Review, August, 1828. Further details on this subject are to be found in my *Parerga,* Vol. II, Section 86 (second edition, Section 88). The story of the fall of an apple is a fable as groundless as it is popular, and is quite without authority."—*World as Will and Idea* (ed. Haldane and Kemp), II, 225-226.

EARLIER THEORIES OF GRAVITY.

It is universally conceded that gravitation is the most incomprehensible of all forces. Gravitation is supposed to be included in the law of conservation of energy, and from one point of view there is doubtless evidence to show this. When a body is poised upon the edge of a table, let us say, it possesses a certain amount of potential energy. When that body falls to the ground, its potential is converted into actual or kinetic energy. The energy is therefore released from the body which now possesses none. The energy it once possessed has been expended and converted into the work of the world, or its energy has been radiated uselessly into space; and thus we see how gravitation, the attraction of the earth for all material bodies, can be made to enter into the circle of generally recognized forces and included in the law of conservation. It might be questioned whether potential energy *is* energy in the strictest sense of the term, but I shall let that pass for the moment and assume that these facts prove what they are said to prove.

Gravitation is certainly the most mysterious of all known forces, and even yet nothing definite can be said as to its *modus operandi.* In the case of all other forces known to us it is possible to shut off their influence, to find some body which is opaque to their power. Take, for instance, light and electricity. Roughly speaking, glass permits the passage through it of light rays but prevents the passage of electric rays. Steel on the contrary, being a good conductor, permits the passage through it of the electric current but is impervious to light. The same is true of all other forces with the single exception of gravitation. No body has been found opaque to gravitation. It seems to exert its influence above, below, and equally upon all sides of any object. The introduction of a solid sheet of metal, of glass, or of any substance whatever, seems to have no appreciable effect. The body beneath which it is introduced seems to be attracted to the earth by gravitation just as strongly as it was before the introduction of such a sheet. And yet, from all that we know of force and energy, such should not be the case! We are confronted by an insoluble mystery. What is the nature of this force? How can it be conceived to act? What speculations have been advanced by men in the past to account for this mysterious phenomenon which has so puzzled the world since Newton's first famous experiments?

It is interesting to note that Newton himself speculated on this subject, and some years before arriving at his great generalization he threw out a suggestion as to the cause of terrestrial gravity in a letter to Boyle. In view of the recent experiments performed by the Cambridge school in England, by Dr. Gustav Le Bon and others in France, and by various other scientists—demonstrating apparently, that matter is resolvable into ether, or a mode of energy within the ether—the following extract from his letter shows remarkable foresight upon his part and deserves preservation. Writing in January 1678, Newton thus unfolded his hypothesis:

"First, it is to be supposed that there is an etherial medium, much of the same constitution as air, but far rarer, subtler, and more strongly elastic, but it is not to be supposed that this medium is of one uniform matter, but composed partly of the main phlegmatic body of the ether, partly of other various etherial spirits, much after the manner that air is compounded of the phlegmatic body of air, intermixed with various vapors and exhalations; for the electric and magnetic effluvia, and the gravitating principle seem to argue such variety. Perhaps the whole frame of nature may be nothing but various contextures of some certain etherial spirits or vapors, condensed as it were by precipitation, much after the manner that vapors are condensed into water.... *Thus, perhaps, may all things be originated from ether.*"

Newton's own theory of gravitation he formulated thus:

"I will suppose ether to consist of parts differing from one another in subtlety of indefinite degrees, in such a manner that from the top of the air to the surface of the earth, and again from the surface of the earth to the center thereof, the ether is insensibly finer and finer. Imagine now any body suspended in the air, or lying on the earth, and the ether, being by the hypothesis grosser in the pores which are in the upper parts of the body than in those which are in the lower parts, and that grosser ether being less apt to be lodged in those pores than the finer ether below, it will endeavor to get out, and give way to the finer ether below, which cannot be, without the bodies descending to make room above for it to go into....From this supposed gradual subtlety of the parts of the ether, some things above might be further illustrated and made more intelligible."

