PICTURES UNIVERSE ELECTRIFIED SPACE

Prof. Birkeland of Norway Holds That Suns and Stars Are Charged Negatively.

BUT EMIT POSITIVE ATOMS

These, According to His Hypothesis, Coalesce to Form Planets That Revolve About Suns.

Special Cable to THE NEW YORK TIMES.

LONDON, Feb. 22.—An amazing picture of the future development of the universe is drawn by Prof. Kristian Birkeland, a Norwegian physicist, in a lecture delivered before the Academy of Science at Christiania.

The earth, said Prof. Birkeland, had existed as a globe forever a milliard of years. Man had lived and developed for only a fraction of that time. During the last two centuries he had developed in culture and science far more than in the hundreds of thousands of years that he had previously existed on the earth.

How long had this evolution been going on? asked the lecturer. Geology taught that life upon the earth was only a brief episode. Lucien Poincaré once said that human thought was like a flash of lightning in the dark night, but it would seem to be conceivable that new worlds had arrived in space more frequently than human beings were born on earth. Each world probably had its flash of lightning with its human struggle of thought and discovery, again to disappear without leaving a trace. Worlds died more frequently than human beings on earth, in numbers beyond computation.

The researches by which Prof. Birkeland arrived at these conclusions show an interesting similarity with those of Sir William Ramsay and Prof. Collie. His experiments, he said, showed that as a result of an electric discharge in a vacuum tube platinum and uranium appeared. At any rate, the original rays were similar to the alpha rays, or, in other words, behaved in a manner comparable with radium. Such action, he said, would appear to suggest transmutation of the elements concerned.

The bearing of these facts on the theory that Prof. Birkeland puts forward as to the origin of the universe is that it gives experimental confirmation to his hypothesis that bodies, strongly charged with negative electricity, can give out positively electrified particles. He regards the suns and stars as such bodies emitting these particles which coalesce to form planets circulating around the parent body.

From this premise, he concludes with Arrhenius, that the universe is infinite and that the whole of space consists of ether charged throughout with electricity.

The basis of his system, Prof. Birkeland explained, was contained in the belief that all the suns of the universe were strongly and negatively electrified, their electrical condition being maintained by radiation. The intensity of the electrification varied with the different stars, but in the case of the sun and stars of this system it was estimated by Prof. Birkeland at 600,000,000 volts, the determination of the charge in the case of the sun being calculated from the character of the electric rays passing from the sun to the earth and producing the aurora borealis.

The lecturer asserted that he had shown experimentally that a body in the condition of the sun might become magnetized and give rise to electric phenomena, corresponding to those seen in the sun, as, for instance, the sunspots, arranged in belts on both sides of the equator and surrounded by vortex rings, the movements of these spots in different degrees of latitude and the appearance of a corona.

Prof. Birkeland pointed out that in all electric discharges, taking place in a vacuum, the negative pole threw out material particles with a velocity that might become exceedingly great, if the electric tension employed was considerable and the temperature was high. If, for instance, the negative pole of the cathode was a small sheet of platinum, two square millimeters in area, it was possible within a few hours completely to platinize and cover with a most resplendent platinum mirror objects having a surface of several square decimeters, at a considerable distance from the cathode. It depended upon the conditions of the experiments whether the particles, thus hurled out separately from the cathode, became colloidal corpuscles, entire collections of molecules, or were reduced to separate atoms.

The sun, according to the theory advanced, was such a body, and the question, therefore, arose as to what would be the fate of particles thus thrown into space.

The lecturer divided such particles into three groups. The first was thrown into space never to return. The second returned to the parent body by the force of gravitation. The third and lesser group coalesced to form new planets, continually circulating around the sun.

The last of the three groups, which had been the object of special investigation, appeared to be thrown off from close to the magnetic equatorial plane. Corpuscles gathered in rings around definite circles. Those with a relatively large mass in proportion to their electric charge were ranged in circles, close to the central body, while those with a relatively small density, continued to move in rings at the furthest remove from the central body.

On losing their electric charge the particles described ellipses of very small eccentricity and revolved with the central body as a focus provided that the distance from the latter was considerable, when compared with its radius.

The behavior of the positively charged particles was peculiar. These formed planets that revolved round the sun in the same direction as the hands of a clock and at smaller distances than the negative particles, which moved round it in the opposite direction.

Regarding this theoretical system as comparable with the universe, Prof. Birkeland suggested that the 600 or more planetoids between Mars and Jupiter resulted from such a dustring, which had not yet crystallized into one or more large planets. The rings of Saturn could be regarded as partial "dustrings" and the formation of more might be expected.

After expounding this hypothesis, Prof. Birkeland pointed out that to sustain it it was unnecessary to show experimentally that the particles shot out from the negative metallic pole very largely carried a positive electric charge, for to fit in with the assumption that the negative pole sent out nothing but negative particles the motion of the planets would have to be in an opposite direction from that in which they actually moved.

By a series of experiments Prof. Birkeland said he had produced large bundles of positive metallic rays. These were undoubtedly positively charged atoms and the length of the bundles varied with the intensity of the electrification and the temperature of the negative pole. Using an intensity of between 15,000 and 20,000 volts and a temperature of between 1,200 and 1,800 degrees centigrade, such rays had been produced from palladium, platinum and uranium.

These atom rays possessed several of the most characteristic properties of Alpha rays, being formed similarly and behaving generally like them, and in the case of platinum and uranium, at any rate, being transmissible through a very thin sheet of aluminium foil.

In consequence of these experiments Prof. Birkeland proposed to extend the term "Alpha ray," hitherto used as the equivalent for positively charged helium atoms, shot out of radio-active material, to include the rays of particles formed from all positively charged atoms, moving at such a velocity as produce the properties of alpha particles, and to describe the process by which such rays were formed as a sort of radio activity.

Such an idea would suggest the transmutation of the elements concerned, but the lecturer explained that he had not yet succeeded in proving that by this radio activity chemical elements were transmuted, nor had he been able to determine whether heat was developed by the disintegration, as occurs in the case of the transformation of radium.

Elucidation of this point would have an obvious bearing on the heat supply and lifetime of the sun and stars. If such transmutation was possible, the atmosphere of the earth could be regarded as engendered by some such disintegration of the earth's matter as that which gave birth to the moon.

Returning to the meaning of his hypothesis and reminding his audience that according to it every star in its process of development would have shot out electrified particles into space, Prof. Birkeland argued that the largest mass in space was not situated in the stars or in the nebulae, but in the so-called empty space. He imagined this as containing rapidly moving particles of every kind—electrons and electrified and unelectrified atoms and molecules of all the chemical elements.

To illustrate the vastness of space he pictured a globe having a radius only equal in length to the distance between the earth and the nearest star, Alpha Centauri, and showed that if the whole known solar system was distributed uniformly through it there would be only one atom to every eight cubic centimeters of space. It would be possible to believe that the particles present were a hundred times as numerous without the assumption being in conflict with theories based on the optical properties of spaces, or without there being any appreciable resistance offered to the heavenly bodies.

Full acceptance of the hypothesis would involve two important consequences: That light must be absorbed to some extent in space and that the universe must be infinite.

The New York Times
Published: February 23, 1913
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