A SIMPLE MODEL OF FIELDS INCLUDING THE STRONG OR NUCLEAR FORCE AND A COSMOLOGICAL SPECULATION

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Reexamining the assumptions underlying the General Theory of Relativity and calling an object's gravitational field its inertia, and acceleration simply resistance to that inertia, yields a simple field model where the potential (kinetic) energy of a particle at rest is its capacity to move itself when its inertial field becomes imbalanced. The model then attributes electromagnetic and strong forces to the effects of changes in basic particle shape. Following up on the model's assumption that the relative intensity of a particle's gravitational field is always inversely related to its perceived volume and assuming that all black holes spin, may create the possibility of a cosmic rebound where a final spinning black hole ends with a new Big Bang.

Keywords: Gravity, Inertia, Relativity, Strong Force

Introduction

According to what Einstein called the Principle of Mach, the concept of local acceleration only has meaning in the context of a universe, which contains other objects. Simply stated, a particle's inertia is due to its interaction with the rest of the matter in the universe. The only way we know of for each material object in the universe to interact with all of the rest of the matter in the universe (regardless of charge) is through its gravitational field.

A material object's inertial and gravitational masses are identical; hence, it resists forces to the precise extent of its gravitational influence on the space around it. Gravitational influences, however, can counter each other. There is, for instance, a point between the Earth and Moon where a test particle would not fall toward either body. Significantly, though, the Earth and Moon accelerate toward each other. All other things being equal, when an object's gravitational influence on the space around it is countered, it accelerates toward the source of the counter influence. The following model assumes that it does so in response to a reduction in the quantity of its inertia for that direction.

Inertia, Gravity, and Acceleration

Imagine that the gravitational field stretching out from a particle to the rest of the matter in the universe is that particle's inertia. Now, remembering the equivalence between a gravitational field pulling in one direction and acceleration in the opposite direction, imagine acceleration vectors within the particle pointing toward its center. The resulting model is shown in Diagram 1.

In this model gravitational attraction between two objects occurs because space cannot warp in two directions at once. This means there is less inertia for each in the direction of the other. Inertial imbalances result in acceleration vector imbalances, and the objects accelerate toward each other as shown in Diagram 2. The rate of each object's acceleration is no greater or less than the extent of its field's reduction.

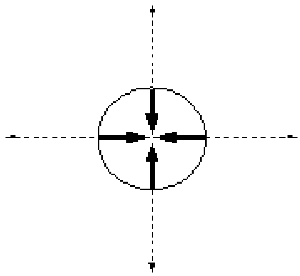

Diagram 1. Heavy arrows represent acceleration vectors within the particle, and the dotted arrows represent its gravitational field.

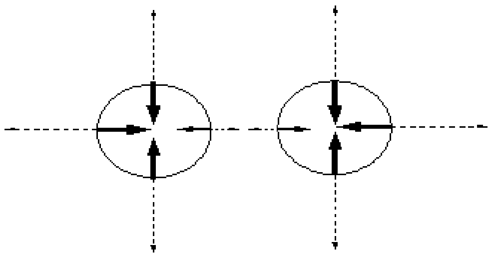

Diagram 2. Gravitational field cancellation between the particles results in unbalanced acceleration vectors within them. Hence, they accelerate toward each other.

Electrostatic Charge and Acceleration

To minimize and equalize the pressure on its surface, a bubble of air in water or a droplet of water in the air becomes spherical. A basic particle is like a bubble or droplet; all other things being equal, its acceleration vectors tend to make it spherical when at rest. Irregularities in a basic particle's shape necessarily have an influence on its gravitational field. In this model, the relative magnitude of the acceleration vector from any given point on the surface of a basic particle varies with the curvature of the surface of the particle at that point.

Electromagnetic fields influence the shape of basic particles. A charged basic particle is like a balloon with flexible wires attached to it: manipulating the wires changes the balloon's shape. Lines of force drawn to represent a charged particle's electrostatic field always enter or leave the particle at right angles to the plane of its surface at the point of entry or exit. When two similarly charged basic particles near each other, the lines of force representing their electrostatic fields diverge with the minimum possible amount of bending as shown in Diagram 3.

