The Physics of Motion

A Revolutionary New Theory Explains the Mysteries of the Sub-Atomic World

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Physical science stands today on a pinnacle of success unprecedented elsewhere in the history of human thought. The workings of nature are currently under scientific scrutiny all the way from the smallest sub-atomic particle to the most gigantic galaxy. A host of important developments have emerged from this intensive study and investigation, with dramatic effects on human life.

The unique feature of the physical sciences that has made this remarkable record possible is no secret. These sciences alone, out of all of the many branches of thought, have agreed on an *objective* standard of validity, one that, in principle at least, is independent of human opinion or judgment. If a scientific assertion is in full agreement with the observed and measured facts it is valid; if it is not inconsistent with these facts it *may* be valid; if it disagrees with the facts it is *not* valid. When expressed in this way, most persons will probably be inclined to believe that this criterion is accepted everywhere. But this is not true. It is not accepted *anywhere* outside of the physical sciences.

In religion, for example, the situation is just the opposite. A religious doctrine, by definition, is superior to anything else, and from the religious standpoint an observed fact that conflicts with such a doctrine is worthless.

Most branches of thought do not openly defy the facts in this manner; they simply ignore them when they are inconvenient. In the field of economics, for example, the wide gap between the assumptions of the theorists and the observed facts is a perennial source of comment. Many economists recognize that the obvious shortcomings of their theories are chargeable to the absence of a criterion of validity. As expressed by Professor Douglas Hague, "The great obstacle to applying scientific method in the social sciences is that we have not yet established an agreed standard for the disproof of an hypothesis."

Of course, scientists are also human beings, and as such they share the ordinary individual's inability to fully live up to the ideals that he accepts in principle. Like other human beings, scientists dislike having to change their ideas, particularly if they are ideas of long standing. It is not probable that many of them would deliberately reject a new idea or theory that they recognize as being correct—the traditions of the profession are too strong for that—but history shows that they will go to extreme lengths to avoid such a recognition. Acceptance of new discoveries is therefore a slow process, but the existence of an objective criterion of validity exerts a pressure in favor of correct ideas and against incorrect ones that cannot be resisted indefinitely.

Inasmuch as the application of this criterion involves checking ideas—concepts, theories and beliefs—against observed and measured facts, one of the most important contributions that can be made toward resolution of outstanding issues is to add to the supply of relevant facts. One area in which additional facts are sorely needed is at the base of the physical system. Strangely enough, the great achievements of science in unraveling the intricate details of physical processes have been accomplished without any clear understanding of the fundamentals. As seen in present-day physics, space and time, the basic entities of the physical universe, are, in the words of R. B. Lindsay, "primitive, undefined concepts." The entities and phenomena of the next level—matter, charge, radiation, gravitation—are not much

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better understood. Indeed, the general tendency at present is to regard the true nature of these items as not only unknown, but unknowable, and to brand questions about their character and origin as meaningless. As one physicist puts it,

> “The answer to these questions is simply that there is no answer, not that there is no answer as a matter of fact but that there is no answer as a matter of principle, and this means that the question should not have been asked in the first place.”

The inevitable result of such a policy is an accumulation of unsolved basic problems. In view of the long and painstaking study that was given to these problems by generations of competent scientists before the decision to give up the search for answers was reached, it is quite unlikely that answers will be forthcoming unless some further facts are uncovered. The recent discovery of a whole series of previously unrecognized facts bearing directly on the points at issue is therefore a significant event.

These facts were uncovered in the course of a theoretical investigation whose origins were described in an article in the July-August 1981 issue of *Frontiers of Science*. Of course, facts cannot be derived from theories (something that is often overlooked in modern practice), but what a correct theory can do is to furnish the clues that make possible the discovery of new facts, or recognition of the significance of facts previously known. As explained in the previous article, the new theory is based on the concept of a universe of motion, one in which the basic entities are units of motion, rather than units of matter. These basic units, we find theoretically, are necessarily scalar. That is, each is simply a relation between a unit space magnitude and a unit time magnitude. Scalar motion thus plays a role of primary importance in such a universe.

Galaxies, Balloons and Scalar Motion

In present-day physics, however, scalar motion is regarded as unimportant. Motion is often defined in such a way as to exclude it. But it is recognized by practically everyone that the motion of the distant galaxies, as observed by the astronomers, is in some way different from ordinary motion. The movement of galaxies illustrates scalar motion.