It is well to bear in mind that every hypothesis which attempts to explain gravity is required *in limine* to give a satisfactory account of the following six characteristics of this mysterious influence:

1. Its direction is radical toward the acting mass, or rectilinear —indefinitely. This rectilinear traction is incapable of deflection by any intermediate force. It suffers neither disturbance nor interference from any multiplication of similar lines of action, and admits neither of reflection, refraction, nor of composition.

2. Its quantity is exactly proportional to the acting mass—indefinitely.

Corollary: Hence its integrity of action is complete with every accumulation of additional demand—indefinitely; this is to say, no multiplication of duty in the slightest degree impairs its previous tensions.

3. Its intensity is diminished by recession, in proportion to the square of the distance through which it acts—indefinitely; in a manner somewhat analogous to—but (as modified by the second condition) radically different from—the action of light.

4. Its time of action is instantaneous throughout all ascertained distances, and therefore, presumably,—indefinitely.

Corollary: Hence its rate of action, (if the expression may be tolerated) is precisely the same on bodies at all velocities—indefinitely. It no more lags on a comet approaching the sun at the speed of two hundred miles or more per second than on a body at the lowest rate of motion, or than on the same comet receding from the sun at the same velocity.

5. Its quality is invariable under all circumstances—indefinitely. It is entirely unaffected by the interposition of any material screen, whatever its character or extent; or, in other words, it can neither be checked by an insulator nor retarded by any obstruction.

6. Its energy is unchangeable in time, certainly for the past two thousand years; presumably—indefinitely.

Corollary: Hence, its activity is incessant and inexhaustible—indefinitely; the ceaseless fall of planets from their tangential impulses involving no dynamic expenditure in the sun or in other known matter.

Let us now give a rapid summary of the theories that have been advanced from time to time to explain this mysterious force. Arago, in his *Popular Astronomy*, attempted to show that gravitation traveled with fifty million times the velocity of light, and that the time required to reach us from the nearest star would be about two seconds. Philippe Villemot, a French doctor of theology and a distinguished mathematician, advanced a theory in 1707 that gravitation is occasioned by a difference of pressure on the outer and inner faces of the fluid constituting the solar vortex, owing to an increase of its density outward from the sun. The general conception is obviously somewhat similar to Newton's speculation hazarded in 1678. The next attempt at a solution was offered by Bernoulli, of Switzerland, who attempted to show that gravitation of the planets toward the center of the sun, and the weight of bodies towards the center of the earth, were caused by the immediate impulsion of a substance which he termed "the central torrent." This was continually thrown from the whole circumference of the vortex to its center, and consequently impressions on all bodies encountered by it in its path imparted to them the same tendency towards the center of the vortex.

Lesage, in 1750, was the next philosopher to advance a definite theory of gravitation. To quote Arago's exposition of the theory, it was as follows:

"A single body placed in the midst of such an ocean of moving corpuscles would remain at rest, since it would be equally impelled in every direction. On the other hand, two bodies ought to advance towards each other since they would form a mutual screen, as their opposed surfaces would no longer be hit by the ultra-mundane corpuscles in the direction of the line joining them, and there would then exist currents whose effect would no longer be neutralized by opposite currents. Moreover, it will readily be seen that two bodies plunged into such a "gravitation fluid" would tend to approach each other with a force varying inversely as the square of the distance."

While this theory finds some support from facts known to science, and has even been called "the only plausible answer to this great problem which has yet been propounded," yet the theory utterly fails to acount for many of the known facts, and seems to be in contradiction to others. All that can be said for it is that, unlike most other theories of gravitation, it is at least conceivable and has some faint beginnings of scientific precision.

Leonard Euler, a Swiss mathematician and philosopher, published in 1760 a treatise in which he commented on the action of gravitation as follows:

"Supposing a hole made in the earth through its center; it is clear that a body at the very center must entirely lose its gravity, as it could no longer move in any direction whatever, all gravity tending continually toward the center of the earth. Since then a body has no longer gravity at the center of the earth, it will follow that in descending to this center its gravity would have gradually diminished; and we accordingly conclude that a body, penetrating into the bowels of the earth, loses its gravity in proportion as it approaches the center. It is evident, then, that neither the intensity nor the direction of gravity is a consequence from the nature of any body, as not only its intensity is variable but likewise its direction, which on passing to the antipodes becomes quite contrary."