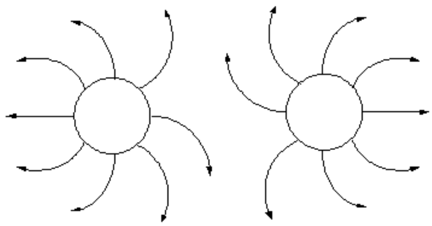

Diagram 3. Lines of force representing electrostatic field direction diverge with the least possible amount of bending.

This field redirection places a strain on the surfaces of the particles. To reduce this strain on their surfaces, the near sides of the similarly charged particles become more pointed, and their far sides flatten as shown in Diagram 4.

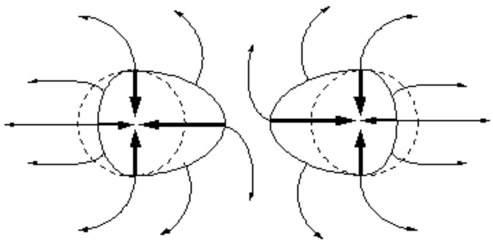

Diagram 4. The shape of the basic particles alters to minimize the stresses on their surfaces caused by the electromagnetic field redirection in the space around them. This causes imbalances in their internal acceleration vectors.

This in turn causes imbalances in the particles' internal acceleration vectors, and the particles accelerate away from each other. When two particles of unlike charge interact, their near sides flatten, their far sides become more pointed, and they accelerate toward each other. Magnetic attraction and repulsion work similarly.

The Strong or Nuclear Force

Assuming that the volume of a basic particle does not change as it changes shape in this way, the more cone shaped a charged basic particle becomes, the less additional deformation it can achieve. This effectively limits the magnitude of electromagnetic forces. At macroscopic ranges between charged bodies, electromagnetic forces follow simple inverse square laws. At subatomic ranges, however, as the charged basic particles become more and more cone shaped, further deformations follow a law of diminishing returns. Because ordinary gravitational attractions do not suffer this limitation, they overcome electrostatic repulsion at very short ranges.

The Problem With Verifying the Model

Scientific understanding of the world around us is generally thought to advance as we test out hypotheses and either accept them or reject them on the basis of the results of the repeatable tests. Occam's razor or the law of parsimony, sadly, does not count as a meaningful means of evaluating anything new.

The major short coming of this new field model is not in anything it does, but rather in something it does not, at least immediately, do: provide a simple means for its verification. I do not expect anyone to build a powerful enough accelerator to find out whether electromagnetic forces can be used to induce massively high rates of acceleration or whether they seem to stop increasing after a while.

So, like Michael Faraday's original illustration of fields with lines of force, this model does not actually predict anything I can envision any way to test. I wish it did.

Advantages of the Field Model

Advantages of this basic field model include the following. First, it links the action of electromagnetic forces to the mechanism of gravity. Charged basic particles accelerate because surface deformations caused by electromagnetic field interactions upset the balance of their internal acceleration vectors. Second, it explains how similarly charged particles can remain in close proximity in atomic nuclei. Electromagnetic forces do not follow simple inverse square laws at close range because of the increasing difficulty of deforming basic particles. And finally third, like Michael Faraday's original field model, it provides a simple conceptual framework for understanding fields.

Nothing Comes of Nothing, a Cosmological Speculation (Introduction)

Cosmic background radiation suggests our universe was born in a Big Bang, so we do not have to consider any steady state models of it here. Since the work of Friedmann the better part of a century ago, we have generally understood that there were two potential ultimate destinies for an expanding universe such as our own. If the average density of matter in the universe is less than some critical value, then its overall geometry is hyperbolic and gravity cannot keep at least some parts of it from expanding outward forever. If on the other hand, its average density is above that critical level, then its geometry is spherical and all of the matter in the universe will eventually all come back together.

