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A Matrix Universe as the Origin of Inertia and Momentum and Translocation as a Chemical Reaction

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ABSTRACT

It is proposed that there is a matrix structure of the universe that persists both in the presence and absence of physical objects, and that chemical reactions involve reorganization of electronic orbitals within this matrix structure. The mechanism by which objects translocate within this matrix is similar to the chemical reaction mechanism, and therefore requires moving objects to cross transition-state energy barriers. This involves an input of energy, which is the origin of inertia and momentum. The matrix concept is used to derive equations of motion that conform to Newton's laws and include terms for inertia and momentum.

INTRODUCTION

Inertia and momentum are properties that are possessed by all physical objects. However, the origin of these fundamental properties has never been established, despite attempts to do so. Some are highly speculative, and invoke interactions with distant celestial objects [1-3]. Our inability to provide explanations for inertia and momentum suggests a fundamental lack of understanding of the mechanism by which objects undergo translocation.

In this paper, it is proposed that the universe has a highly organized scaffold-like matrix structure, as described earlier [4]. This proposed matrix structure is nothing new, in that it its characteristics and properties are exactly those predicted by the quantum mechanical wave equations. What is new is the assertion that the atomic and molecular orbitals described by the wave equations are not an ephemeral concept, but have an existence that persists irrespective of the presence of physical objects. A conclusion that is derived from this idea is that the universe is everywhere filled with "virtual objects" of every conceivable chemical structure, which means all those chemical structures that conform to the quantum rules and therefore correspond to real structures that would be chemically stable in the event that they were chemically synthesized. This is in keeping with well-developed concepts of the quantum vacuum, which is filled with a wide variety of virtual particles and forms of energy that continuously appear and disappear [5]. Measurements of the Casimir effect [6,7] have provided experimental verification of the existence of these virtual entities.

The wave equations not only describe the structure of this matrix, but also provide the rules by which matter can be reorganized within the matrix, and how it can shift from one matrix position to another. It is proposed that ordinary chemical reactions are the process by which matter is reorganized, and that translocation is the process by which objects shift positions within the matrix. Moreover, it is proposed that the mechanisms of these two processes are similar, so that the chemical reaction of translocation between matrix positions resembles the process of chemical reorganization to convert reactant molecules into product molecules. Briefly, a chemical reaction is the process in which electrons of the molecular orbitals of reactant molecules reorganize their electronic structures to form product molecules by passing through transition-state energy barriers. The investment of energy required to cross these transition states is called "activation energy." It is proposed here that the shifting of matter from one matrix position to another, which we call translocation, is achieved by a similar process that requires an activation energy to cross the transition-state energy barrier that separates one matrix position from another; and that what we call "inertia" is actually this activation energy, and that after this activation energy has been invested, the object possesses what we call "momentum," and will continue to move indefinitely until the energy is drained away by friction, etc.

A MATRIX UNIVERSE FILLED WITH VIRTUAL OBJECTS

In order to develop the concept of a matrix universe that contains virtual objects, it is useful to consider a simple real object such as a hydrogen atom, which consists of a proton nucleus and an orbital electron. The wave equations describe orbitals of many different energy levels, each having a particular geometry; and the orbital electron will occupy the one that conforms to its energy content. Since these orbitals are defined by the wave equations, they can be thought of as "existing" around the hydrogen nucleus irrespective of whether they contain electrons. Accordingly, when the electron of the hydrogen atom is in the 1*s* ground state, all the other orbitals, such as the 2*p*, 3*d*, and 4*f* orbitals are there, ready to accept the electron in the event a photon causes the electron to shift from the ground state to an elevated state.

To distinguish between an orbital that contains an electron from one that is empty, the filled orbital will be called a "real" orbital, and the empty orbital will be called a "virtual" orbital. A hydrogen atom in its ground state has a real 1*s* orbital, and all the others (2*p*, 3*d*, 4*f*, etc.) are virtual. A proton, which is a hydrogen atom that has lost its electron, has nothing but virtual orbitals.

Now imagine that a proton, which is surrounded by a full complement of virtual orbitals, undergoes translocation. Clearly, the proton in its new location is surrounded by virtual orbitals, but what has happened to the virtual orbitals in the original location? One possibility is that they somehow disappeared, to become less than the nothing that they already were. Another possibility, which is much more interesting, is that they are still there; but now they are centered on a *virtual proton*, and what now occupies the original location is a *virtual hydrogen atom, including all of its virtual orbitals*. In principle, if a virtual hydrogen atom can exist anywhere, then virtual hydrogen atoms must exist everywhere, because there cannot be a difference between a location in space that has become vacated by a hydrogen atom, and one that can become occupied by a hydrogen atom. A conclusion is that what appears to be empty space is actually filled with virtual hydrogen atoms, and can therefore be conceived as a matrix, each point of which is occupied by a virtual hydrogen atom.