In the past few decades these astronomers have made a number of remarkable discoveries, among which is the finding that most of the matter of the universe is gathered into galaxies, huge aggregates containing billions of stars, which are distributed somewhat uniformly, from the large-scale viewpoint, throughout the vast region of space within the range of the giant telescopes now in use. Motion of these galaxies outward from our location, or inward toward us, can be measured by means of a change in the frequency of the light that we receive from them, an effect similar to the difference in the pitch of the sound that we receive from a train whistle, depending on whether the train is approaching or receding. From this change in frequency, the Doppler shift, as it is called, the astronomers have found that distant galaxies are all receding from us at extremely high speeds that are proportional to their distances. The analogy that they almost invariably use to assist in explaining their findings is that of an expanding balloon. Almost any astronomy textbook contains a statement such as the following, taken from one of them:

> “The common analogy likens the galaxies to spots on the surface of a balloon that is being inflated. As the rubber stretches, all the spots move away from each other.”

A still closer analogy would be an expanding plastic ball, or other three-dimensional object, with identifiable entities scattered throughout its volume. In any event, the widespread use of such an analogy in explaining the galactic motion demonstrates that just about everyone realizes that the motion with which we are dealing in these examples is not the ordinary type of motion that is so familiar to us. Notwithstanding this general recognition of its unique character, the expanding balloon type of motion is completely ignored by the physicists. Apparently the theorists have not regarded it as being of sufficient importance to warrant critical examination. The physics of expanding balloons has not been an inviting field of study. But new light has been thrown on the subject in the course of the development of the theory of a universe of motion. This has prompted a full-scale investigation of the scalar motion phenomena.

The motion of our ordinary experience is vectorial. It has both magnitude and direction, and can be represented by a vector. In order to define a direction it is necessary to relate the motion to a reference system. The reference system used for most purposes is a three-dimensional system of spatial coordinates stationary with respect to some selected physical feature, such as the surface of the earth. Vectorial motion may thus be described as motion relative to the other objects in the particular scalar system, and has no inherent relation to any spatial reference system. In the scalar system of galaxies, for example, each galaxy is simply moving outward from all others. This motion has a magnitude, positive because it is outward and results in an increase in separation, but it has no direction. Such a motion is, by definition, scalar.

Although it has no *inherent* direction in the context of a spatial reference system, a scalar motion can *acquire* such a direction by means of a physical connection to the reference system. For instance, an expanding balloon can be placed on the floor of a room. The system of galaxies cannot be placed *in* anything, but the same result can be accomplished by introducing reference axes into the system. The effect of a physical coupling of the expanding balloon to a reference system is to give one spot on the surface of the balloon a specific location in the reference system, and to assign directions to the motions of each of the other spots. As can easily be seen, this direction is a property of the coupling to the reference system, not of the scalar motion. If the coupling is altered by moving the balloon, the motion itself is not changed in any way. All spots continue moving away from all other spots at a constant speed, just as they did before the change. But the directions of all motions are altered.

What is Scalar Motion?

Insofar as they apply to motions of the expanding balloon type, the foregoing points are generally recognized. But as little attention has been paid to them, the properties of scalar motion have not heretofore been examined critically. The long overdue analysis—initiated by the theoretical study mentioned above—reveals that because of the causal nature of the consideration previously given to scalar motion, a very important point has been overlooked. This has left not merely one, but a whole assortment of blind spots in the field of view of modern science. As already noted, it is recognized that the coupling of a scalar motion to the reference system can be altered without change in the motion itself. It is further recognized that because of this freedom to change the nature of the coupling, the motion of any particular moving object in a scalar system can take any direction. What has not heretofore been recognized is that this ability to take *any* direction is not limited to a constant direction.

Systematic study of motion was begun in the days of the ancient Greeks, but it was not until two thousand years later that Galileo found the key to a real understanding of the subject. This crucial advance was the discovery that an object in motion continues in motion indefinitely unless acted upon by a force. In other words, continuous and uniform motion is permanent. Subsequent investigations have extended this finding to directions. Continuous and uniform change of direction, such as that which occurs in rotation, is also permanent. But because of the failure to make any systematic study of scalar motion, and the consequent lack of appreciation of the fact that the coupling of a scalar motion to the reference system is independent of the motion itself, it had not been recognized that the direction of this kind of motion can be changed continuously and uniformly by rotating the coupling. A scalar motion with this kind of a changing direction is also permanent.

