FORCE OF CONSCIOUSNESS IN MASS CHARGE INTERACTIONS

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ABSTRACT: Primitive awareness leading to consciousness can be explained as a manifestation of internal forces between charge and mass. These internal forces, related to the weak and strong forces, balance the external forces of gravity-inertia and electricity-magnetism and thereby accommodate outside influences by adjusting the internal structure of material from which we are composed. Such accommodation is the physical implementation of a model of the external physical world and qualifies as Vitiello's double held inside ourselves. We experience this accommodation as the conscious experience in front of our noses. Neural pulse traffic is interpreted as unconscious signal processing activity happening between this internal accommodation and our external interface of sensors and actuators.

KEYWORDS**:** Cognitive Action Theory; Gravitational Objective Reduction; Mass-charge interaction; Reversible Quantum Processes; Physical Correlates of Consciousness

1) CHARGE AND MASS SEPARATION

Mass-Charge separation as introduced in Cognitive Action Theory (CAT) does not in itself contain new physics nor does it conflict with existing quantum or physical laws (Baer 2013,2014). It does provide a visualization that encapsulates a large body of research below the atomic and above the astronomic levels. It is here presented as a simplification that describes the interior of matter as patterns of energy for the purpose of addressing the hard problem of consciousness. As such it provides a physical mechanism by which such energy patterns that can be correlated with conscious experiences.

CAT assumes space, charge-mass densities, and their influence fields exist in forms that become aggregated as particles, systems, and generally things in our everyday experience. Let us consider any system - from the universe to the smallest atom - such as an apple. If we break it apart to try to understand how it is made from its constituent parts we find that each piece may be characterized by some distribution of charge and mass and that these pieces influence each other through electric and gravitational force fields. No matter how many parts we break any system into we can only directly observe electric and gravitational influences these pieces have on our

measuring apparatus. We may infer a large variety of internal structures from such measurements but such inferences are always derived from measurements that rely on gravitational and electrical forces. We only experience the gravito-electric influences each part has on us or our surrogate measuring apparatus because we are looking at them all from the outside. We now introduce the simple assumption that internally to each part there are short range forces that hold the charge and mass together.

The picture that emerges is shown in figure 1 below. Here the outline of an apple is used to represent any object in our environment. In principle we can calculate the center-of-mass and the center-of-charge of such an object which are shown as rectangular and circular icons respectively at some point location inside the material.

Each mass interacts with the rest of the masses in the universe through gravito-inertial forces. Forces on the mass are shown as incoming arrows and labelled Fgi, while transmitted forces are labelled Fgi*. We are assuming Mach's Principle which identifies inertial properties as gravitational interactions with the surrounding star shell mass in order to group inertia into the gravitational force category. Similarly the center-of-charge is influences by the incoming electro-magnetic forces Fem from all the other charges in the universe. The outgoing electromagnetic influences are labeled Fem*. The asterisk is used to designate an influence that logically goes from these centers to the rest of the universe in the forward time direction but can also be treated as a reverse time influence from the rest of the universe.

Unless the universe is perfectly homogeneous the sum of the gravity and electric influences will not cancel and therefore a net force will pull the charge and mass in different directions. The question then arises, "What holds the charge and mass together?" Physicists in the past have described material as particles and assumed all the properties of the particle are located at a single particle location. This allowed classical mechanics to define a particles position with two the generalized coordinate vector $\underline{\mathbf{q}}$ and the generalized momentum $\underline{\mathbf{p}} = \underline{\boldsymbol{p}} + e\cdot\underline{\mathbf{A}}/c$ which includes both gravitational momentum $\underline{\boldsymbol{p}}$ and electromagnetic momentum "$e\cdot\underline{\mathbf{A}}/c$" (where: e=charge, $\underline{\mathbf{A}}$ =Electro-magnetic vector potential, c=speed of light). The charge and mass were both assumed to be at the same point. In Bohr's calculation of the Balmer series of the Hydrogen atom that initiated modern quantum theory for example, the charge was pulled in by a positively charged nucleus and the mass is pulled out by inertial gravitational forces and both were assumed to be at a single point circulating on a single orbit. Further development of quantum theory eventually led to the visualization of orbitals which is effectively a charge-mass distribution associated with the time average position of the single charge-mass point. The fact that such moving

charge does not radiate electro-magnetic influences was then explained by the additional postulate of stable orbits.