If each point in this matrix is occupied by a virtual hydrogen atom, what else might be there? The reasoning that led to virtual hydrogen atoms can be used to argue that there are also virtual carbon, oxygen, and nitrogen atoms at each matrix point, and every other type of atom as well. Moreover, we can consider that the orbitals around any atom can exist in various states of hybridization, such as *sp*, sp^2 and sp^3 hybrid orbitals. There is accordingly a virtual carbon atom at every matrix point in which its virtual valence orbitals are in the sp^3 hybridization state, and therefore can form virtual *sigma* bonds with the virtual hydrogen atoms located at the corners of the tetrahedron formed by the virtual carbon orbitals, to make a molecule of virtual methane. A virtual *p* orbital of this same virtual carbon atom is also participating in a virtual *pi* bond with an adjacent virtual carbon atom, and the virtual sp^2 orbitals of these carbon atoms are participating in virtual *sigma* bonds with a different set of virtual hydrogen atoms so as to form a molecule of virtual ethylene. This points toward the principle that a virtual atom can use virtual orbitals of any allowable hybridization state to form virtual bonds with any of the virtual atoms that surround it. Since every type of virtual bond is possible, every conceivable allowable chemical structure is represented in virtual form at every point in the matrix. Since all these virtual atoms and bonds are present simultaneously, it follows that virtual representations of all conceivable molecular structures (objects) are present everywhere in the universe.

OBJECTS UNDERGOING CHEMICAL REACTIONS

We ordinarily speak of chemical reactions as the process by which electrons around reactant molecules reorganize to become electrons around product molecules in a process that chemists call bond-breaking and bond-forming. If we think about this in the context of a matrix architecture, what is happening is that electrons in the real orbitals of the reactant molecules move out of those orbitals and into the virtual orbitals of the product molecules, thereby converting the reactant orbitals into virtual orbitals and the product orbitals into real orbitals. In doing this, the electrons have to cross over an energy barrier that chemists call the "transition state," and the energy required to do this is what chemists call the "activation energy." The transition state is said to be the highest energy point between reactants and products, and is the point at which electrons are in the process of leaving one orbital state (breaking a bond) and entering another orbital state (forming a bond); but what is really happening within the matrix is that electrons are departing from real orbitals that become virtual, and entering virtual orbitals that become real.

OBJECTS UNDERGOING TRANSLOCATION REACTIONS

This puts the process by which objects undergo translocation in a new light. We ordinarily think of translocation as a process of such simplicity that that we do not think about it. Early Greek philosophers who thought about it concluded that objects should not be able to move [8], But since they do, their arguments are regarded as flawed. However, when one

thinks about the translocation of objects in the context of the matrix, translocation appears to be analogous to a chemical reaction, except that the atomic and molecular orbitals do not need to undergo reorganization, but merely shift from one position point in the matrix to another. A useful analogy is a Chinese checkerboard, in which a marble at one location is moved to another location. This requires some energy to lift it out if its current detent to pass over a transition state, whereupon the marble can drop into an adjacent detent if one assumes that friction has drained away enough of the activation energy to prevent the marble from continuing to roll across the board.

To move an object, you need to push against it. If the object is embedded in the orbital matrix, then in order for the object to move from one matrix position to another, the electrons need to be elevated out of their current real orbitals and transferred into virtual orbitals. Just as for the chemical reaction, this requires an input of activation energy so it can cross the transition state energy barrier that separates the initial matrix position from an adjacent matrix position. Once this activation energy has been invested, an interesting circumstance is encountered. Whereas the Chinese checker marble settled into its new detent location because the energy required to lift it out of the original detent had been dissipated by friction, the energy imparted to the object molecule might not be dissipated, so the activation energy that lifted it out of its original molecular orbital detent will prevent it from dropping into an adjacent orbital detent, and it will continue to move indefinitely, until the activation energy is dissipated by collisions or frictional forces. Only after the activation energy has been dissipated will the molecule be able to settle into the orbital detent of an adjacent set of virtual orbitals, thereby making them real. Once this has occurred, the object will have translocated from one position in the matrix to another.

This concept of the process of translocation suggests the origin of inertia and momentum. The activation energy required to lift the object out of its original detent position corresponds to inertia. Once this has occurred, the activation energy becomes the object's momentum, which it will retain until it collides with another object, or is drained away by friction. Inertia is therefore the activation energy that is required to elevate the reactant object into the transition state that it must traverse in order to convert an adjacent virtual object into a real object, and momentum is the result of the activation energy being used over and over to move the object through a series of intermediate virtual objects, with each virtual object in the series being a momentary container of the protons, neutrons, and electrons of the real object.