The rotating change of direction can be illustrated by referring again to the expanding balloon. Obviously, the balloon can be turned around the vertical axis passing through the spot that is resting on the floor. The inherent scalar motion of any other spot Y on the balloon is not changed. But the direction of the outward motion of Y, as seen in the reference system, is now distributed over the entire plane of rotation. A further rotation around a second axis distributes the motion in all directions.

As can easily be seen by examination of the balloon situation, the characteristics of this *distributed scalar motion* are altogether different from those of ordinary vectorial motion. In vectorial motion the magnitude and direction of the motion are interrelated. For instance, a motion in the direction AB superimposed on a motion AB' of equal magnitude but opposite direction adds up to zero motion. But point Y on the balloon surface continues moving outward from all other spots, including the spot that is resting on the floor, regardless of the changes in direction. The scalar magnitude of the motion, the total outward motion of Y, is not altered by the directional distribution.

The discovery of distributed scalar motion has a significance for scalar motion theory comparable to that which the findings of Galileo and Newton had for the theory of vectorial motion. In a sense, it is even more significant. Vectorial motion was already well known to both scientists and laymen, so that the task of these pioneers of modern science was merely to determine its properties, and to systematize the relations between them. In the scalar situation even the *existence* of distributed scalar motion was unknown, and the task of the investigator involved identifying this previously unrecognized type of motion, as well as deriving an explanation of its properties.

In the rotating balloon example we are examining a distributed scalar motion of little importance, originated and maintained by human action. Once the existence of motion of this type is recognized, however, it is obvious that similar motion of natural origin can also exist. Whether it necessarily follows that such motion *does* exist is a debatable issue. Some scientists and philosophers assert this as a principle of nature. As expressed by K. W. Ford:

> "One of the elementary rules of nature is that, in the absence of a law prohibiting an event or phenomenon, it is bound to occur with some degree of probability. To put it simply and crudely: anything that *can* happen *does* happen."

Whether or not this is a rule of nature that has no exception, experience indicates that it holds good in general. We can be practically certain that naturally occurring distributed scalar motion exists somewhere in the basic areas of the universe. Present-day physical science recognizes no such motions. But, as we have seen, there are a number of physical phenomena whose nature conventional science is unable to explain. When there is something missing that we have good reason to believe actually exists, and in the same general area there is something extra whose existence is not accounted for, an obvious possibility is that these are two manifestations of the same thing. Let us therefore take a look at one of these unexplained phenomena: the electric charge.

The Mystery of Electric Charge

In conventional scientific thought the electric charge is accepted as a given feature of the universe. Its properties are likewise accepted without explanation, either as to their origin or as to their nature.

The charge manifests itself by exerting a force on objects of certain kinds within a certain region of space. A charge at point A, for instance, exerts a force on a test charge at point B somewhere within its range. This effect appears to indicate the existence of action at a distance, a concept that is philosophically unacceptable to most present-day theorists. To avoid conceding reality to this objectionable process, they *assume* that the charge at location A is surrounded by a “field.” The force is thought to be transmitted through this field, and it is the field then that exerts a force on the test charge at location B. There is no clear understanding or general agreement as to just what this hypothetical field actually is.

Einstein contends that the charge “calls into being something physically real in the space around it,” and that this “something” is the field. Other physicists disagree. P. W. Bridgman dismisses the whole idea. “It is only by an uncritical analogy,” he says, “that we form the concept of a field independently existing in its own right.” He adds that, “Instrumentally the distinction between field and action at a distance appears to be meaningless.”

As the only feature of this situation of which we have actual knowledge is that the charge exerts a force, the first step toward a better understanding is to take a closer look at the concept of force, with particular reference to its relation to motion.

Motion is measured, on an individual mass unit basis, as speed or velocity (that is, each mass unit moves at this rate). On a collective basis, motion is the product of mass and velocity, which is momentum, formerly called “quantity of motion.” The time rate of change of the motion is acceleration on an individual mass unit basis, and it is force, the product of mass and acceleration, on a collective basis. Thus force could legitimately be called “quantity of acceleration,” a term that would reflect its true nature. By definition, force is a property of an accelerated motion, not something that can exist in its own right. Wherever there is a force, there must be a motion, of which the force is a property.

