Remodelling the Big Bang

Dewey B. Larson

Unquestionably, the most significant development that has taken place in cosmology in recent years is the replacement of the original Big Bang theory by a totally different hypothesis. The drastic nature of the conceptual change that is involved is well illustrated by comparing the following two statements:

> According to this [Big Bang] theory, the outward motion of the galaxies was caused by an exploding *atome primitif* which ejected them in all directions.
> —H. Alfven, 1966

> Many people (including some scientists) think of the precession of the galaxies as due to the explosion of a lump of matter into a pre-existing void, with the galaxies as fragments rushing through space. This is quite wrong… the expanding universe is not the motion of the galaxies *through* space, away from some centre, but is the steady expansion of space.
> —Paul Davies, 1981

While the new hypothesis still goes by the name of the Big Bang in most of the current literature, its conceptual basis is obviously very different from that of the original Big Bang. The objective of the change was to extricate cosmological theory from the multitude of difficulties that have been experienced in developing the original Big Bang theory in detail. To a large degree, the new hypothesis accomplishes this objective, but it does so at the expense of eliminating the explanatory content of the original theory.

The original version of the Big Bang provided an explanation of the expansion of the universe in terms of a known process, the explosion of an unstable aggregate of matter. Because of the gigantic extension of the scale of the explosive process that was required in order to apply it to the universe as a while, this explanation was never very plausible, and its repudiation by a large segment of the astronomical community is readily understandable. However, it should be understood that the hypothesis of an inflationary universe that is now being offered as a replacement for the original Big Bang contains no explanation at all.

The observed fact that calls for some kind of an explanation is that the portion of the universe within the current observational limits is expanding in the context of the conventional spatial reference system. Some attempts have been made to extend the explosion concept to the space expansion hypothesis, and we occasionally hear expressions such as explosion of space itself. But an explosion is a process of a specific nature, one in which energy in a concentrated form is suddenly converted to kinetic energy and applied to acceleration of the residual products. Inasmuch as the revised Big Bang is something of a totally different character, it is not an explosion. It is a purely hypothetical concept for which there is no known physical justification. Aside from this clearly unacceptable suggestion, the new hypothesis simply accepts the expansion as a given feature of the universe, and makes no attempt at explanation.

It is evident that we will have to look further for any real explanation of the observed situation. Now that the original explosion explanation has been discarded, we need to find some other means of accounting for the observed outward motion of the galaxies. In approaching this task, the first point that should be considered is whether we have correctly identified the problem, specifically whether the galaxies are actually moving outward in the manner described by the astronomers. The principal evidence for this expansion is the Doppler shift in the frequencies of the radiation received from the distant galaxies. It is generally conceded that this frequency shift is sufficient to establish the reality of the outward movement. There is some controversy with respect to the applicability of the usual redshift-distance relation in certain special cases, but there appears to be adequate support for the conclusion that the normal galaxies are actually receding from our location at the speeds indicated by the redshifts. However, this does not settle the issue as to whether the present interpretation of the motions of the galaxies is correct. We still have to consider the deeper question as to whether we are using the correct reference system.

It is ordinarily assumed that the stationary spatial coordinate system to which we customarily refer the motions of the galaxies is the *natural* reference system, the one to which physical activity actually conforms. On the basis of previous experience, this appears to be a logical assumption; Indeed, it seems so obvious that the possibility that it might be erroneous has seldom, if ever, been examined. But nature does not always agree with the results of human thinking, and when we are confronted with a difficult problem we always need to explore the possibility that our assumptions with respect to the factors that enter into this problem may be invalid.

The question arises, How can we determine whether nature prefers one reference system over another? The first step toward arriving at an answer to this question is to *define* the natural reference system. This presents no problem. Once the issue is raised, it is obvious that the natural reference system is that system in which an object that is, in fact motionless, does not move. We may further say that any object which has no independent capability of motion, and is not acted upon by any external force is, in fact, motionless. By definition, such an object must remain stationary in the natural system of reference.