EQUATIONS RELATING FORCE AND VELOCITY THAT EMBODY INERTIA AND MOMENTUM

One way to test the validity of these concepts is to use them to derive equations that relate the velocity of objects to the forces that set them in motion. If the concepts are valid, they should produce equations that conform to Newton's laws of motion, except they should contain terms for inertia and momentum. By invoking the matrix concept, it is possible to write a phenomenological equation that relates the velocity of an object to an input of energy from a particular direction.

$$v = \frac{I_0 M_f}{m} \Delta E_v \qquad \text{Equation 1}$$

ΔE_v is a discrete packet of energy imparted to the object from a particular direction, which will impart vectored energy to the molecular orbital of the object and distort it in the direction of the transition state that is required to transfer the real protons, neutrons, and electrons into an adjacent virtual object that lies in the direction determined by ΔE_v I_0 is the *Inertial Modulus*, with units of g-c per unit of ΔE_v and represents the extent to which a given energy input can distort the molecular orbital toward the transition state energy barrier, and is related to the deformability of matter. M_f is the *Momental Frequency*, which has units of sec^{-1}, and represents the kinetic rate at which the transition state is crossed. It is argued that both I_0 and M_f are fundamental attributes of matter that reflect the extent to which it can be distorted by force, and the rate at which electrons can shift from one orbital state to another. The term for mass, m, is placed into the denominator to reflect the fact that the extent of distortion to the transition state is inversely proportional to the mass of the object.

This equation conforms to Newton's first law, in that without an input of ΔE_v, the object, if it is at rest, will remain at rest. Once a packet of ΔE_v has been imparted to the object, it will acquire a velocity that will then remain constant, so an object in motion will continue in motion. The equation also conforms to Newton's third law, because the only way that a packet of vectored ΔE_v can be imparted to the object is by means of pushing against it with another object, and there is no way to distinguish between the object that is imparting the energy and the one that is receiving it, so that both objects are pushing equally against each other; so that for every action there is an equal and opposite reaction.

Equation 1 can be differentiated with respect to time, t, to give

$$\frac{dv}{dt} = \frac{I_0 M_f}{m} \frac{d\Delta E_v}{dt}$$

This can be rearranged to

$$I_o M_f \frac{d\Delta E_v}{dt} = m \frac{dv}{dt}$$ Equation 2

Equation 2 is mathematically indistinguishable from Newton's second law, $f = ma$, and shows that the classical concept of f is actually a composite variable, $I_o M_f \frac{d\Delta E_v}{dt}$, consisting of the rate at which vectored energy is imparted to the object, $\frac{d\Delta E_v}{dt}$, together with constants related to inertia (I_0), and momentum (M_f). Equation 2 reflects the matrix structure of the universe as well as its quantum-mechanical properties, and also the mechanism by which vectored energy is converted into motion. It is therefore more meaningful than $f = ma$, which is an empirical equation that provides no mechanistic insight.

In view of the fact that the wave equations of quantum mechanics have been available for nearly a century, it is surprising that that these conclusions have not been reached earlier; because they are the logical consequence of assuming that quantum mechanics provides an accurate description of the structure of the universe as well as the fundamental rules by which it operates. All that is done here, is to assert that these rules are in force everywhere all the time; in places that are devoid of physical objects as well as places where physical objects are present. Evidence in favor of these conclusions is that they immediately resolve the mystery of inertia and momentum, which cannot be satisfactorily accounted for by any other hypothesis. These conclusions also allow the derivation of laws of motion from first principles, instead of empirical observation. According to the standards of scientific inquiry, any hypothesis that can be excluded by experimental observations must be abandoned in favor one that is inclusive of those observations. Inertia and momentum are experimental observations that can be used to adjudicate between a universe that possesses a matrix architecture that is filled with virtual objects from one that lacks these attributes. Inertia and momentum are explained by this hypothesis. Satisfactory alternate explanations do not seem to be available.

Knowledge that ordinary chemical reactions and translocation proceed by a unified mechanism could have important consequences. For example, chemists know a great deal about catalysis, which allows chemical reactions to proceed more rapidly by decreasing the energy barrier of the transition state [9]. A catalyst of translocation would allow objects to be set in motion using less energy, and they would possess less momentum; which would be a boon to transportation and other human endeavors. How such a catalyst could be discovered or designed is not obvious. However, knowing that something is theoretically possible is often the crucial factor in transforming a possibility into reality. It could also be that the magnitudes of the constants I_0 and M_f may not be the same at all times, nor in all places, nor under all conditions; which could help to resolve anomalies in the motion of celestial objects, and accordingly contribute to our understanding of the evolution of the universe.

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