Estimates of the expanding universe's deceleration parameter derived from observing the red shifts of distant galaxies have at least not yet ruled out the possibility that its geometry is spherical. If it is, then our universe seems destined to end in the great information sink of a single black hole. It would be philosophically satisfying if there were a reason to suppose that the death of one universe would necessarily result in the birth of another. If all black holes rotate as they collapse (and I cannot imagine how one could possibly collapse symmetrically enough to avoid doing so), then I think it is possible to imagine such a reason. Assuming that the field theory presented earlier is correct in that a basic particle's volume seems greatest to us when we perceive it at rest, and that black holes always spin as they collapse may allow a potential explanation for how a cosmic rebound could occur.

The Special Theory of Relativity states that a perceived velocity, which will decrease an object's perceived length by a given magnitude, will increase its perceived mass to the same extent. Its perceived width and height do not change with the Lorentz-Fitsgerald contraction of the object's length. Hence, its perceived volume varies directly with its length and inversely with its perceived mass. The rest of this essay examines the possibility that the magnitude of a basic particle's inertia is always an inverse function of its perceived volume -- no matter what causes the compression.

A Spinning Black Hole

Even if an unquestionable measurement of our expanding universe's deceleration parameter unambiguously told us that its geometry was hyperbolic at this particular moment in time, this would still not necessarily mean that it had to remain that way forever. As a particle in a spinning black hole gains velocity, the intensity of its gravitational field increases as described by Einstein in his special theory of relativity. Consequently, the intensity of the gravitational field around a spinning black hole will have to increase as it collapses. If the intensity of a basic particle's perceived gravitational field is always an inverse function of its observed volume, then the intensity of the gravitational field around a black hole will increase very much more rapidly. What these increases in field intensities mean, is that even if there does not seem to be enough mass in the universe to catch its run away expansion now, there very well might be enough gravitation intensity associated with spinning black holes to change the geometry to spherical and pull everything back together again later.

As a particle falls into a spinning black hole in the plane of the black hole's equator, it does not follow the Euclidean straight line path toward the black hole's central axis. It spirals down the geodesic path of the twisted space. As it gains velocity, it loses perceived length (assuming an observer who can actually perceive it) in the direction of its instantaneous travel and ultimately gains tremendous angular momentum. Its rate of progress toward the center, however, may slow because space becomes increasingly twisted the closer to the central axis it gets. A decreasing rate of progress toward the central axis would mean that the side of the particle furthest from that axis would move toward it more quickly than the nearer side. This reduction in the particle's width would reduce its volume, further increasing its inertia.

Relative particle momentum is highest for particles in the equatorial plane of a rotating black hole. Therefore, particles falling in from outside that plane fall toward it. As they fall toward the equatorial plane, they follow the geodesic path of the increasingly twisted space. Hence, as before, they may fall toward it at an ever decreasing rate. This means the side of a particle furthest from the equatorial plane may approach the nearer side. This reduction in the particle's height would reduce its volume and once again increase its inertia.

If particles approach its central axis and equatorial plane at ever decreasing rates, a spinning black hole could both last a long time and gain tremendous gravitational mass (which would cause great local time dilation relative to more distant objects). Maybe it could even last long enough so that when it finally did become a singularity, every particle in the universe would have had time to arrive for the event. When the moment arrived, perhaps all of the particles could achieve zero length, width, and height, infinite mass, and maximum velocity simultaneously. At this juncture, as I will discuss, a Big Bang would have to occur because there would no longer be any gravity to hold everything together.

Discussion Points

Gravitational fields only exist between objects. When there is no more between, there is no more gravitational field. Without a gravitational field to define the local flow of time, there is no possible interval between events.

A completed infinity of gravitational intensity is a logical absurdity. If perceived gravitational attraction is actually infinite (and not just very large) at one distance from its source, then it must also be infinite at every other finite distance from that source. This would mean that space was not warped, but uniform. Un-warped space means a gravitational potential of zero.

Looking at the Lorentz transformations, the local rate of time flow for an object slows tremendously as its perceived velocity approaches the speed of light. At that limit, however, the function becomes undefined. This does not mean that time stops — just the opposite. When time is undefined, by definition, everything happens at once with no interval between.