Similar assumptions of single point charge-mass location, point movement, stable non-radiating orbits, and probability interpretations produced visualizations of stable charge-mass density visualizations of the plethora of particles and properties occurring in atomic and nuclear physics. This combination has achieved undeniable success in explaining and predicting experimental measurements. It has also lead to the well known computational procedures of quantum mechanics which though agreeing with experimental observations are difficult to understand as attested by the large number of possible quantum mechanical interpretations listen in Wikepedia (2014). To short circuit this complexity when addressing problems outside the real of atomic and nuclear physics we jump directly to a visualization of charge-mass densities and centers of charge and mass with the assumption that they are held together by internal forces labeled Fcm and Fmc in figure 1. Fcm labels the force of the charge on the mass while Fmc labels the force of mass on the charge. We will argue in the following sections that the existence of these internal forces are the fundamental embodiment of conscious experience and are therefore called the consciousness forces.

If we assume a charge density ρc and a mass density ρm permeates any space parameterized by coordinates xi then the amount of mass and charge at the center of a volume can be calculated by,

Eq. 1a $ch[xi] = \rho c[xi]\cdot\Delta x1\cdot\Delta x2\cdot\Delta x3\cdot\ldots\ \Delta xi,$
$m[xi] = \rho m[xi]\cdot\Delta x1\cdot\Delta x2\cdot\Delta x3\cdot\ldots\ \Delta xi$

and the position of the center of charge and mass can be calculated by,

Eq. 1b $\underline{\boldsymbol{\Delta}}ch[xi] = 1/ch[xi] \int Vi\ \rho c[xi,](\underline{\boldsymbol{\Delta xi}})\cdot\ \underline{\boldsymbol{\Delta xi}}\cdot dV\underline{\mathbf{x}}i$, and,
$\underline{\boldsymbol{\Delta}}m[xi] = 1/m[xi] \int Vi\ \rho m[xi,](\ \underline{\boldsymbol{\Delta xi}})\cdot\underline{\boldsymbol{\Delta xi}}\cdot dV\underline{\mathbf{x}}i$.

Where:

Vxi = volume of the i'th volume element ($\Delta x1\cdot\Delta x2\cdot\Delta x3\cdot\ldots\Delta xi$)
Δxi = position vector within the i'th volume element
ch[xi] = amount of charge in the i'th volume element
m[xi] = amount of mass in the volume element
$\Delta ch[xi]$= center of charge vector in the volume element
$\Delta m[xi]$= center of mass vector in the volume element

We note that the vector **Δxi** used to calculate the center positions are relative to the coordinates xi used to label the origin of each volume V**x**i. We have thus converted a density into two fields, one for charge and one for mass. The charge mass separation distance **z**[xi] is then given by,

Eq. 1c $$\mathbf{z}[xi] = | \mathbf{\Delta}ch[xi] - \mathbf{\Delta}m[xi] |,$$

which is also a field. It can be shown that for any constant density of charge and mass in a volume the centers are at identical positions.

The actual position of the charge mass centers in any volume will be determined by the balance of forces between the gravitational and electromagnetic forces from/to the outside and the internal cognitive forces on the inside. The D'Alambert Principle is the most fundamental principle in physics incorporating Newton's Laws and the Least action Principle. Stated succinctly the principle says that material only appears where all forces on it balance. So for example the trajectory of any particle will lie along a path on which all forces are balanced. This incorporates Newton's second law rewritten as 0 = F – ma, where "ma" is treated as the force due to the interaction with the distant mass shell according to Mach's principle. By splitting material into charge and mass the cognitive forces can be incorporated in an extended D'Alambert Principle. The forces on charge balance if

Eq. 2a $$0= \mathbf{Fmc} + \mathbf{Fem} + \mathbf{Fem}^*.$$

The forces on the mass balance if

Eq. 2b $$0= \mathbf{Fcm} + \mathbf{Fgi} + \mathbf{Fgi}^*.$$

Both must be true. Physically the shape of the particle which determines the charge-mass separation and the position of the material adjusts the path so that the internal forces counter balance the external gravito-electric forces at every position along its path. If there is reciprocity between the cognitive forces so that Fcm = -Fmc then adding the two equations cancels the internal forces and the classic principle applicable to a particle consisting of some amount of mass and charge is regained.

