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A Random Resistor Network Model of Motion in Space-Time

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Abstract

A new model of motion in space-time is proposed that incorporates the properties of a random resistor network. The self-similar nature of such networks was particularly useful in extrapolating force interactions to different levels of scale. By modeling time and matter as current and resistance, respectively, a simple equation for mass, time, and motion was derived that provides a novel mechanism for the displacement of matter. An unexpected feature of the model was the independent determination of the relationship between matter and energy ($E=MC^2$).

Introduction

Recent cosmological observations suggest that prevailing models of space-time may not adequately describe certain phenomena, thus inviting the formulation of alternative constructs that address these unresolved issues. To this end, we propose a new model in which space is not continuous, but is instead composed of infinitesimal pores. It is postulated that the properties of this porous universe correspond to those of other permeable materials, and can therefore be characterized in terms of percolation models. A useful feature of such models is their self-similar nature, which provides a means of determining force interactions at different levels of scale [1,2].

The proposed model incorporates the characteristics of a standard percolation system in which a potential gradient acts against a fluid-like material through a latticework of conducting sites. The effluent in this case is an extra dimension of time that permeates the 4-dimensional universe through a network of interconnecting pores. The postulated diameter of the pores is small enough to preclude measurable interaction with surrounding space, and would therefore approximate the Planck length [3]. The flow is spatially uniform, such that time appears to be everywhere at once with no internal point of origin.

As in other percolation models, the flow of time would be limited by the probability that the connection between adjacent pores was either open or closed [4,5]. For open connections, time would flow into and out of our universe unimpeded. Conversely, closed connections would block the flow of time, resulting in a change in its potential, analogous to the displacement of current in a capacitor. This displaced timeflow would accumulate between the pores as charge potentials that interact in the same manner as matter [6].

None of the underlying postulates of the current model are completely new. The possible existence of extra dimensions of time has already been discussed [7], and the concept of pores is based on the idea that there is a lower limit to the amount of space that contains measurable information [3]. Nevertheless, the use of these postulates in the context of percolation models provides an entirely novel framework for relating mass, time, and motion.

Formulating the Model

The current model incorporates the properties of a specific percolation structure, known as a random resistor network, where wires (bonds) are cut indiscriminately. In such a system, conductance between pores is associated with probability *p*, and zero conductance has probability 1-*p* [4]. Matter accumulates when a threshold value (critical probability) is reached at local sites within the network. Assuming every bond between the pores has the same conductance (G), mean current or timeflow (I) in response to the formation of matter is associated with an average voltage potential (V), and these values are related as follows [8]:

$$I = GV$$

Substituting resistance for conductance,

$$V = RI$$

The interaction of timeflow and matter in the network is thus identical to that of current and resistance in an electrical circuit, and can be expressed in terms of the familiar equation, V = RI. As applied to matter (M) and timeflow (T), this equation would take the following form:

$$V = MT$$

where V is the potential associated with the matter.

The macroscopic behavior of matter would reflect its interactions at the level of the pores, and can therefore be described by established models of kinetic theory applied to a 3-dimensional, spatially uniform field. The electrophoretic movement of particles, as described by Smoluchowski, is a particularly appropriate model to examine the activity of charged matter in the current model, since it involves similar types of forces [9]. This model is valid for particles of any shape or concentration.

As applied to the current model, the electrophoretic movement of a particle would be proportional to its potential (V), and would continue until a state of equilibrium is reached. Any further movement would require the application of an external force to counteract the intrinsic potential of the particle (inertia), according to the following equation:

$$V' = V - V_i$$

where V' is the potential of the moving object, V is the potential of the object at rest, and V_i is the counterpotential induced by work.

This above equation may also be expressed as follows:

$$MT' = MT - M\mathit{V}$$

where M*V* is the momentum of the object.

Or,

$$MT' = M (T-V)$$

And,

$$T' = T - V$$

where T is the flow of time through the object at rest and T' is the flow of time through the object undergoing movement.

This relationship may also be expressed as follows:

$$V = \Delta T$$

Thus, time and motion are interchangeable. As such, the maximum change in timeflow would be the same as the upper limit for velocity, and a mass moving at the speed of light (C) would be associated with a timeflow rate of zero. Furthermore, since the upper limit of timeflow varies with the percolation probability *p*, it follows that C varies inversely with the formation of matter. The concept of a variable C has been previously proposed by a number of investigators [10-12]. However, it is generally presented as a mathematical overlay to an existing model, rather than as a direct consequence of the model itself.

The above equation,

$$MT' = MT – MV$$

invites further examination of the relationship between mass and velocity, particularly at speeds approaching C. According to special relativity, the mass of an object would become infinitely large at C. In the current model, however, momentum is equivalent to counterpotential (V_i), and therefore cannot exceed the actual potential of the mass (MT). Total mass is unchanged at C because all of the energy associated with acceleration is converted to counterpotential rather than mass. The amount of work needed to accelerate a resting mass to C can be determined by the formula for electrical power ($P=RI^2$), which can be applied to either the mass potential or counterpotential (which are equivalent at C) as follows,

$$P = MT^2 = MC^2$$

Thus, the current model diverges from special relativity with regard to the effects of velocity on mass, but is consistent with the theory in terms of the total instantaneous power or energy associated with a given mass. The loss of charge in proximity to C would reduce particle deflection in a magnetic field, thus simulating an increase in mass.

Modeling Field Effects

In discussing the properties of the random resistor network, it was postulated that the pores had equal conductivity, producing a bimodal distribution of bond conductance. However, the accumulation of matter might result in a special case where localized voltage differences in the network alter bond conductance [8]. In a spatially uniform field, this process of "voltage trimming" would produce a symmetrical loss of conductance extending out from a given mass, thus assuming the properties of a field.

The magnitude of this field would be proportional to the mass of the object that produced it, and would be capable of inducing voltage drops in neighboring masses that result in movement according to the previously derived equation:

$$V' = V - V_i$$

where,

$$MT - MT' = M\mathit{V}$$

Such a mechanism would produce the same effect as gravity, but would not require the postulation of a distinct gravitational force.

The Application of the Model to Cosmological Phenomena

The self-similar nature of percolation models implies that the arrangement of visible matter in the universe may be a reflection of what is occurring at the level of the pores. In accordance with a random resistor network, the probability of noncommunicating pores would yield a relatively homogeneous distribution of matter, consistent with the observed isotropic formation of galaxies within the universe. Furthermore, the model suggests that expansion of the universe could occur as a result of changes in the gating potential of the pores, which would be reflected by an increase in entropy [13].

Conclusions

As with most theoretical constructs, the modeling of space-time as a random resistor network has both advantages and limitations. One useful feature of the model is the concept of mass potential and counterpotential, which permits the formulation of a novel equation for mass, time, and motion. However, the idea of a porous universe is a theoretical construct that may not be subject to experimental verification since it presumably involves interactions beyond the limits of measurement. Nevertheless, it is hypothesized that changes in conductance between pores would alter the fine structure constant, which is related to the structure of space [14]. While these changes would be infinitesimal over small time intervals, both increased instrument sensitivity and new approaches to determining this value may eventually provide evidence that supports this hypothesis.

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