Non-Local Interactions, Spin, the Strong and Weak Forces, Inertia, and Faraday Induction

What follows is an informal continuation of the work presented in, "*A Computational Model of Time-Dilation*" [1],[1] in which we presented a theory of time-dilation rooted in information theory and computer theory, with equations for time-dilation that are identical in form to those given by the special and general theories of relativity. In this note, we finalize the outlines of the model of physics we presented in [1] by presenting an explanation for effectively continuous time, non-local interactions, charge, quantum spin, a generalized principle of conservation that is consistent with the weak force and the strong force, an explanation for inertia, and an explanation for Faraday induction.

Effectively Continuous Time and Magnetic Fields

In a previous note entitled, "*A Unified Model of the Gravitational, Electrostatic, and Magnetic Forces*" [2][2], we presented a unified model of the gravitational, electrostatic, and magnetic forces that made use of an omnipresent, stationary background field comprised of discrete quanta of energy. Specifically, we argued that the emergence of a magnetic field was in turn due to the local emergence of a dynamic electrostatic field produced by two charges moving at unequal velocities. Further, we argued that, in our model of physics, all phenomena of nature require some form of "computational power" to process the interactions that give rise to the phenomenon in question. In the model of physics we presented in [1], in the case of a massive particle, the mass energy of the particle acts as a computational engine that processes the behavior of the particle, and is, as a result, the source of any time-dilation experienced by the particle. Specifically, as a massive particle gains kinetic energy, the mass energy of the particle experiences a greater draw on its finite computational power, as the particle spends more objective time processing the motion of the particle, instead of changing states, thereby ultimately causing time-dilation (see Section 3 of [1] generally).

Since our model views fields as exogenous to particles, something exogenous to a charge must be processing the behaviors of the force-carriers of the electrostatic field generated by that charge. Moreover, since the interactions of a dynamic electrostatic field are more computationally complex than those of a static electrostatic field, it follows that a dynamic electrostatic field must draw upon some additional processing power that allows for it to be more computationally complex, yet nonetheless update at the same rate as a static electrostatic field. That is, the net electrostatic field of two charges that are moving at the same velocity is only marginally more complex than a stationary electrostatic field, since it is a constant electrostatic field propagating through space (i.e., an object with constant structural complexity, but a changing position). In contrast, two charges moving with unequal velocities will produce a complex, net electrostatic field with a structure that will need to be constantly updated to reflect the changing relative positions of the two charges over time, therefore requiring more computational power to process than a static electrostatic field.

[1] Available at www.researchgate.net/publication/323684258_A_Computational_Model_of_Time-Dilation.
[2] Available at https://www.researchgate.net/project/Information-Theory-16/update/5bd9e4adcfe4a76455feb075.

As a result, we argued in [2] that in order for electrostatic fields to maintain their integrity, it must be the case that their interactions are effectively processed “instantaneously”. That is, if this weren’t the case, then a dynamic electrostatic field would take more time to update its structure than a static electrostatic field, which is not the case. This is a consequence of the model of time we presented in [1], which is effectively discrete, since particles change properties and positions only upon the occurrence of a “click”, which happens simultaneously, everywhere, every t_0 seconds. As a result, our model implies that a complex, dynamic electrostatic field should take more clicks, and therefore more time, to process than a static electrostatic field, since it is the product of a relatively larger number of interactions between the force-carriers that together comprise the electrostatic field.

To reconcile our model with the fact that there is in reality no difference in the rate at which dynamic and static electrostatic fields update, we argued that magnetic fields arise due to the temporary increase in momentum of a stationary, omnipresent background field that processes the behaviors of the force-carriers of an electrostatic field. That is, as an electrostatic field grows more complex, the momentum of this background field increases, which corresponds to more computational power being allocated to the processing of the electrostatic field, thereby creating the appearance of force-carriers that interact instantaneously. This does not, however, imply that changes to an electrostatic field propagate instantaneously, but rather, that the interactions between the force-carriers that ultimately give rise to these changes do not require any additional time to occur. This is in contrast to ordinary particles, which, in our model, process their own interactions, causing particles to lose velocity as they allocate more of their finite processing power to interactions, taking processing power away from processing their motions through space. This is, for example, why light travels at a velocity of less than c through a medium in our model (see [2] generally).