Eq. 2c $$0 = \mathbf{Fem} + \mathbf{Fgi} + \mathbf{Fem}^* + \mathbf{Fem}^*.$$

This equation describes the classic physics external view of material. In this view no account is taken of any internal structure. From the outside all we encounter are

objects whose behavior can be explained by the classical gravito-electric forces which as Henry Stapp (Stapp 2004) points out do not include any mechanism for consciousness to emerge. It is no accident that the exploration of the internal structure of matter lead to the development of quantum mechanics and ultimately to the connection with consciousness by the analysis due to vonNeuman(1955). VonNeuman realized that if the whole universe including any systems of interest, the measuring apparatus including the human body were taken into account by quantum equations then consciousness would be the only thing left to collapse the wave function into the observable experiences we see every day.

Exploring the interior of matter has opened the door to explaining consciousness. Something in our understanding of what is inside material, an inside that is not directly visible, leads is to speculate about the physical nature of our experiences. The charge-mass separation postulate provides a visualization of what might be the cause of those experiences.

2) PHYSICAL IMPLEMENTATION VS. CORRELATES OF CONSCIOUSNESS

Neurophysiologists have found neuron pulse generating activity is correlated to broad categories of mental activity in conscious subjects through fMRI investigations. The physical mechanism behind pulse generation is fairly well understood at the bio-chemical scale. Though pulse activity, EEG waves, and a host of other measurable brain characteristics show correlations to conscious experiences they do not claim to solve the hard problem (Chalmers 1997). How is the experience of this sentence in front of your nose implemented in physical brain activity so that if that activity were physically duplicated in a different implementation than your brain it would be conscious of these words in front of your nose?

Efforts to delve deeper into the interior mechanisms of material have lead to new candidates for implementing rather than correlating consciousness. The most prominent of these is attributed to the work of Hameroff and Penrose which supports the theory that quantum effects in microtubules are physically responsible for conscious experiences (Hagan 2002). An equally advanced theory is based upon quantum effects in the ion channels that govern the rate at which pulses can be generated as a vehicle of processing communications between conscious experiences and the external world (Bernroider 2004). A promising theory is that consciousness is internally implemented in the glia system and specifically the Astrocyte cells (Mitterauer 2012). These implement a field of feedback loops in tripartite synapses that control the pulse processing and through it external communication. The idea that a field of systems can provide a kind of ether for conscious space and its content to

appear is very attractive. Computer analogy cosmology models assume spinor fields act as a memory space for a conscious universe (Kafatos 1990). If John Grandy is correct the DNA molecule is precisely the system that performs this function in the three pound universe inside our skull (Grandy 2011).

The unifying principle behind all these efforts is to remember that brains are physical objects, and physical objects are defined by the mass charge densities occupying space. Each one of the approaches discussed in the last paragraph involve aggregations of material that appears to respond to external gravito-electric forces. But if the mass-charge separation hypothesis is correct they may serve the function of controlling the pattern of energy contained in the charge-mass separation field where the conscious experiences are physically produced.

There are several reasons for postulating the mass charge separation energy patterns as the physical implementation of consciousness. The first comes from an analysis by quantum field theorist Giuseppe Vitiello that treats the brain as an open dissipative system that exchanges energy with the rest of the environment rather than treating the brain as an isolated system. His methodology requires the doubling of degrees of freedom (i.e. number of particles) so that the brain had one set of particles interacting with the rest of the universe and one set to maintain an internal model. This internal model is "the double inside" which Vitiello refers to in the title of his work (Vitiello 2001). After learning of this work I realized that the doubling could also be achieved through a separation of charge and mass rather than doubling the particles. The mass-charge interaction forces would then balance the external forces effectively providing an physical accommodation mechanism to outside influences.

That the brain of any animal does not run a representational model as suggested by the computer analogy to brain function but rather is an accommodation system that optimizes its response to external stimulation was proposed by H. Maturana (Maturana 1998). His rational was derived from the study of organisms and their behavior not from neuroscience and artificial intelligence. He concluded that cognition is not a representation of the world out there but rather an adoption to the stimulus of external interactions tuned by evolution. The word "model" should be interpreted as "physical accommodation" in the following paragraphs. The obvious reason for rejecting the representational model hypothesis is that since Plato's Cave analogy cognitive perception has been recognized as an interpretation of external influences in our own objective vocabulary. As Depak Chopra preaches, "There is no doubt that the brain doesn't actually experience reality but only a confirmation of its model of reality". (Chopra 2014) We cannot get outside of ourselves to view the reality and build a representation of it. We live in our model as Bjorn Merker points out and

maintain a naïve reality belief that the display of our model is actionably real because it was designed to work that way. The cost of understanding how our cognitive mechanism does its job is too great when facing every day survival challenges so that such awareness is habitually and necessarily suppressed (Merker 2013).