Once this point is recognized, the role of force in physical action becomes clear. The basic physical process is the transfer of motion. Such a transfer consists of a simultaneous decrease in the magnitude of one motion, a negative acceleration, and an increase of equal magnitude, a positive acceleration, in another motion. The force, or quantity of acceleration, is a measure of the magnitude involved in the transfer. In firing a rocket, for example, the force exerted by the combustion products on the rocket is the quantity of acceleration transferred from these products. The product of the mass of the rocket and the acceleration imparted to it is the quantity of acceleration received by the rocket. Except for losses in the process, these two quantities are equal.

The status of force in general as a quantity of acceleration, a property of a motion, obviously applies to the force exerted by an electric charge. But present-day physical science cannot find the motion of which the force must be a property. So far as the physicists are able to determine, the electric force originates directly from the charge, although they have been unable to discover *how* it originates. Furthermore, to the physicists force is a vector quantity; that is, it has a specific direction as well as a magnitude. But the force exerted by the electric charge is *not* a vector. It is a distributed force: a field.

These discrepancies have thrown the whole situation into confusion. In the Wonderland of present-day fundamental physics, the physicists can see the grin of the Cheshire cat, the electric force, but they cannot see the cat, the motion of which the force is a property. So they ignore the definition of force that they have set up, the definition that is the basis for all of their subsequent applications of the force concept. They assume that the "fundamental forces" are autonomous entities, existing in their own right. Indeed, they go even farther and characterize these forces as the primary physical entities. A typical statement taken from a physics text asserts categorically that, "The gravitational force, the electric force, and the nuclear force govern all that happens in the world."

This leaves the antecedents of the forces, such as the electric charge, suspended in thin air without any connection to anything else. If the force is the fundamental entity, what is the charge? The physicists cannot answer this question. The general tendency is to evade the issue by contending that there is no answer. As one author puts it, "When we have said in what condition objects are when they are 'electrically charged,' we have said all there is to say." Another tells us this:

> "The question, 'what is electricity?'—so often asked—is… meaningless…We must have in physics something behind which we do not go; if it were not electricity, it would have to be some other conception."

Under the circumstances, it is not surprising that there are major differences of opinion as to the nature of force and its place in the physical picture, in spite of the general agreement as to how it is to be defined. Richard Feynman attempts to rationalize the basic contradiction by advancing the curious contention that force is "more than a definition." Meanwhile, the enthusiastic followers of Einstein claim that he "made the concept of force unnecessary" by reducing it to geometry. What this amounts to, as L. W. H. Hull points out, is a return to Aristotle's "idea that there are various kinds of 'natural' motion in various parts of the universe." It portrays the gravitational force as having a nature and origin totally different from those of other forces, a conclusion which, as Hull indicates, is a step backward in the continuing effort to unify physical theory.

Once the existence of distributed scalar motion is recognized, all of these contradictions and discrepancies clear up almost automatically. The electric force is a property of a motion by definition. The fact that this force is distributed in the form of a field shows that the motion of which it is a property is not an ordinary vectorial motion, the force aspect of which is a vector, but a distributed scalar motion, the force aspect of which is a field. As the electric force is a property of an electric charge, and we now find that it necessarily must be a property of a distributed scalar motion, it follows that an *electric charge is a distributed scalar motion*.

So the question, What is an electric charge?, is not meaningless after all. It is true, as asserted in the statement quoted above, that "we must have something behind which we do not go," but it is a serious mistake to stop too soon. It is a mistake to treat something like an electric charge, or the force that it exerts, as fundamental when it is not fundamental. When we go a step farther, and identify the charge as a motion, the answers to the long-unanswered questions quickly emerge. As soon as we know what an electric charge is, the reason why it exerts a force is clear. Because a distributed scalar motion extends over a three-dimensional space, it is an accelerated motion. One of the properties of any accelerated motion obviously is a quantity of acceleration; that is, a force. The reality behind Feynman's assertion that force is more than the defined quantity also becomes evident. In explaining his statement, Feynman notes that "in dealing with force the tacit assumption is always made that the force is equal to zero unless some physical body is present." We can now see that the presence of this "physical body" is not something in addition to the definition of force; it is implicit in the definition. Force is a property of a motion, and the existence of identifiable motion involves a physical body.