Herapath next, in 1816, published an essay "On the Physical Properties of Gases." He attempted to show that there was "one cause for heat, light, gravitation, electricity, cohesion, aërial repulsion, etc., from which all these flow, and are deducible; and their effects may be computed by mathematical induction [deduction?]. It shows us that gravitation, cohesion, and affinity are but the same thing under different modifications; that the differences of the two latter arise from a difference in the figures and sizes only of the particles; that attraction and repulsion are not properties of matter."

Herapath contended that, by noting the continued and mutual condition of particles of gases in the containing vessels, and by extending the principle to the planets, which he supposed to be all of the same density as the earth, he attempted to show that it was possible to calculate the amount of gravity of varied bodies, one toward another. There were of course several fundamental defects in his theory, so obvious that they need hardly be mentioned. The known dissimilarity of the composition of stellar bodies, and the fallacy that any pressure-differences would result from temperature-differences, naturally vitiated his whole argument.

The next ingenious attack upon the problem was made by Guyot in 1861 in an essay entitled "A Sympathetic Glance at the Form and Forces of Matter." Still maintaining that all the properties of bodies are derivatives of their vibratory movements, and that the equilibrium and the phenomena of the world exist only under the condition of constant pressure of the ether upon coercible matter and the reaction of the latter upon the former, he argues that "if it be shown that the vibration of the atoms of bodies may and actually does cause the rarefaction in the sphere of activity of each of the atoms," this constitutes a proof that "the approximation of the atoms of bodies of ponderable matter is due to the rarefaction of the imponderable fluid, and consequently to the diminution of its pressure in the space between the atoms of the same body"; and hence that "we are compelled to admit that attraction is a mechanical force, consisting first of the rarefaction of the ether between molecules, masses, or the heavenly bodies, resulting from the ceaseless vibration of the atoms of ponderable matter; and secondly of the reaction from the exterior pressure of the ether upon the same, resulting from the general pressure of the imponderable universal medium which constitutes the *mother-liquor* of the world."

In 1844 Faraday issued a speculation on the nature of matter in which his first unformed views were stated. This was followed in 1850 by a memoir on the possible relation of gravity to electricity, in which he stated his belief that there was such a definite connection, though he could give no proof of it. Several years later in a memoir on "The Conservation of Force" he gave the results of his further meditations on "the attractive theme of gravitation." They were these:

"It is a simple attractive force, exerted between any two or all the particles or masses of matter at every sensible distance, but with a strength bearing inversely as the square of the distance.... For my own part, many considerations urge my mind toward the idea of a cause of gravity which is not resident in the particles of matter, merely, but constantly in them and all space. I would much rather incline to believe that bodies affecting each other by gravitation act by lines of force of definite amount or by an ether pervading all parts of space, than admit that the conservation of force could be dispensed with."

On no subject, perhaps, have the distinguished author's ideas been more vague and intangible than on this.

The next speculations of note are those by Seguin, submitted to the French Academy of Sciences in 1848 and 1858. In his earlier writings he held to a crude kinetic theory, founded upon the laws of cohesion, repulsion, attraction, etc. In 1858, however, Seguin published in the *Cosmos* a somewhat elaborate essay on the origin and propagation of force, in which he seems to have abandoned the kinetic theory of gravitation. It is true that he there holds that "matter is inert; that is to say it does not harbor in itself the power to put itself into movement, and still less, *a fortiori*, to communicate it, since a thing to be transmitted must first exist." And it is also true that he repeatedly speaks of "the great principle of infinite conservation of motion" as being the foundation of all mechanics, and regards the possibility of destruction of motion as equivalent to annihilation of force.