As a result, as the local complexity of an electrostatic field increases, the background field will increase in momentum, which we assume to give rise to a magnetic field. That is, the force-carrier of a magnetic field is this stationary background field itself, which charges “hit” when they traverse an area of the background field that is “excited” by the local emergence a dynamic electrostatic field. The greater the velocity of a charge, the more often it will hit the background field, and therefore, the force exerted by a magnetic field on a moving charge should be proportional to the velocity of the charge, which is indeed the case. (See [2] for more details on our model of a magnetic field).

In [2], we noted that, but did not explain why, the background field would increase in momentum in order to increase its computational power. That is, we assumed the existence of a background field comprised of stationary matter that increases in momentum as the complexity of a local electrostatic field increases, and noted the connection between this increase in momentum and the presumed increase in computational power, but did not explain how the two were specifically related. We now present an explanation for the connection between an increase in the momentum of the background field, and its increase in computational power, which we attribute to the background field increasing the frequency of its interactions. That is, we assume that the background field is capable of interacting at a rate that is greater than once per click, which is otherwise the minimum time in our model. This implies that the background field does not increase the amount of momentum exchanged per interaction, but instead, increases the frequency of its interactions, which in computational terms implies that its “clock rate” increases with the complexity of the local net electrostatic field, allowing it to process more interactions per click, thereby preserving the integrity of the local electrostatic field, regardless of its complexity.

Under this view, we can think of each interaction between a charge and a magnetic field as “turning the wheel” of the charge, causing the charge to change direction. Though we can only measure time once per click (because all ordinary clocks are presumably comprised of ordinary matter), we can posit the existence of time in between clicks, meaning that the total change in momentum of a charge moving through a magnetic field over a single click is actually due to multiple interactions that occurred in between clicks. The greater the “clock rate” of the background field, the greater the number of interactions per click between a charge and the magnetic field it’s traversing, and therefore, the greater the charge’s change in momentum per unit of time. That is, the greater the clock rate of the background field, the greater the force it exerts on a charge moving through it.

Since there is no apparent limit to the strength of a magnetic field, it follows that the clock rate of the background field can be arbitrarily high, in turn implying that what is otherwise the minimum time for ordinary matter can be subdivided into arbitrarily small intervals of time. However, it could still be the case that these subdivisions are quantized. That is, it could be the case that time is always subdivided into increments of t_0 / n, where n is an integer, implying that time is effectively continuous, and not actually continuous, though a definitive conclusion on this point is not necessary for purposes of this discussion.

In summary, this model of the background field allows us to formally relate the processing power of the background field to the force it exerts on a moving charge, with the force exerted on a moving charge increasing with the complexity of the net, local electrostatic field, which in turn increases the strength of the resultant magnetic field, and the processing power of the background field.[3]

Non-Local Interactions

It is known to be the case that entangled particles can interact with each other over arbitrarily large distances, apparently instantaneously. This is arguably problematic under the theory of relativity, since it implies that something, whatever it is, is travelling faster than light. In contrast, the model of physics we presented in [1] allows for particles to travel faster than light (see Section 3.3 of [1]), though we did not fully address this issue in [1], since it was not necessary to fulfil the main purpose of the paper, which was to demonstrate time-dilation without space-time.

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[3] In [2], we argued that this background field also powers the centrifugal force, which we assume to be the result of the emergence of a dynamic gravitational field. As a result, analogous reasoning would apply to gravitational fields. Further, random interactions between a particle and this background field could serve the role of something akin to a “quantum foam”, which would randomly disrupt the motion of particles on a very small scale, but with a net zero expected force over any appreciable interval of time. Note that this would be achieved without the use of space-time.

