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J. J. Thomson's theory of matter is largely the outgrowth of his own experimental researches in the nature and structure of electricity. In reading the records of his work it is often hard to discriminate in just what sense he uses the term "electricity." It is certainly not well defined whether the term stands for primordial energy or matter.

In only one instance does he speak with any definiteness on the point. He says, "that one view of the constitution of matter is that the atoms of the various elements are collections of positive and negative charges held together mainly by their electric attractions." Continuing at another point, he says: "All mass is mass of the ether, all momentum, momentum of the ether,and all kinetic energy, kinetic energy of the ether."

These statements would lead us to think that to him the term "electricity" and "ether" are at least synonymous. If there is any difference, it may be stated by saying that electricity is ether under a corpuscular stress. The term "corpuscular" here will explain itself later.

Electricity, we are told, has an atomic structure. The term "atomic" is used here in a general sense signifying merely that electricity is an aggregation of individual units of ether called corpuscles. As evidence of this divisibility of the electric charge, he first turns to the phenomenon of electrolysis. We know that when electricity is transmitted through a solution, the amount of the positive and negative charges is directly proportional to the number of ions coming up to the electrode. A divalent element carries twice as much as a univalent; a trivalent three times as much. Electrolysis tells us, accordingly, that the magnitude of electrical charges on ionized atoms in solution is always an integral multiple of that on the hydrogen atom. As Helmholtz says, "if we accept the hypothesis that elementary substances are composed of atoms, we can not avoid the conclusion that electricity, positive as well as negative, is divided into definite elementary particles which behave like atoms of electricity."

The fact of the ultimate divisibility of an electric charge is more clearly grasped from the behavior of an ionized gas. When a gas is subjected to the influence of Roentgen rays it takes on conductivity. This conductivity is due to the presence of minute particles of electricity mixed with the gas. These particles can be filtered out of the gas through a plug of cotton wool. They can also be attracted or repelled out by the action of a strong electric field. The mass of these particles of electricity was determined by J. J. Thomson and other experimenters in various ways. It would take too long to discuss any of these methods in detail. The principal method, however, consisted in making the particles nuclei of visible vapor particles. In this manner, a cloud was formed and from the rapidity of motion of the descending cloud, under the action of gravity, the number of particles in a given charge was quite accurately determined. Knowing the number, the mass of a particle of electricity was easily obtained. The magnitude of this mass was found to be about $\frac{1}{1000}$ of the mass of a hydrogen atom. No matter what the nature of the ionized gas, it was always found that the mass of the particle was unvaried and that the charge it carried was negative in sign.

These negatively electrified particles denoted by J. J. Thomson as corpuscles are accepted by him as the primordial units of all matter. We recognize also that these corpuscles consist of ether under a very intense stress. The ether in the corpuscle is so much concentrated that its density is greater than that of any known molecular mass. Furthermore, this corpuscle is in a sense dual in structure, consisting of an elongated mass of ether whose strain at one end constitutes the negative charge, while that at the other end constitutes an equal and opposite positive charge. It is deduced from the mathematical discussion, however, that the ether is so concentrated in the negative charge that it constitutes essentially the entire mass of the corpuscle.

Having considered briefly the nature of the corpuscle, let us consider for a moment the evolution of atomic matter from primordial conditions.

In the beginning, space was filled with a continuous medium called ether consisting in the aggregate of these primordial dual units called corpuscles. The corpuscular temperature was very high. In other words, the corpuscles were in a high state of motion which prevented any combinations at first. It is demonstrated, however, mathematically that such a tube of ether as the corpuscle by virtue of its motion in ether would gradually lose its kinetic energy through the process of radiation. In other words, a tube of ether moving in ether produces waves, the energy of which comes from the corpuscle. Accordingly, some corpuscles might lose their energy faster than others and would be first to come together to form those complex aggregations denoted by chemists as atoms.

An atom as presented us by Professor Thomson consists of a group of negatively charged corpuscles enclosed in a sphere of positive electrification. The nature of the atom is determined by the number and arrangement of the corpuscles inside this sphere of positive electrification. The corpuscles thus restrained are in rapid motion. In other words, the atom possesses corpuscular temperature. If the motions of the corpuscles are such as to be confined to the space inside the positive sphere, the atom is stable and in a neutral condition electrically. This means that the combined negative charges of the enclosed corpuscles exactly equals in quantity the charge on the surrounding positive sphere.