What we need to do, then, is to identify some physical objects of this kind and see how they behave relative to our conventional system of reference. One class of such objects consists of the photons of light and other electromagnetic radiation. So far as we know, these photons have no capability of independent motion. No mechanism for the propagation of radiation has ever been discovered. Einstein is often credited with having provided an explanation of this phenomenon, but what he actually did was to dismiss the problem as too difficult. In *The Evolution of Physics*, he discusses the difficulties, and concludes that:

> Our only way out seems to be to take for granted the fact that space has the property of transmitting electromagnetic waves, and not to bother too much about the meaning of this statement.

By this time, after long years of effort have failed to find any trace of a motion-generating property in electromagnetic radiation, we may legitimately conclude that the photon is incapable of independent motion. In the absence of any evidence that it is, or can be, acted upon by any agency in open space, it can therefore be identified as motionless in the natural system of reference. But it is *not* motionless in the conventional reference system. In this system, photons move outward from their points of origin at the speed of light, if not subjected to external forces. Neutrinos and other massless particles follow the same pattern. Furthermore, the same is true of the galaxies at extreme distance. The matter of which these galaxies are composed does have a property, gravitation, which is capable of causing motion to take place, but this is the only such property that it possesses, so far as we are able to determine, and when the gravitational effect has been reduced to a negligible level by extreme distance, the galaxies, too, move outward at the speed of light.

If only one such class of objects was involved, we would have to consider the possibility that the objects of this class might contain a concealed motion-producing mechanism. But since three different classes of objects follow the same pattern, this possibility can be ruled out on probability grounds. We must therefore conclude that the objects of these three classes are, in fact, *not* moving; that is, they are motionless relative to the natural reference system. The reason why they have no mechanism for causing motion (or effective motion, in the case of the distant galaxies) is then evident. Objects that do not move have no need for a motion-producing mechanism.

Each of these motionless objects that is represented in the conventional system of reference as moving outward at the speed of light is observed to be moving in a definite direction in that reference system. It can be shown, however, that this direction is a result of the manner in which the motion is coupled to the reference system, and is not an inherent property of the motion itself. For this purpose, let us review what we know about the motions of the galaxies. Since all of the distant galaxies are moving outward away from us, it follows that, unless our galaxy is the only stationary object in the universe, a hypothesis that no scientist accepts today, we must be moving outward away from all other galaxies. Consequently, we are moving outward in *all* directions. This means that our motion has no specific direction. Inasmuch as there is no reason to believe that our galaxy is unique in this respect, we can conclude that this is a general property of the galaxies, and that all galaxies (except those that are quite close, and are therefore subject to relatively strong gravitational forces) are moving outward without any specific direction. Such motion, which as magnitude only, and no inherent direction, is *scalar motion*.

The existence of scalar motion is not recognized by conventional science. In fact, motion is customarily defined in vectorial terms. But the motions of the galaxies, as we observe them, are definitely scalar, and the information now available regarding the motions of the photons and massless particles indicates that these are motions of the same kind. For present purposes it is important to recognize that scalar motions cannot be represented in their true character in the conventional reference system. This limitation of the capability of the reference system is new to science, and some may find it hard to accept, but its existence can easily be verified by a further examination of the galactic situation.

We can represent the motions of the distant galaxies in the usual manner, as radially outward from our location, only if we assume (1) that our galaxy is motionless, and (2) that each of the other galaxies has a specific direction of movement. But we know that both of these assumptions are false. Aside from the exception stated, all galaxies, including ours, are moving outward in all directions. It follows that the representation of the motion of any galaxy in the conventional reference system can only show the change of position relative to some *one* location in that system of reference. We take our galaxy as the reference location, and we see galaxy X as moving in the direction AX, where A represents our location. But observers in galaxy B see galaxy X as moving in a totally different direction BX, those in galaxy C see it moving in the direction CX, and so on.