However, the model of time we presented in the paragraphs above suggests that it would be possible for particles to travel faster than light by simply updating their positions at a frequency of greater than once per click. That is, light travels at a velocity of c by updating its position once per click, traversing a distance of ct_0 per click. The analysis above implies at least the theoretical possibility of particles that update their positions more often than once per click, in turn implying the theoretical possibility that these particles travel faster than light. If we posit the existence of a force-carrier through which entangled particles interact, and we assume that this particle is not like ordinary matter or light in that it updates its position more than once per click, then it would be possible for such a force-carrier to create the appearance of instantaneous interactions at a distance. That is, this force-carrier would traverse space, from one particle to its entangled pair, but do so within one click, making it impossible for the ordinary particles with which we measure time to detect its motion, creating the appearance of instantaneous change. However, if our model of the background field above is correct, then it should be at least theoretically possible for the background field (e.g., when acting as a magnetic field) to interact with such a superluminal force-carrier particle, which could perhaps allow for the detection of such a particle, despite its velocity.

Quantum Spin and Electrostatic Charge

In the model of physics that we presented in [1], momentum cannot exist without energy (see Section 3.6 of [1]). That is, if a particle has non-zero momentum, then it necessarily has non-zero energy. As a result, the additional momentum of an elementary particle due to its quantum spin is arguably problematic in our model, since it would necessarily imply that this additional momentum is due to the particle having some additional energy, beyond its mass energy and kinetic energy. Specifically, this implies that the particle would experience time-dilation as a function of this additional spin energy. Since this is not the case, it follows that it cannot be the case that the quantum spin of a particle is due to energy that is intrinsic to the particle.

Instead, we assume that the quantum spin of an elementary particle is due to energy that is contained in the background field at the point in space occupied by the particle at a given moment in time. That is, the spin energy of a particle is “housed” outside of the particle, in the background field itself, as an excitation of the background field, in that the background field contains some additional energy at the point in space occupied by the particle that generates the momentum generally attributed to the quantum spin of the particle itself. As the particle traverses space, this spin energy would “shadow” the particle, also traversing space through the background field. As a result, the spin of an elementary particle would have no impact on the rate at which the particle experiences time-dilation, which is consistent with observation, and the fact that the spin of a particle is independent of the particle’s mass, which suggests that the additional momentum of a particle attributable to its spin is not due to the particle actually rotating.

This theory of quantum spin is also consistent with the model of elementary particles we presented in [1], which assumes that particles effectively “code” for their own properties. That is, particle type, charge, and in addition, spin are the result of a code that is determined by the collective states of the discrete quanta of energy of which the particle is comprised (see Section 3 of [1] generally). Informally, in our model, energy is the fundamental substance of all things, and it is discrete, and comes in quantized "chunks". Each quantized chunk of energy has a particular state, and the collective states of the energy that together comprise a particle completely characterize the properties of the particle, together forming a "code" for the particle.

Similar reasoning would allow, for example, for the mass energy of a tau lepton and electron to both code for the same spin, thereby causing the background field to generate the same amount of additional momentum, despite these two particles having different masses. That is, though the particles have different masses, their energy contains the same "spin code", thereby causing the background field to generate the same spin momentum that shadows the particles along their paths.

They of course also contain the same "charge code", causing both particles to have the same charge, which we assume to be due to an amount of energy that is exogenous to the particles, and again "housed" in the background field. That is, the charge of a particle cannot be due to the mass energy of the particle, since if that were the case, then the tau lepton and electron would have different charges, which is not the case. Instead, we assume that, like quantum spin, the charge of a particle is the product of a code that is in turn the product of the collective states of the quanta of energy that together comprise the particle. This charge code causes the background field to house an additional amount of energy that generates an electrostatic field. This is in contrast to a gravitational field, which we assume to be generated by the mass energy of the particle itself.