Motion and Stationary Charge

The biggest obstacle in the way of recognizing that the electric charge is a motion is the observed existence of stationary charges.

How can a stationary charge be moving?

It clearly cannot move vectorially if it is stationary in the reference system, because vectorial motion is motion relative to that reference system. Recognition of the charge as a distributed scalar motion provides the answer.

All objects in a scalar system—all galaxies in the galactic system, all spots on an expanding balloon and so on—are moving relative to each other. But in order to represent such a system in a stationary frame of reference, one of the moving objects must be arbitrarily coupled to the reference system in such a way that it is stationary relative to that system. In the galactic system the location of our own galaxy is the point that is tied in to the reference system. The position of our galaxy is the *reference point*. In the balloon system the reference point is the point at which the balloon rests on the floor.

Since the motion of our galaxy, or of the spot on the balloon surface that rests on the floor, still exists irrespective of the way in which it is represented in the reference system, that motion has to appear in the reference system as motion of the galaxies or spots with which the reference objects are interacting.

Thus the measured recession of galaxy A includes the motion of our own galaxy away from A, as well as the motion of A away from our galaxy. Similarly, the motion of spot X on the balloon surface outward from some other spot Y does not appear as a movement of X if X is the stationary point in the reference system. Nevertheless, the motion of X exists and increases the separation between X and Y. It follows that the motion which does not appear in the reference system as a change in the position of X is included in the representation of the motion of Y outward from X.

The situation of a charged object is similar. Such an object is moving either inward toward all other members of its class or outward away from them, but in the reference system it appears to be stationary. Its motion therefore manifests itself as motion of the interacting objects.

The facts revealed by the scalar motion investigation will be unwelcome to many, perhaps most, scientists. Old ideas, like old shoes, are comfortable. And even though scientists are committed to the advancement of knowledge in their field, they find it distressing to be faced with the necessity of changing some of their basic concepts. But we have no choice.

When we undertake to ascertain how nature operates, we have to accept the world as we find it, whether we like what we find or not. Those who are in the forefront of scientific research have long realized that the simple view of physical reality that we associate with the name of Newton is untenable in the light of present knowledge, and that the universe is actually much more complex. The only question at issue is the nature of the complexity. At least some of the simple ideas of long standing will have to be sacrificed. But though it may be hard for most individuals to change their ideas as to the nature of something that they believe they understand as well as they do motion, the readjustment of thought is a minor matter compared to the bewildering mathematical and conceptual complexity that has been introduced into physics in the last hundred years by those who have been trying to solve the outstanding problems *without* the benefit of an understanding of scalar motion and its properties.

Furthermore, there are many compensations for the loss of the old and cherished, but mistaken, traditional ideas about motion. Every advance in knowledge clears up some of the previously existing difficulties, and a big advance, such as the discovery of distributed scalar motion, solves a great many problems. One of these is the long-standing “mystery” of gravitation.

What has been said about the electric force in the proceeding paragraphs is equally applicable to the gravitational force. Mass, like charge, is a distributed scalar motion that is not recognized as a motion by present-day science. Gravitation is an aspect of that motion; that is, the gravitational force is the force aspect of the motion that is called mass, just as the electrical force is the force aspect of the motion that is called charge.

Magnetostatic phenomena, such as the force exerted by a permanent magnet, are in the same category. We will have to recognize that there exists a magnetic charge, a distributed scalar motion analogous to mass and the electric charge. There are, of course, differences between these three types of phenomena, even though all are distributed scalar motions. It will not be possible to explain the reasons for these differences within the limits of the present article, but a full account will be given in a book[*] to be published shortly.

In addition to the clarification of basic physical relations that follows directly from the recognition of distributed scalar motion, this forthcoming work will also show that by combining the new knowledge of the properties of scalar motion with some well known facts whose full significance has not heretofore been appreciated —particularly the fact that the electric charge exists only in discrete units —it is possible to establish on a purely factual basis the true nature of a wide variety of hitherto poorly understood phenomena, not only in the field of basic physics, but also in astronomy and cosmology.

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[*] Larson, Dewey B., *The Neglected Facts of Science*, North Pacific Publishers.