Notwithstanding all this, he says in regard to the uniform tendency of a material system towards its center of gravity:

"We are thus led to consider attraction as a first cause, emanating directly from the Divine Will in the creation of matter. Doubtless, it is not impossible that it may hereafter be discovered that attraction in its turn is only a consequence of a more general law, comprehending in itself more implicitly the means of explaining the effects attributed to attraction....But as these considerations are purely metaphysical since observation cannot reach beyond the established fact that two confronting bodies gravitate toward each other by virtue of a force to which is given the name of 'attraction,' it appears to me wiser not to advance further to penetrate a mystery which nothing within our knowledge as yet appears able to explain. Let us then consider matter as existing from the beginning, uniformly in space, and attraction as an essential property with which it is endowed, by virtue of which the different parts or molecules composing it possess in themselves the power of mutual attraction."

M. de Bouchepom read a memoir to the French Academy of Sciences, July 30, 1849, in which he attempted to explain the general laws of gravitation. It was based on the idea that the movements of the heavenly bodies might be explained by an external impulsion, or by the action of a universal fluid. He pointed out first, that the intensity of the impulse propagated in the etherial medium follows the law of the inverse square of the distance from the center of disturbance; second, that the resistance of the ether does not sensibly effect the velocity of a body when this is sufficiently less than that of the theory of propagation; third, that taking the density of the fluid as unity, the quantity of motion impressed by a body on the ether is equal to its volume multiplied by the square of its velocity; fourth, that the pressure would produce the effect that all layers of equal thickness would include the same quantity of matter if propagated to the interior of the heavenly bodies, and that the mean density is three times that of the surface; "fifth, as to attraction, the displacement of the ether by the movement of a body, A, will produce in all parts of the fluid a sort of aspiration toward the point being left by its center; and any body, B, receiving these aspiring waves on its nearer hemisphere, will have lost all or a part of its own pressure, and the half pressure (volume multiplied by the square velocity) which acts on the opposite hemisphere, no longer being counterbalanced, will give an impulse to the body B, in the direction of A. Such would be the principle of attraction."

In a learned work on elasticity, Gabriel Lamé, in 1852, next attacked the problem of gravitation. He insisted on the necessity for admitting an all-pervading ether. Having theoretically proved its existence, he contends that it is scarcely to be doubted that in the intervention of the ether is to be found the secret or true cause of the effects which are attributed to heat, to electricity, to magnetism, to universal attraction, to cohesion, to chemical affinities. For all these mysterious and incomprehensible agencies are at bottom but coordinating hypotheses.

In 1858 J. J. Waterston, of Edinburg, published an essay entitled "On the Integral of Gravitation, and its Consequence with Reference to the Measure and Transfer or Communication of Force." He contended that "a force-generating faculty exists in space and *is directed centripetally.* 'The *mutual gravitation of two bodies,*" he said, "develops mechanical force in each of them, inversely proportioned to its mass." The theory is really very indefinite throughout, since he appears to make gravitation a function of space, being the content of space, or the dynamic medium supposed to occupy it. It may be said that his speculations have failed to find corroboration.

Prof. James Challis, in 1859, published a series of communications beginning with his mathematical theory of attractive forces, and following it through in other papers on "Force," and "Gravitation." He found the theories of elasticity, cohesion, attraction and repulsion in matter insufficient to account for the facts, and was forced back upon the ether. "Yet," he says, rightly enough, "as it is contrary to principle to ascribe elasticity to atomic matter, the question might arise, why is it more proper to ascribe this occult property to the ether?" Concluding that we cannot, he stated his conviction that "we must conceive *another form of ether,* having the same relation to the first as that has to air." In 1876 this author returned to a discussion of the problem. In dealing with the residual effect of vibration, which, he said, "is the attraction of gravity," he says:

"This result expresses the force of gravity as due to the attractive action of a molecule of a higher order as to magnitude than the molecule of molecular attraction. For distinction, a molecule of this superior order might be called a gravity-molecule. Its magnitude may still be considered to be so small that in comparison with the magnitudes of terrestrial and cosmical masses, it may be treated as an infinitesimal quantity....Lastly, it is to be noted that on account of the large value of λ for gravity-waves they do not suffer sensible retardation or refraction in passing through gross bodies. I have on several previous occasions treated of the problem of gravitating force theoretically, and by slow steps have approximated to its solution; but before the present attempt I had not succeeded in exhibiting satisfactorily the *rationale* of this kind of attraction by vibrations."