If our model of the background field above is correct, then the greater the energy of the background field is at a given point, the greater the clock rate of the background field at that point. This suggests the admittedly theoretical possibility that the clock rate of a charged particle is higher than that of an electrostatically neutral particle, in turn suggesting the possibility that charges might be able to interact with superluminal particles. This is consistent with our model of a magnetic field, where a charge would necessarily interact with the background field at a rate of greater than once per click.[4]

The Conservation of Code and the Weak Force and Strong Force

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[4] In [2], we assumed that the gravitational and electrostatic forces have a maximum frequency of one interaction per click. If there are particles that are capable of changing their properties and positions in between clicks, then even a maximally powerful gravitational field or electrostatic field would not be able to prevent such a particle from escaping the effects of that field. For example, in the case of a gravitational field acting on a particle that is at the Schwarzschild radius of a mass, which we assume to act on the particle once per click, a particle that is capable of changing its position in between clicks would be able to escape the gravitational field of the black hole, since the particle could simply change position while the field is not acting on it, in between clicks. If, however, our model of gravity is wrong, and instead a gravitational field has no maximum frequency, and can act at an arbitrarily fast rate, then nothing would be able to escape a maximally powerful gravitational field, since it would have an infinite frequency at the Schwarzschild radius, making the probability of interaction with the field truly 1, regardless of the clock rate of the particle. Finally, a field that constantly acts on a particle at a given point in space would imply that an infinite amount of energy will traverse that point over any finite interval of time.

As discussed above, we assume that particle type, charge, and spin, are all coded for by the mass energy of an elementary particle. Similarly, in [1], we assumed that the direction of motion of an elementary particle is coded for by the kinetic energy of the particle (see Section 3.3 of [1]). As a result, if a particle changes the direction of its momentum, but not the magnitude of its momentum, then this implies that the direction of motion coded for by the kinetic energy of the particle changed. Since momentum is conserved, this implies that some other particle must undergo an offsetting change to its momentum, corresponding to a change in code that is equal in magnitude, but somehow opposite in direction, or sign.

That is, the model presented in [1], as supplemented above, implies that elementary particle type, charge, spin, and momentum are all reduced to properties that are coded for by the energy of the particle. This suggests that there should be a general conservation mechanism by which if a particle changes type, charge, spin, or momentum, then there is some associated magnitude of change in code that is conserved, in that there is always an offsetting change in code of the same magnitude, and opposite sign, or direction, in the code of some other particle or set of particles. This is consistent with the existence of the W and Z bosons, the emission and absorption of which can change the type, charge, spin, flavor, and momentum of a particle, thereby mediating the weak force. Similarly, this is also consistent with the exchange of gluons among quarks, which can change the color of a quark, thereby mediating the strong force.

As a result, our model allows for particle type, charge, spin, momentum, flavor, and color, to all be viewed as coded for by the energy of the particle, and subject to a generalized principle of conservation that conserves changes in code, thereby conserving changes in charge, spin, momentum, flavor, and color. Moreover, it provides a simple theory as to why all of these properties can be changed through the ejection and exchange of force-carrier particles. In contrast, energy is conserved due to a seperate principle, which simply asserts that energy is the fundamental, underlying substance of all things, and therefore, cannot be destroyed, but instead simply changes states (i.e., codes) over time, thereby allowing particles to decay, interact, and annihilate. Under this view, particle annihilation is not *bona fide annihilation*, since it does not destroy energy. Instead, particle annihilation is, under this view, an interaction between one particle with a given code, and another particle that presumably has a complimentary code (i.e., its antiparticle).[5]

Further, though we do not present a specific theory of how these codes operate, we note that if changes in code are modular, and go around in a single direction like a clock, then there could be asymmetry in the amount of time it takes for an interaction and its reverse to occur. For example, if the codes for a given property (e.g., color) are modulo K, then the code K + 1 would map to 1. Further, if we fix the change in code per interaction between a force-carrier and a particle, and assume, for example, that a force-carrier acts by always increasing the code of a particle, then the distance between one code and another could depend upon the direction of the transition. For example, assume that the code for one particle state is 7, and that the code for another particle state is 10. Further, assume that the codes are modulo 20, and that the applicable force-carrier

[5] If particle interactions can be described by an algebra on the set of particle codes, then since all particle-antiparticle annihilations generate a photon, it could be the case that the code for a photon is the zero, or unity, of the underlying algebra for these codes.

