of two cloud chambers with one on top of the other. In the top one a particle is photographically traced through a strong magnetic field to determine its energy and other characteristics, a standard procedure.

Then, with these instantaneously determined, the particle flies into the lower chamber where a series of metal plates is arranged to trap it, slow it down and possibly destroy it in one of these cataclysms. A camera will also record the happenings in this lower chamber and the scientists hope to obtain a picture of the disintegration. A feature of the apparatus is that it operates automatically, resetting itself after each passage of a cosmic ray.

In announcing the research the investigators pointed out the need for hundreds of photographs of the new particle since only a very small number of those reaching the earth can be used in scientific studies. Most of the particles reach earth at such stupendous speeds that they slip through laboratory speed traps and thus afford no basis for investigation.

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New Atomic Particles Forecast in Cosmic Radiation

SCIENTISTS are now on the hunt for still another type of cosmic ray particle which is predicted by Dr. Robert M. Langer, research physicist of California Institute of Technology.

In a report (*Physical Review,* March 15) Dr. Langer suggests that atomic particles weighing from two to ten times the mass of ordinary electrons should be found in cosmic radiation.

Already, in cosmic ray studies, high-energy electrons of ordinary mass and a positive electrical charge have been identified. And also the massive "X" particles weighing several hundred times the mass of ordinary electrons have been observed and studied.

The new and yet-unfound particles would have mass intermediate between these two extremes, says Dr. Langer.

Experiments now show, Dr. Langer reports, that the initial, incoming cosmic rays appear to consist largely of positive electrons. These high-energy particles strike air atoms and from the impact