In 1861, Mr. J. S. Glennie published in *The Philosophical Magazine* several papers on the subject of gravitation. Summarizing his own views in later articles, Mr. Glennie thus recapitulates and states the substance of his theory:

"Matter is conceived to be made up, not of an elastic ether and inelastic atoms, but of elastic molecules of different orders as to size and density. If a rough physical conception of these molecules be required, they may be conceived as etherial nuclei, the ether of the nuclei of a lower, being made up of nuclei of a higher, order, and so on *ad infinitum.*"

Mr. Glennie postulated a universal repulsion, varying through various intensities, instead of universal attraction; but, could it be discussed in detail, it must be said that his theory completely fails to be convincing.

Keller in 1863, Tait in 1864, and Saigey in 1866, all offered speculations upon this subject, based more or less on their theory of force. Saigey went so far as to say that bodies do not owe their gravity to an intrinsic force, but to the pressure of the medium in which they are immersed. Why this pressure should vary at various points in the universe is not stated.

In a communication to *The Philosophical Magazine* in 1867, Mr. James Croll revived the difficulties that had been stated by Faraday and attempted to solve them. He was first of all led to the conclusion that there must be, in order to account for the facts, a destruction of force in one place and a creation of force in another. Finding, however, that this ran counter to the law of conservation of energy, he gave up that attempt and attacked the problem in a different direction. Discussing it from the point of view of the law of conservation of energy, he pointed out that if gravity be correlated to other forms of energy, it must be included in the law of conservation. But here he was met with difficulties. Admitting that gravity can perform mechanical work, and mechanical work can be converted into other forms of energy, he yet pointed out that it is generally denied that there is a decrease or loss of gravity resulting from such transformations, that is, the body did work without losing any of its force of gravity. It would therefore appear to be outside the law of conservation. After much theoretical discussion, Mr. Croll arrived at the following conclusion: That gravity is in all probability of the nature of an impact or pressure. Finding he could not account for it either on the theory that it resulted from the impact of corpuscles or from the difference in pressure of a substance filling space, he was forced to the conclusion that it was some kind of "pure force."

In 1869, P. Leray published an essay entitled "A New Theory of Gravitation." In this he postulated first, the existence of an ether; second, that at every point there exist equal currents crossing each other in all directions; third, that in passing through bodies the currents of the ether are retarded proportionately to the thickness traversed and to the mean density of the path. In the same year Boisbaudran published a short paper entitled "A Note on the Theory of Weight." His conclusion was: "It is to the longitudinal vibrations of the ether that I attribute the cause of weight." Guthrie in 1870 published an account of some experiments entitled, "On Approach Caused by Vibration." His hypothesis practically made gravitation a function of temperature, which was of course, contrary to all observation.

Sir William Crookes in 1873 offered some speculations in which he pointed out the possible influence of the energy of light-waves as effecting the results, but his statements at that time were little more than restatements of the difficulties, and he had no positive theory of his own to offer.

Lord Kelvin, in his essay "On Ether and Gravitational Matter Through Infinite Space," in 1901 said: "The potential energy of gravitation may be in reality the ultimate created antecedent of all the motion, heat, and light at present in the universe." It will be observed that his definition is really vague and does not attempt to tell us what the *kinetic* energy of gravitation may be. Speculations have also been advanced on this subject by the Cambridge school, by Sir Oliver Lodge, Dr. Gustav Le Bon, and others. It is hardly necessary to say, however, that their articles have consisted almost entirely of accounts of the difficulties to be faced by any theory advanced, and but little has been offered by way of positive theory.