interacts with a particle by incrementing the code of a particle by 1 upon each click. It follows that 3 interactions, and therefore, 3 clicks, are required to transition from state 7 to state 10 (i.e., 7 + 3 (mod 20) = 10), whereas 17 clicks are required to transition from state 10 back to state 7 (i.e., 10 + 17 (mod 20) = 7). As a result, in this case, the amount of time required for a particle to transition from one state to another would depend upon the direction of the transition, creating an asymmetry in time between an interaction and its reverse. As a result, this model of code as a quantity that is exchanged via a force-carrier could perhaps be used to explain, for example, the known asymmetry of the weak force.[6]

Cyclical Codes, Inertia, and the Origin of Fields

The modular codes described above suggest the possibility that an otherwise stationary particle could oscillate through states, thereby repeatedly ejecting force-carrier particles. Though this would not require actual rotation in space, it would be analogous, since the cycle of a modular code can be represented by a rotating vector. As a result, this mechanic could serve as the mechanism by which fields are generated. That is, it could be the case that a mass, or a charge, has a code that changes often enough to emit a number of force-carrier particles that are sufficient in number and frequency to "power" the resultant gravitational or electrostatic field. Moreover, if the field produced through this mechanism is not constant, then our model implies that background field interactions should occur due to the complexity of the resultant field.

We hypothesize that the inertia of ordinary mass is due to exactly this mechanic. That is, a gravitational field is by its nature not constant, but only constant on average over time, producing an inertial "pinching" interaction with the background field that is equal in all directions around a moving mass, but opposite in direction on either side of the mass, producing a zero net force when the velocity of the mass is stable. "Pushing" the mass in any direction will create a greater disturbance to the gravitational field in that direction, which we assume to generate a temporary increase in the force in that direction. In turn, this produces a non-zero net force on the mass, opposing the acceleration of the mass. Moreover, the inertia of a mass will therefore depend upon the initial velocity of the mass, since that velocity determines the frequency with which the mass will hit the background field in a given direction in the first instance, which is consistent with observation.

In contrast, if we assume that an electrostatic field is by its nature truly static for a charge with a constant velocity, and not just constant on average over time, then the property of charge should not add to the inertia of a particle, which is consistent with observation. Moreover, accelerating a charge should, in this view, cause a background field interaction, since it creates a temporarily dynamic electrostatic field, which could explain why electrons emit radiation when accelerated.

Finally, because light does not have a gravitational field, it would not have inertia in this model, though it would still have momentum. This is consistent with the fact that light can slow down in a medium, and then immediately recover its velocity upon exit. This would not be possible if light had inertia, since light would be unable to recover its original velocity upon exit if it did

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[6] See, e.g., http://blogs.nature.com/news/2012/11/particle-physicists-confirm-arrow-of-time-for-b-mesons.html.

have inertia. As a result, this model of inertia as the product of an interaction with the background field allows us to formally distinguish between the momentum of a particle, which is the result of its energy, and its inertia, which is the result of its gravitational field. In terms of effect, momentum is the capacity to cause acceleration, whereas inertia is the resistance to acceleration.[7]

Mass as Bounded Energy

In the model of physics we presented in [1], energy is always in one of two categories of states: a mass state, or a kinetic state (see Section 2 of [1] generally). Because we assume that the collective states of the energy contained within a particle form a code for the particle, this of course does not imply that there are only two states of energy. Rather, we assume that all possible states can be categorized as either a **mass state**, producing energy that generates a gravitational field and has no macroscopic motion, or a **kinetic state**, producing energy that has no gravitational field but does have macroscopic motion. So, for example, in our model, a stationary electron would consist entirely of energy that is in a mass state, whereas a photon would consist entirely of energy that is in a kinetic state. This in turn implies that a stationary electron generates a gravitational field, whereas a photon does not, which is consistent with observation.