We may generalize the relation between scalar motion and the conventional reference system by saying that scalar motion can be represented in this reference system only by the use of a reference point, a point in the moving system that is coupled to the stationary reference system by arbitrarily assuming that it is motionless (from the scalar standpoint) in that system of reference. As has been indicated, the usual reference point for the motion of the galaxies is the position of our own Milky Way galaxy. For the photons and the massless particles, the reference point is the point of origin, and the direction taken by each individual particle is determined by chance.

All of the objects that we have identified as motionless in the natural reference system are observed in the conventional system of reference as moving outward from their respective reference points in the same manner and at the same speed, the speed of light. It follows that this is the relative motion of the two systems; that is, the natural system of reference is moving outward at the speed of light relative to the conventional system.

This outward movement of the natural reference system carries *all* physical entities with it, the consequence being that objects which are motionless in the *conventional* reference system are, in fact, moving *inward* at the speed of light. This finding revolutionizes the problem of identifying the motion mechanisms. Instead of having to look for one mechanism whereby electromagnetic radiation is propagated, another to account for the motion of massless particles, and still another to explain the recession of the most distant galaxies, all that we need to do is to identify a mechanism whereby the atoms and particles of matter are able to move inward toward each other. This is easily done. It is true that the *nature* of this mechanism whereby matter is capable of self-generated motion has never been identified by previous investigators, but the *existence* of such a mechanism is incontestable. This mechanism is gravitation, a known property of matter that accomplishes exactly what is required in order to counterbalance all or part of the effect of the outward progression of the natural reference system. It moves each gravitating object toward all others.

From the fact that the gravitational motion is the inverse of the outward motion, or progression, of the natural reference system, it can be recognized as an *inward scalar motion*. It is generally regarded as a force, but there is no conflict here, as force is defined in such a way (by Newton's Second Law of Motion) that it is a property of a motion. Einstein's "principle of equivalence," the key feature of his General Theory of Relativity, asserts that gravitation is equivalent to a motion. On the basis of the findings that have been described herein, we can go a step farther and say that it is not only equivalent to a motion; it ***is*** a motion. But it is not vectorial motion, the only kind of motion that Einstein appears to have recognized. Identification of gravitation as an inward scalar motion accounts for the observed radial character of the gravitational force field, and eliminates the need for postulating a distortion of space by the presence of matter, one of the most questionable expedients employed in the construction of the General Theory.

Because it is generated by a fixed relation between the two reference systems, the outward movement of physical objects due to the progression of the natural system always has the same magnitude: the speed of light. But the gravitational effect varies with the distance between the objects, the interaction of these two opposing scalar motions under different conditions is therefore capable of explaining a wide variety of results within the conventional reference systems, all the way from net speeds that approach the speed of light in the outward direction to net speeds that approach the speed of light in the inward direction. In particular, the range of speeds involved in the galactic recession, the specific subject of the present inquiry, is fully explained by the combination of the two oppositely direction scalar motions. At great distances, the gravitational attraction is weak, and the outward motion, observable as the galactic recession, predominates. As the distance decreases, the gravitational force becomes stronger, and the net outward motion decreases, until at a certain point, the gravitational limit, we may call it, the inward and outward motions are equal, and the net motion is zero. Inside this limit there is a net gravitational (inward) motion.

Here, then, we have arrived at an explanation of what is currently regarded as the primary cosmological problem, that apparent expansion of the universe, and we have reached it purely on the basis of existing knowledge, without introducing anything new or making any special assumptions. Like Copernicus in his day, all that we have found necessary is to look at our problem from a different point of view, to use a reference system that gives us a more complete and correct picture of the factors that are involved.

The universe, we find, is not expanding. On the contrary, the general direction of movement is inward. The aggregates of matter, the galaxies, are *growing*. The cannibalism that is currently being attributed to the giant galaxies in the centers of relatively dense clusters is not peculiar to the giants; it is a general feature of the universe that applies to aggregates of all sizes.