

PHYSICS

Cosmic Rays Are Photons, Dr. Millikan Declares

Latest Observations at Great Altitudes Held to Support Theory of Interstellar Origin of Penetrating Radiations

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COSMIC RAYS are primarily light rays, or photons, which may be mixed to some extent with secondary charged particles, even when they enter the atmosphere. The rays originate out in interstellar space. These were the conclusions of a discussion of cosmic rays presented at the Mt. Wilson Observatory by Dr. R. A. Millikan, based on results made possible by recent advances in experimental technique developed at the California Institute of Technology.

Dr. Millikan acknowledged the assistance in this work of three especially able and resourceful young men, Drs. I. S. Bowen, C. D. Anderson, and V. H. Neher. Dr. Millikan said it was largely through their ingenuity that the new improvements were attained. The work was supported by the Carnegie Institution of Washington.

All observers, said Dr. Millikan, agree that the immediate agents through which the cosmic rays make their presence known are charged particles moving at such high speed that they disrupt atoms all along their path. There has been developed at the California Institute of Technology a photographic technique by which the energy of these particles has for the first time been directly measured. Over six hundred such photographs have been taken during the past year. They show the rays to be of enormous energy. They range from 40 million to 1,000 million volts, at least a hundred times larger than any that have been measured previously. The voltages below 500 million predominate. This has an important consequence, for it means that all those of less energy than 500 million must be secondary rays, produced in our atmosphere by primary cosmic rays, because charged particles with energy of even 1,000 million volts could barely penetrate the atmosphere. Indeed, Dr. Millikan showed photographs in which the actual formation of these secondaries could be seen taking place, for tracks sprang out of

lead interposed in the path of the cosmic ray beam when no tracks entered the lead.

The only agents which could produce such tracks without being seen themselves are photons. Dr. Millikan pointed out that this conclusion received complete support from all the recent careful experimenters working on the so-called latitude effect. They agree that there is no latitude effect in regions more than 30 degrees from the equator. Dr. Millikan himself has been looking for such an effect for several years with ever-improving methods. So far he has failed to find any evidence of it at sea level. At very high altitudes—in airplanes at 21,000 feet—there may possibly be some indication of a small effect.

Now, some observers have found small influences within 30 degrees of the equator. Dr. Millikan has not yet explored this region with his latest instruments and would not deny the possibility of such an effect. However, it does not weaken his argument that the

cosmic rays as they come into the atmosphere are primarily photons. A few electrons are necessarily generated by the photons in passing through tenuous matter in interstellar space. These would surely show a latitude effect if we could go to high enough altitudes and use sensitive enough instruments.

One of the most interesting results of the airplane flights was the rapid and continuous increase in cosmic ray intensity with altitude, especially between 19,000 and 21,000 feet. This is in agreement with previous work and shows a less penetrating component of the cosmic radiation which must account for most of the intensity observed near the top of the atmosphere. The primary rays at high altitudes are photons, most of which, from their penetrating power, are found to have energies in the neighborhood of 25 million volts.

Even the trained physicist must reflect a while before he can appreciate how conclusive a proof of the photon nature of cosmic rays is provided by this rapid rise in intensity with altitude coupled with the absence of any great latitude effect.

The interstellar origin of cosmic radiation is shown by the absence of any large or regular effect of the sun on cosmic rays. If the sun or milky way were responsible for a considerable portion of the cosmic radiation, the intensity would have to rise and fall according to the posi- (Turn to Next Page)

ASTRONOMY

Diminishing Moon to Eclipse Bright Star Regulus

STAR GAZERS in the southern and eastern parts of the country will see an interesting sight on the evening of Sunday, December 18, when the moon occults, or "eclipses," the bright star Regulus. Though every night the moon passes in front of some stars, it is very seldom that one as bright as Regulus is occulted.

Astronomers at the Naval Observatory in Washington will see the moon cover the star, which is of the 1.4 magnitude, at 9:41 p. m., Eastern Standard Time. At that time the moon, approaching last quarter and in a gibbous phase, will be low in the east. At 9:54 p. m.

the star will reappear. Farther north the time will be shorter, while in the southern part of the country it will be a little longer, and the times different. In the middle west and west, the occultation will be over when the moon rises.

Observations of the exact time of such occultation are important to astronomers, because by their aid the correctness of predictions of the moon's wandering through the sky can be checked. The positions of the stars are accurately known, and when the time of an occultation is found the exact position of the moon at that moment is known.

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