As discussed above, we can explain the emergence of fields generally by assuming that some spontaneous change in code is taking place, thereby causing the emission of force-carrier particles that ultimately generate a field, and thereby conserve momentum. Further, as noted above, we've explained the emergence of inertia as the product of the inherent complexity of a gravitational field, which implies that the changes in code that in turn generate a gravitational field must have some minimum degree of complexity to them. We cannot know how much complexity is necessary to generate inertia, but nonetheless this view allows us to unify light and mass in an elegant manner, by assuming that energy in a mass state is simply kinetic energy (i.e., the same energy of which a photon is comprised) that spontaneously changes direction, in a manner that causes it to be bounded by some finite, and presumably extremely small region of space. That is, under this view, a quantum of energy in a mass state is simply a photon that changes its direction constantly, but with an expected velocity of zero over any appreciable interval of time, causing its location to be effectively bounded. Because this change in velocity is otherwise spontaneous, it can serve the role of our hypothesized change in code that we discussed above, ultimately causing the emission of force-carrier particles, and thereby generating a complex gravitational field, and consequently, an inertial resistance to acceleration.

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[7] Note that light-on-light interactions are unlikely, and generally occur only at very high energies. As a result, it could be the case that the probability of interaction between two particles increases as a function of their inertia, which would imply that the probability of two photons colliding is extremely low, which is consistent with observation. Since it seems to be the case that dark matter generally does not interact with ordinary matter or light, then perhaps dark matter is comprised of massive particles that have no inertia. That is, dark matter would produce a "perfect", truly static gravitational field, which would imply that dark matter has no inertia, and therefore, a low probability of interaction. Further, we note that it is possible in our model for dark matter to have charge.

Moreover, this view of mass is consistent with Quantum Mechanics, since it implies that a massive particle doesn't have an exact location, but instead, is associated with some region of space in which it is most likely to exist at any given moment in time. Further, if we assume that energy in a mass state does not exchange energy with exogenous particles, but instead exchanges only momentum, then because a photon carries momentum, energy in a mass state would be capable of deflecting exogenous particles through collisions by causing exogenous particles to change direction through an exchange of momentum. This would explain why massive particles interact as if they were solid, even though in this view, they do not have a single well-defined location. This would not however, preclude a massive particle with some kinetic energy from exchanging kinetic energy with an exogenous particle. Rather, the point is that mass energy itself is never exchanged, but instead, mass energy exchanges only momentum, thereby causing the deflection of exogenous particles.

Therefore, this view of matter as bounded light allows us to explain gravity, inertia, quantum uncertainty, and mass-energy equivalence with a single set of assumptions.

Angular Momentum as Inertia; Faraday Induction

Our model of inertia above implies that the angular momentum of a rotating mass is actually better described as a type of inertia. Consider the example of a bicycle wheel that is rotating while hanging from a string. The rotation of the wheel is generally said to produce "angular momentum" in one direction perpendicular to the rotation of the wheel. However, the wheel has no capacity to cause acceleration in that direction, but instead only has the capacity to cause acceleration in the direction of its rotation. The wheel does, however, have additional resistance to acceleration in the direction of its angular momentum, which we could explain as a background field interaction, due to the complexity of the wheel's rotating gravitational field. Put simply, a moving bike stands up because it experiences a "pinching force", much like the force we describe above, which we also attribute to a type of rotation, albeit a more abstract type of rotation through codes, not physical space.

But unlike a wheel that is attached to a bicycle, a wheel that is rotating freely in space will also spin, without any exogenous source of acceleration causing it to spin. This is a peculiar result that cannot be explained by the inertial force we describe above. Moreover, because the resultant spin is orthogonal to the rotation of the wheel, it increases the total kinetic energy and momentum of the wheel. Additionally, the spinning force increases as a function of mass, which implies that the force is not constant. For example, by hanging a weight from the spoke of the wheel, we will increase the rate at which the wheel spins. Therefore, it seems plausible that the acceleration that gives rise to this spin is truly exogenous, and is the result of a field acting on the wheel.