It may be said that the newer discoveries in physics have had a double bearing upon this problem. The experiments carried on of late years may, perhaps, have furnished us with the first outlines of a possible reconstruction; a comprehension of the facts. On the other hand, they have made the phenomena more mysterious than ever! Gravity has no appreciable action on electricity, while it is the sole reason of the laws governing the flow of liquids. Nevertheless, it more nearly resembles electricity than any force we know. As Dr. Le Bon said in his *Evolution of Forces*: "One gets clearer and clearer glimpses that weight is due to the relations between the ether and matter, connected, doubtless, by lines of force; but this is only a more or less vague hint, which still escapes the teachings of experiment. It is possible that the gyratory movement of the atoms are communicated to the ether and through it to the different material bodies, thereby establishing an attraction between them. The reciprocal attraction of vortices has, at the present day, been demonstrated by many experiments....Gravitation displays the incomprehensible characteristic, which no other manifestation of energy possesses, of not being arrested by any obstacle. The most delicate researches have shown that no body exists which is opaque to gravitation. Gravitation is a very small force if we consider only the action of the masses we have at our disposal, but it is a force extremely great for considerable masses. This power is apparent to us every day in the phenomenon of the tides. Under the influence of the combined motion of the sun and moon, the seas are raised to an average height of one meter, which represents a weight of one thousand kilogrammes per surface-meter.

"Physicists have been able to say nothing more on gravitation than what is said above. In an important memoir of which I reproduce a few passages, Prof. Vernon Boys has shown perfectly how inexplicable it remains. 'It seems to defy,' he says, 'all our attempts to abandon the inconceivable idea of action at a distance; for even when we might conceive another mode of action it is entirely incomprehensible that gravitation should act at a distance without regard to the existence or nature of bodies in its path, and, as it appears, instantaneously....The speed of the propagation of gravitation was estimated by Laplace as being immensely higher than that of light. Henri Poincaré considered it as propagated with a velocity of the order of that of light vibration. We do not know how gravitation is propagated, but it seems to me that the law of the inverse square of the distance allows us to imagine gravitic waves having a form analogous to that of the waves of light, electric waves, etc.....When a force decreases with the distance in accordance with this law, it is legitimate enough to imagine that it is propagated by spherical waves. This should be the case with gravitation."

So long ago as 1876, Mr. William B. Taylor, in his valuable essay on gravitation, pointed out the difficulties in the various theories that had been advanced by way of explanation. The corpuscular theory, even in his time, he regarded as finally and conclusively disproved. The hypothesis of undulations he regarded as equally impossible. He pointed out that such undulations as had thus far been established were quite incapable of inducing anything in the slightest degree analogous to gravitation, and that the new species of undulation necessary for the theory have never been proved. Great as is the credit due to Professor Challis, for instance, for his laborious efforts to develop this theory by the stern logic of mathematics, the whole demonstration is vitiated by the unwarranted preliminary assumption of qualities and modes of action in the ether analogous to those of gases; but experiment has failed to demonstrate any such similarity. Even if the undulation postulated were proved it would be entirely inadequate to account for the facts. The experiments of Guyot and Guthrie quite conclusively show that neither in the law of quantity nor in the law of intensity can gaseous vibrations represent even approximately the ascertained facts of gravitation embodied in the general propositions. The difficulties presented by inertia, elasticity, etc., have likewise never been overcome.

Failing thus at every point, the hypothesis leaves still more inscrutable the *origin* of the undulation. The center of disturbance is supposed to be the vibrating material element; but the *cause* of the vibration is never stated. If "innate tendency" be the answer, never surely was a more mysterious "occult quality" attributed to matter in the history of physics. Force cannot originate without an originator. The new discoveries in physics have thrown an entirely different light over this problem, causing us to reconstruct our views as to the nature of matter and energy, and their interrelation. Matter, in fact, has been resolved into energy and springs from it. We have the universe traced back to a homogeneous primal ether in rest. Once this ether receives an initial impulse, then all the rest would follow—etherial vibrations, electric atoms, material atoms, worlds, the universe! And into ether all shall return! What caused that prime initial impulse? That we cannot say. Science says that "forces unknown to us" caused it to emerge. It is possible to conceive that this first grand impulse was none other than some human or divine Will.