When we say the universe was born in a Big Bang, we effectively say that all of the matter in the universe started moving outward simultaneously. Consequently, I feel it is not unreasonable to use the same word in describing the moment of its ultimate death. It is only in between the beginning and end that the word simultaneous necessarily loses meaning.

Philosophical Considerations

If the Big Bang which began our universe did not result from the death of a previous universe, then we might not unreasonably ask ourselves why it happened in the first place and go on to wonder if having something in the way would really stop it from doing the same thing again.

The French Jesuit priest and philosopher Pierre Teilhard de Chardin once stated that he had, "... no difficulty in accepting miracles, providing (and this, in fact, is precisely what the church teaches) the miracle does not run counter to the continually more numerous and exact rules we are finding in the natural evolution of the world." [Teilhard, 1969: 63].

I share the man's view (on this and some other topics), but I cannot begin to reconcile it with the miracle of creation if that creation is a one and done Big Bang which is not part of a recurring cycle. I just cannot see how such a thing follows any sort of rules at all.

Like everyone else, I need to believe that there exists a comprehensible explanation for natural phenomena. Even if I do not understand how something works yet, I need to believe that I can understand it. And a one and done Big Bang which is not part of a recurring cycle is, and will I think forever remain, totally incomprehensible to me.

For this reason when I first learned that the universe contained strange things called black holes and that it all started with a Big Bang, I just took it for granted that the two were related and the one would naturally lead to the other. Having thus followed the highly scientific method of deciding what I wanted the answer to be, all I had to do was find a reason why it should be that way. My first answer was that the special relativistic increase in the effective mass of a spinning black hole would be enough to bring everything back together. Later on, however, it occurred to me that my new field model could help with the explanation too.

It is only human to ask ourselves not only why we are here, but why there is a here in the first place. The first question is interesting, but the second of the two is the one, which must occupy us right now. Saying, as does much of the scientific community today, that there was a one and done Big Bang and that everything ultimately is destined to end up in either the information sink of a black hole or scattered and fallen to eventual entropy does not begin to answer that second question. Worse than not answering the question that led us to the study of cosmology in the first place, that statement brings up the truly awful question of "why now?"

In a steady state universe, lives like ours are no more or less probable or possible in the present moment than they were an indeterminate number of years prior or they will be an indeterminate number of years hence. Consequently, the question of "why now?' is not an issue. After all, if one time is as good as any other, why not right now?

In an expanding universe which is not destined to end with a repetition of the cycle, though, the question of "why now?' must become critical. The flow of time, which began with the Big Bang, would in this scenario continue onward forever. Lives like our own, however, would only be possible in a very small and ever shrinking proportion of that eternity.

In general, this idea of time going on forever or, for that matter the universe expanding forever, is not a concept with which I am excessively comfortable. I cannot get my mind around it. I can deal easily enough with a "finite but unbounded space", but infinite is just a little more than I can process.

I think I do somewhat better dealing with zero, especially if it is a net zero. If we wanted to assume, for instance, that the stuff of basic material particles were electrostatic charge, the universe as a whole could have a net charge of zero and still exist without overly straining my credulity. A Big Bang that started with something that netted out to zero and grew from there would not offend me either if I thought I saw how it was done.

I hope and believe that I now understand, in a very general sense, how the Big Bang, which began our universe, occurred. I merely hope that I have successfully communicated my thoughts on this subject. Discussing events within a black hole's event horizon, however, is an awkward exercise at best.

Whether we suppose our universe ends in a single black hole or as scattered pieces slowly giving way to entropy, if we do not think its ultimate demise necessarily results in the birth of a new universe, we have to contend with the very thorny philosophical question of "why now?" without any hope of an answer. If, on the other hand, we suppose that our universe is just one part of a cyclical system of birth, growth, decline, death, and rebirth, then we have either answered or evaded that question entirely. Consequently, if the present suggestion proves inadequate, I will continue to believe that a cyclical cosmological solution must exist, and I will look for it. So, I think, will you.

References

Pierre Teilhard de Chardin, How I Believe, 1969, Harper & Row, Publishers, New York