We argue that this spinning force is the result of the background field changing its structure in response to the wheel being displaced, causing yet another background field interaction. As discussed above, we argue that the centrifugal force is itself exerted due to the complexity of the wheel's gravitational field. But because the wheel is rotating, and not truly uniform, the centrifugal force will actually vary at any given fixed point over time. As a result, the interactions between the wheel and the background field at any fixed point will change in magnitude and direction over time, though macroscopically, the centrifugal force will nonetheless probably have some stable average magnitude and direction over time. This suggests that the background field has a direction, in addition to a frequency of interaction.

In light of the discussion above, we can think of the magnitude and direction of the background field at a point as codes contained within the energy of the background field itself at that point, each of which are capable of changing over time. Because we assume that code is conserved, it follows that changes to the background field's code at any fixed point could result in the emission of force-carriers, thereby generating forces, and even fields. That is, if the background field changes the magnitude or direction of its interactions, then this would presumably be the result of a change in the background field's code. If we assume that code is conserved, then there must be an offsetting change to the code of some other particle or system. In this particular case, we argue that the constantly changing centrifugal force at any given point near the wheel causes the background field to constantly change its code, generating yet another interaction, in order to conserve momentum, ultimately causing the wheel to spin.

Note that this implies that the initial centrifugal interaction between the wheel and the background field is not due an exchange of momentum between the wheel and the background field, but is instead a spontaneous interaction due to the increased complexity of the wheel's gravitational field, which in turn requires a second interaction in order to conserve momentum.

Further, we assume that the strength of this additional interaction increases as a function of the mass of the system in question, which is consistent with the observation that hanging a mass from a rotating wheel will cause the wheel to spin faster. We concede that it is not obvious what constitutes a sufficient nexus between two masses to cause them to generate a single overall spinning force, but clearly, if our model is correct, physically hanging a mass from a wheel would suffice.[8]

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[8]This suggests the admittedly theoretical possibility that this additional spinning interaction could act on an object that is not physically attached to the rotating mass in question. In any case, this is a "free lunch" scenario, since one type of motion produces acceleration that is orthogonal to the original motion, thereby increasing the total energy of the system in a manner that could be used to extract energy.

Secondly, if our model of this additional spinning interaction is correct, and light is subject to this additional interaction, then this interaction could alter the path of light emitted by a stationary source that is sufficiently connected to a rotating mass.

Further, our model of inertia above implies that the more complex the motion of a particle is, the more complex its gravitational field will be, and therefore, the more inertia it will have as a consequence of its motions. It follows that the closer the motion of a particle is to truly rectilinear motion, the less inertia the particle will have. Thus, our model implies a connection between the information content (i.e., the entropy) of the distribution of motion of a particle, and its inertia, with inertia increasing as a function of entropy. This is consistent with our model of light, which has perfectly rectilinear motion, and no inertia.

Moreover, both the centrifugal and inertial forces can be viewed as specific instances of a more general principle, whereby the background field exerts a force in the direction of computational simplicity. That is, in the case of the inertial force, the added complexity of a particle's gravitational field is presumably in the direction of acceleration, Finally, we argue that this same mechanic underlies the phenomenon of Faraday induction. Specifically, we argue that a displaced magnet causes the background field to change the magnitude and direction of the interactions underlying the magnetic field, following the path of the magnet through space, thereby producing in this case a force that acts on exogenous charges, thereby conserving momentum. This view implies that Faraday induction should also be possible whenever the magnetic field at a point changes, regardless of whether it is due to the physical displacement of a magnet, which is indeed the case.

Spontaneous Changes in Momentum

The models of the centrifugal and inertial forces we presented above suggest the more general principle that momentum can change spontaneously, so long as momentum is conserved. This would in turn allow for the spontaneous generation of energy, so long as momentum is conserved, which is consistent with the obvious fact that gravitational and electrostatic fields are net contributors of energy to the systems with which they interact. This is also consistent with spontaneous particle decay, which is in our model due to the particle changing its code, which is a more generalized notion of momentum.