The theory assumes that the stabilities of different atoms are unlike. Under the action of a strong extraneous electric field, or by collision, or by the forces of solution, an atom may be sufficiently unstable as to lose one or more of its corpuscles. When this happens, it becomes electro-positive to the extent of the excess charge on the surrounding positively charged sphere. On the other hand, other atoms may possess such great stability, or low corpuscular temperature, that under similar conditions they are able to take in one or more additional corpuscles thus making them electro-negative to the extent of the charges of the excess corpuscles taken in. We thus have a division of atoms in kind; electro-positive and electro-negative. Hydrogen is an example of the first and chlorine of the second.

The valency of an atom is accounted for in a similar manner. When an atom is of such a nature that under natural conditions, it never loses more than one corpuscle, it is univalent and electro-positive; when it can lose two, it is divalent; when three, trivalent. On the other hand, atoms that can receive an additional atom and only one, are univalent and electro-negative. Those that receive two are divalent; three, trivalent. It is easy to see that the mutability of the atom within the range here indicated would be probable inasmuch as the simplest or least complex atoms, such as hydrogen, carry about one thousand corpuscles. It is clear also that the bonds ascribed to atoms by the chemist are merely the attractions of the excess charges on the atoms. All chemical affinity is electric attraction.

The Periodic Law of Mendelejeff is accounted for by the different arrangements of the corpuscles in the atoms. To illustrate this, Professor Thomson employs an experiment first made by Professor Mayer. In this experiment a number of magnets are made out of a piece of steel knitting needle. These magnets are thrust through pieces of cork so that they float in perpendicular positions with the positive poles up. Such floating magnets, of course, will repel each other. If a powerful negative pole of a bar magnet is held above them, they will all be attracted by it and will arrange themselves in some definite geometrical configuration. Three floating magnets will give a triangle. Five magnets arrange themselves either as pentagon or as a quadrilateral with one magnet at the goemetrical center. As the number of floating magnets is increased, the figures will successively vary. Large numbers of magnets give combinations of the elementary figures. For instance, with three, we have a triangle; with eleven, a triangle inside of an octogon; with thirty-five, the triangle appears again surrounded by more complex figures. Accordingly, it is argued by analogy that the negative corpuscles inside of the sphere of positive electrification arrange themselves in definite configurations which determine the similarities and differences in atoms. Any two atoms may differ greatly in weight which means that they differ greatly in the number of corpuscles they contain; yet if they should possess in common some elementary corpuscular configuration, they would exhibit some similarity in properties as is the case with lithium and sodium.

It is impossible to do justice to this interesting theory in a brief discussion since its speculations are based largely on mathematical deductions. It might be interesting to note in what manner it lends itself to the explanation of some of the undetermined phenomena of nature.

An example where free corpuscles are produced under the action of a strong electric field is seen in the Crooke's tube. The so-called cathode rays are streams of negatively charged corpuscles expelled from the atoms of the residual gas in the tube. These corpuscles, as we should expect, are always of the same kind, no matter what the nature of the residual gas. We are also aware that other rays quite different from the cathode rays emanate from the anode of a Crooke's tube. Those from the anode consist of streams of atoms of the residual gas positively charged. We would expect the existence of such ionized atoms from the theory since it is evident that the forcing out of negative corpuscles would leave the atom with an excess charge of positive electrification.

The X-rays which emanate from a Crooke's tube are assumed to be ether waves produced by the rapid motion and intense collisions of the corpuscles.

Radium, in the light of this theory, consists of atoms in a state of instability. Radium atoms are probably in a period of transition. Radium gives off B-rays, which like the cathode rays of a Crooke's tube consist of negatively charged corpuscles. These corpuscles being ejected from the radium atom leave behind an excess charge of positive electrification. The positively charged atoms interact on each other and give place to X-rays like those emanating from the anode of a Crooke's tube. Finally, by virtue of the B-rays, Y-rays are also produced. The Y-rays are identical with the X-rays of a Crooke's tube.

Again, we infer from this theory that mass formation from primordial conditions is the result of a spontaneous and prolonged process of accretion. First corpuscles, then atoms of varied structure; finally, atoms by their electric attractions produced the molecules that make up the aggregate masses.

In the summer time, it is customary to say that the high relative humidity of air prevents the retention of static charges on insulated conductors. The more probable reason, in the light of modern research, is that the air is given conductivity by the presence of a large number of free corpuscles due to the radio-active gases of damp soils.

Finally, we note the interesting fact that a substance might have a very high corpuscular temperature and yet a very low atomic or molecular temperature. In other words, the expression "corpuscular temperature" does not mean heat in the accepted sense. It means kinetic energy of corpuscles which results in continuous ether wave radiation of different periods.

It is possible then for a nebulous mass in the heavens to give off an intense light and yet be very cold. The light of a comet increases in intensity as it approaches the sun, not because of the increased temperature of its substance, but rather because of an increased corpuscular activity induced by some manner by the sun.