Nevertheless, granting a prime mover—the immediate operation of a demi-urgus, if necessary—the difficulty would still remain: How is the initial impulse converted into vibration? What is the resisting power deflecting the element in motion from that rectilinear direction which is the first law of action? Upon that subject there is a very remarkable reticence. Is the universe a perpetual motion machine?

There is no reason whatever to believe that the ether is a *source* of energy. We have no experience of any undulations originating in its broad expanse. It is never self-luminous; and even in the case of electricity there is always required the disturbance of a material element. Nor it there any ascertained fact to warrant the supposition that the ether is a *reservoir* of force, in any other sense than that, without the possession of intrinsic tension, it would be incapable of transmitting energy (I am using the terms "matter" and "force" here as they are commonly understood). There is a great deal of loose speculation current regarding the nature of this supposed ether. Dr. A. Rabagliati, in his introduction to my *Vitality, Fasting and Nutrition,* called attention to this, and said: "But what is this ether? M. Le Bon tells us, or at least suggests to us, that it is a solid without density or weight. Some scientists indeed suggest to us that the ether has density and no weight, while others say that it has weight and no density! These are the men, be it observed, who speak somewhat disparagingly of 'purely metaphysical considerations.' They deduce their conclusions from 'experiments.' But are not the definitions purely metaphysical? And are they any less so because deduced from experiments? It is a highly interesting state of mind which uses metaphysical expressions, and justifies them because they are alleged to have been come to by 'experiments' and not from philosophical considerations. A solid without density or weight! What is such a body? Is it nothing? I suggest that it is—nothing. But according to the thesis, it is the origin, and it is again the grave of the atom. The atom then came from—nothing, and it goes back to—nothing. But is not this the very proposition which, when it has been stated by philosophic or religious men, has been sneered at by the scientists? It is the very proposition! But then it was made for metaphysical speculation, and now that it has been stated from physical speculation (is that it?) or from experimentists, it is allowable! Nay we must yield our consent to it. All I can say is, that never have I been asked to believe anything more transcending reason by any philosopher. The scientific men and the physicists and the experimentalists seem, certainly, to have got themselves into a quagmire regarding this solid without density or weight, and I wish them well out of it."

Thus the nature of ether cannot be said to be much more clearly defined than that of gravitation. Both remain unsolved mysteries, closely related to one another, and present many similar difficulties. Perhaps some "metaphysical Newton" will one day solve the problem!

HEREWARD CARRINGTON.

NEW YORK.

THE FRENCH NEWTON.

She was, in fact, a woman of genius.
Ernest Renan.

In the early days of our civilization, men, being finer, more intelligent, more keen-eyed and more joyful than to-day, became universally impassioned for Truth and Justice, those two lovely sisters upon whom we modern civilized people, herded into loathsome cities and indulging too often in tiresome, stupid toils, seem to look now with indifference and contempt. True sons of nature, amidst which they lived peacefully, they knew not yet of equatorials and telescopes, of experimental retorts, tubes and flakes, of balloons for experimenting in the upper regions of the air and drags and nets for researches into the lower regions of the sea, of registering thermometers and barometric charts, of scientific cinematographs and wireless Marconi. Indeed their five senses were so acute, so subtle that they almost amounted to a sixth one. Lovers of life and beauty with which their poetical souls were ceaselessly enraptured, and too respectful of natural life to irrationally imprison it in barbarous fashions, they enjoyed themselves in constantly developing their marvelous gifts, either in long journeys through mountains and valleys, forests and pastures, jungles and deserts, or in adventurous travels upon the liquid plains, or also during long pauses for rest on the verdant, fragrant islands, or by the well-sheltered shores of Hellas and its Asiatic colonies!

In such a splendidly luminous era—far too short, alas!—which rejuvenated humanity from the extreme east of Asia to the western