Gravitation and the Galaxies

Dewey B. Larson, July 1985

Today, three centuries after Newton, gravitation is still one of the enigmas of science. "It may well be the most fundamental and least understood of the interactions," says Robert H. Dicke. In all of the efforts that have been made to formulate a unified physical theory the big challenge has always been to bring gravitation within the theoretical framework. One of the most basic problems is to define the nature of the phenomenon. According to Einstein's general theory of relativity, the theory that is currently accepted (often with some reservations), gravitation is equivalent to a motion. This assertion implies that, while it has some of the characteristics of motion, it is actually *not a* motion. The objective of the present discussion is to examine the validity of this conclusion.

Let us consider a dispersed system of gravitating objects isolated in space. From our present knowledge of the gravitational effects, we can deduce that each of these objects will move toward all of the others. In this particular case, then, gravitation *is* a motion, not merely the equivalent of a motion. It is a motion that differs in some respects from the motions with which we are familiar, but it is by no means unique. The motions of the galaxies, for example, have the same characteristics, except that these objects are moving outward away from each other, rather than inward toward each other. All of the distant galaxies are observed to be receding from our Milky Way galaxy at high speeds. Unless we make the assumption that our galaxy is the only stationary object in the universe, an assumption that was repudiated by science long ago, our galaxy is likewise receding from all others. Thus the galactic system is one in which all individuals are moving outward away from each other.

A small scale example of the same kind of motion can be seen in the motion of spots on the surface of an expanding balloon, often used as an analogy by those who undertake to explain the nature of the motions of the galaxies. Here, too, each individual is moving outward from all others. If the expansion is terminated, and succeeded by a contraction, the motions are reversed, and each spot then moves inward toward all others, as in the gravitational motion.

In each of the examples cited, the inward or outward motion of the individual points or objects takes place in all directions, which means that the motions have no specific, or inherent, directions. It follows that these are *scalar* motions, defined by magnitude and sign (positive or negative, represented as outward or inward in the reference system). Here, then, we observe three different examples of a type of motion, *the existence of which is not recognized by present-day physical science.*

This lack of recognition is due to the fact that in current practice motion is defined in a manner which excludes scalar motion. The prevailing view is that motion is a change of position relative to some identifiable point or object, and it is assumed that this change can be represented in a coordinate reference system. On this basis, the magnitude and direction of the change are specified by a vector, which occupies a definite position in the reference system. But it is evident that a system of scalar motions cannot be represented in its true character in this spatial reference system, as the system of coordinates has no way of representing simultaneous motion in all directions. In order to make representation possible, the scalar system must be coupled to the reference system at some particular point, the *reference point,* as we will call it. This point, or the object at that location, is then seen as stationary, or moving vectorially independently of the scalar motion, while all other points or objects in the scalar system are portrayed as moving inward toward, or outward away from, the reference point.

In the case of the galaxies, we take our galaxy as the reference object, and view all of the distant galaxies as moving radially outward from our location. But it can easily be seen that the directions thus imputed to the galactic motions are determined by the coupling to the reference system, and are not inherent in the motions themselves. For example, if we denote our galaxy as A, the direction of motion of galaxy X, as we see it, is AX. But observers in galaxy B see it as moving in the very different direction BX, those in galaxy C see the direction as CX, and so on.

In this particular case, the reference point is the location of the observer, because we assume that we are stationary in the spatial reference system that we are using. But in the more general situation, the observer is outside the scalar system of motions, and the reference point is determined by whatever influence dictates the coupling to the reference system. The expanding balloon, for instance, may be resting on the floor of a room, in which case the point that touches the floor is motionless in the reference system, and is therefore the reference point for the scalar motion.

Before this balloon was placed in the reference system, points A and B on the balloon surface were moving outward away from each other, and their separation was increasing at a specific rate. Immobilization of point A, the reference point, in the reference system did not change the rate of increase in the separation between A and B. But the reference system now shows point A as motionless. In order to maintain the correct rate of separation between A and B, it is now necessary for the reference system to attribute the motion of point A to point B, giving that point an additional motion component, over and above its own motion. It can easily be seen that this is a general property of the representation of scalar motion in a spatial reference system. The scalar motion of the reference point or object has to be attributed to the points or objects with which it is (apparently) interacting.

With the benefit of this understanding of the relation between the scalar motion and the reference system, we can now return to the gravitational problem, and consider the situation in which the gravitating object is *not* free to move in the reference system. Here, present-day physical science is faced with a contradiction. The behavior of gravitating objects that are free to move shows that gravitation is a motion. But there are gravitating objects that do not change their position in the reference system, and therefore are not in motion, as motion is currently defined. The reaction of the theorists to the situation has been to evade the issue by treating gravitation as a *force* rather than as a motion.