Taken as a whole, these ideas suggest the possibility that spontaneous changes in momentum could occur in a more organized, and perhaps even deliberate fashion. For example, in our model, the background field changes the magnitude and direction of its interactions in response to the complexity of a gravitational and electrostatic field. This is not an ordinary interaction between two systems, which is in all ordinary cases the result of an exchange of energy or

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due to a temporary "pile up" of force-carriers. Similarly, in the case of the centrifugal force, the added complexity is presumably within the area bounded by the particle's rotation. Thus, in both cases, the background field resists acceleration, and exerts a force in the direction of computational simplicity. That is, it pushes mass that is in an area of high complexity, into an area of low complexity, thereby minimizing interactions with the background field. This suggests the possibility of a generalized force in the direction of computational simplicity, that could, at least theoretically, be used to generate motion.

Additionally, though ordinary mass has inertia, our proposed model of stationary dark matter above does not. It would, however, gain inertia if it were rotated, since this would generate a complex gravitational field, and as a result, a pinching force. This pinching force would presumably be orthogonal to the plane of rotation. This suggests the possibility, though again, admittedly entirely theoretical, that dark matter could be rotated, without any inertial resistance, which would in turn produce spin, subject to some inertial resistance due to the rotation, but presumably, much less than the inertial resistance of ordinary matter. If the spinning force exceeds the inertial force, then it raises the possibility of a feedback loop of acceleration, generating unbounded acceleration, and unbounded energy.

Finally, it could be the case that two magnetic fields that attract each other are generated by underlying net electrostatic fields that are complex in an offsetting manner. That is, when two magnetic fields produce an attractive force, it could be because the complexity of the underlying net electrostatic fields would be reduced by moving the two magnets closer together, thereby producing an attractive force between the two magnetic fields themselves. In crude terms, it is computationally "cheaper" to have the two underlying net electrostatic fields closer together, and so a background field interaction is produced that generates an attractive force between the two magnetic fields. In contrast, when the complexity of the two underlying net electrostatic fields cannot be reduced by moving two magnets closer together, perhaps the magnetic fields behave as semi-solid objects, creating a repulsive force, again ensuring a minimum complexity arrangement of the two underlying net electrostatic fields.

momentum. Instead, in this case, the background field simply changes its behavior because of some exogenous change in circumstances. This suggests the more general possibility that systems can simply change their properties in response to exogenous circumstances, even in the absence of an exchange of energy or momentum, so long as momentum is conserved. If true, this would be a truly remarkable property of nature that might even allow us to objectively distinguish between sentient physical systems, and inanimate systems. That is, a sentient system would in this view be a system capable of spontaneous, computationally complex changes to its properties and behaviors, whereas an inanimate system would be capable only of interactions due to the exchange of energy or momentum that in turn change its properties and behaviors.

The capacity to change the momentum of a system can of course be measured, since it is actually a type of momentum itself. This in turn implies that if there is some substance underlying this phenomenon, then this substance would be capable of physical measurement, and arguably, have units of momentum. That is, if the ability of a system to spontaneously change its own momentum is due to the presence of some physical substance, then because we can measure the capacity of a system's ability to change momentum, we can in turn measure, at least by proxy, the quantity of this substance, assuming it exists.

We present no formal theory of what drives the emergence of spontaneous changes in momentum, but instead merely note that it is at least anecdotally associated with complexity in our model. Specifically, complex gravitational fields and complex electrostatic fields give rise to spontaneous interactions in our model, and similarly, biological organisms, which are generally wildly complex systems, also appear to be capable of spontaneous changes in behavior that do not always follow any obvious path from some input energy to some corresponding output action. Strangely, this implies that biological systems might be emitting some kind of field as they take actions, changing their behaviors through otherwise spontaneous changes to the momenta of the energy that underlies their corporeal substance.

These ideas are admittedly bordering on the philosophical, perhaps beyond the appropriate bounds of a note on otherwise traditional areas of physics. But the bottom line is that by allowing for a more generalized notion of spontaneous change in momentum, which is known to exist in at least some cases, we can in turn present a quantitative, and possibly even measureable, theory of sentience, that could perhaps, eventually, help us understand the nature of consciousness.