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## HIGH FREQUENCY RAYS OF COSMIC ORIGIN<sup>1</sup>

It was as early as 1903 that the British physicists, Rutherford and McLennan, noticed that the rate of leakage of an electric charge from an electroscope within an air-tight metal chamber could be reduced by enclosing the chamber within a completely encircling metal shield or box with walls a centimeter or more thick. This meant that the loss of charge of the enclosed electroscope was not due to imperfectly insulating supports, but must rather be due to some highly penetrating rays, like the gamma rays of radium, which could pass through metal walls as much as a centimeter thick and ionize the gas inside.

In view of this property of passing through relatively thick metal walls in measurable quantity, the radiation thus brought to light was called the "penetrating radiation" of the atmosphere, and was at first quite naturally attributed to radioactive materials in the earth. But in 1910 and 1911, it was found that it did not decrease as rapidly with altitude as it should upon this hypothesis. The first significant report upon this point was made by a German physicist, Gockel, who took an enclosed electroscope up in a balloon with him to a height of 13,000 feet and reported that he found the "penetrating radiation" about as large at this altitude as at the earth's surface, despite the fact that Professor Eve, of McGill University, had calculated that it ought to have fallen to half its surface value in going up 250 feet.

In 1912, 1913 and 1914, two other German physicists, Hess and Kohlhorster, repeated these balloon-measurements of Gockel's, the latter going to a height of 9 km., or 5.6 miles, and reported that they found this radiation decreasing a trifle for the first two miles and then increasing until it reached a value at 9 km., according to Kohlhorster's measurements, eight times as great as at the surface. This seemed to indicate that the penetrating rays came from outside the earth, and were therefore of some sort of cosmic origin. The war put a stop the world over to further studies of this sort, but as soon as we could get the proper instruments built after the war in the newly equipped Norman Bridge Laboratory of Physics, I. S. Bowen and myself went to Kelly Field, near San Antonio, Texas, with four little recording electroscopes which we succeeded in the spring of 1922 in

<sup>1</sup> Read to the National Academy of Sciences, Madison, November 9, 1925. Copyright, 1925, by Science Service, Inc.

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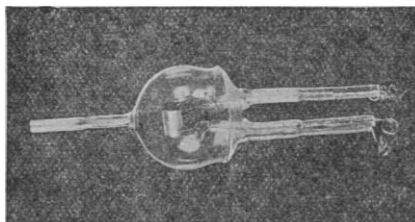
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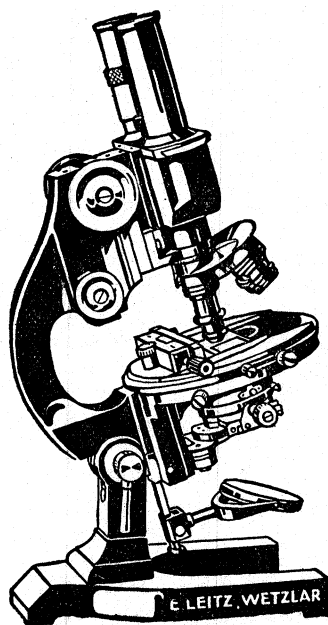
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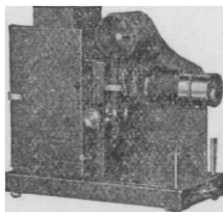
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