At this time, therefore, we need to give some consideration to the relation between force and motion. For application in physics, force is defined by Newton's second law *of* motion. It is the product of mass and acceleration: F = ma. Motion is measured on an individual mass unit basis as velocity, or speed (that is, *each* unit moves at this rate), or on a collective basis as momentum, the product of mass and velocity, or speed. Momentum was formerly called "quantity of motion," a term that more clearly expresses the true nature of the quantity. The time rate of change of motion is dv/dt (acceleration, a) in the case of the individual units, and m dv/dt (force, ma) when measured collectively. Thus force is a property of a motion, in exactly the same way as acceleration. It is the time rate of change of the total quantity of motion, the "quantity of acceleration," we could call it.

It follows from this that a force cannot be autonomous. Every force is, *by definition,* a property of a motion. Thus force cannot originate in a motionless object. The problem of the motionless gravitating objects is therefore not solved by the introduction of the force concept. What is needed is a recognition that gravitation *is* a scalar motion, and that the apparently motionless gravitating object is actually moving inward in all directions just as it is when it is moving in free space. But, like the spot on the balloon surface that is resting on the floor, and like our Milky Way galaxy, it is coupled to the reference system in the location which it occupies, and it is therefore stationary *in the context of that reference* *system.*

The effect of a negative (inward) scalar motion is to decrease the separation between the individual members of the scalar system. Inasmuch as the reference object is actually in motion, even though it is represented in the reference system as motionless, the gravitational motion of this object contributes to the magnitude of the decrease in separation between it and any distant object. And since the reference system cannot attribute this contribution to the object that is represented as motionless, it has to attribute the entire decrease in separation to motion of the distant object. In the gravitating systems with which we are most familiar, one member of each system (the earth, for example) is much more massive than the objects with which it is interacting, and becomes the reference object because it is immobilized by its own inertia. The contribution of this reference object to the motion of the other objects of the gravitating system (falling bodies) is clearly evident, and the reference object is therefore credited with exerting a force of attraction on each of these other objects. When it is recognized that gravitation is a scalar motion, it can be seen that the motion component, or force, apparently acting against the distant object is actually the motion of the reference object itself, misrepresented by the reference system, which is incapable of representing the scalar motion correctly.

The transfer of the motion of the reference object to the objects with which it is interacting explains the presence of a "force field" in the space surrounding the reference object. This field is not a tangible physical reality. Nor is it a strain in the hypothetical ether, or in space, as asserted in some theories. In fact, if there is no other mass within the effective gravitational range of the reference object, the force field does not correspond to anything at all, other than potentially. But if a mass is introduced into this region, a portion of the gravitational motion of the reference object is transferred to this mass by the manner in which the scalar motions are represented in the reference system. Since the reference object is moving in all directions, the force field due to its motion is radial, and there is no need for the kind of a distortion of space that Einstein's general theory calls for.

When gravitation is recognized as a scalar motion it becomes evident that the forces due to electric charges and the corresponding magnetostatic phenomena (magnetic charges, we may call them) are likewise properties of scalar motions. Observationally, these forces differ from the gravitational forces only in those respects in which scalar motions are variable; that is, in magnitude and in sign. Here, again, the absence of observable motion at the points of origin is due to the fact that the locations of the motions (the locations of the charges) are the reference points at which the motion is frozen by the coupling of the moving scalar system to the reference system.

This explanation of the origin of the forces that appear to be exerted on the distant objects provides the answer to the long-standing problem of action at a distance. Newton's gravitational law appears to call for direct action of one mass on another, regardless of their spatial separation, but many scientists are strongly opposed to the idea that a force can be exerted without a physical contact of some kind. The prevailing opinion has therefore been that the force *must be* transmitted through some kind of a medium, even though there is no actual evidence to support this assumption. The first hypothesis called for transmission through a medium, the ether, which was assumed to exist in space, but this hypothesis encountered difficulties because of the contradictory properties that the ether would have to possess in order to meet the requirements. It has therefore been succeeded by the concept of space itself as the medium, with various kinds of fields located in this space. The need for speculative constructions of this kind is now eliminated by the finding that the apparent action at a distance is merely an illusion due to the inability of the spatial reference system to represent scalar motion as it actually exists. In reality each object in a scalar system is pursuing its own course, independently of the other objects in that system.

The foregoing discussion of the scalar motion situation should be sufficient to demonstrate that by failing to give consideration to the scalar form of motion modern science has made a serious error. It is no doubt difficult for most scientists to believe that there could be a major defect in the *foundations* of present-day physical theory, but the facts are clear. The existence of scalar motion is incontestable. As pointed out earlier, it is readily observable in several different phenomena. The properties of this kind of motion can easily be deduced. Knowledge of these properties then enables identifying additional phenomena, including some of the most fundamental features of physical activity, as motions of the scalar type. The need for a thorough reconsideration of basic physical theory to take the various manifestations of scalar motions into account is therefore clearly indicated.