If brains build accommodative structures it may be possible to argue by analogy that such internal structures inside a being must rationalize external stimulation. Such rationalization in physical systems implies a physical adjustment to balance the external forces. A spring changes its length to accommodate the force placed on it by a weight. A computer changes its memory to accommodate data and commands issued to it. A brain changes its internal structure to accommodate both stimulation from and commands to the external world. Our mass-charge separation hypothesis simply states that at the bottom of all the regions, such as neurons, ion flows, etc., that pass along influences through the processing pathways of the brain one fundamental accommodation mechanism exists. Mass and charge adjusts their relative densities to accommodate gravito-electric influences from all other sources at every point. If densities are reduced to a field of mass charge centers in volume cells as discussed, the accommodation can be described in terms of mass charge separation fields as we have done in section 1) above.

Internal accommodation to external influences is pervasive; however, attributing such accommodations to mass-charge separation is not explicitly done in the particle oriented physics. The same mechanism is usually formulated in terms of particles containing different quantities of mass and charge which are integrated over many measurement events to derive the stable density distributions. In the next section we will discuss examples of mass charge separation to show how our short circuit approach can be employed at macro and quantum scales.

3) MACROSCOPIC EXAMPLES OF CHARGE MASS SEPARATION

Consider a neutral particle such as an apple sitting on a table as shown in figure 2. In classic physics its position is well defined as its center-of-mass and its momentum is zero. The mass (m) is pulled down by gravity so Fgi=-m·g. Where "g" is 9.8m/s2 on the earth surface. Since the mass is stationary there must be a balancing force. This is applied at the table top and is due to the repulsive electric force between the charge of the surface electrons of the table (cht) and those of the apple(cha). Calculation of the exact forces between the table and the apple surface involves Van der Waals' forces in classical mechanics and some visualization of atomic structure. Only a qualitative description of the situation is necessary to show that material distortions in the apple can be interpreted as a charge mass displacement.

If we now concentrate on the moment before the apple was placed on the table we would notice that just before the table and apple touch there is no force between them. This is because at large distances the positive charge of the neutrons cancel that of the electrons. As the surfaces come in contact the two electron sheets come closer together than the interior proton sheets and therefore they repel each other more strongly than the protons attract producing a net repulsive force. The repulsive force pushes the apple electron sheet closer to its protons and would lift them up however gravity pulls them down so that the electron and protons are squeezed closer together - closer than they would be if they were freely floating and not squeezed by the two opposing forces. This squeeze propagates throughout the volume changing the shape of the apple. The massive protons inside the apple are pulled down while the electrons are pushed up.

We calculate the center of charge by calculating the center of positive charge from all the protons and then the center of negative charge from the electrons so that the combined charge center is half way between them. The center of positive charge will be below the center of charge. The positive charge center carries with it most of the mass of the nucleus so the mass center will also be lower than the charge center. Thus a distance "**z**" exists as shown, not to scale, in figure 2 when the apple is in equilibrium. This distance reflects the volumetric distortion produced by the two opposite forces and can be considered an internal property of the material. We have used the entire volume of the apple to qualitatively define the charge-mass separation as a single bulk property. If we divide the apple into small volume elements then a field of charge-mass separation distances could be superimposed over the entire apple and reflect the internal stress and strain considered to be the physical cause of the shape distortion.

The actual displacement is ultimately produced by the atomic interactions at the boundary between the apple and table surface and hence would involve quantum calculations. However even without knowing the detail force we know that for very small displacements around an equilibrium point the force can be approximated by a linear restoring force so that $\mathbf{Fmc} = -kc \cdot \mathbf{z}$ where $\mathbf{z}$ is a displacement of the mass from the charge. If the forces are symmetric **Fcm** could also be used. Integrating this force gives the energy due to the mass charge separation as

Eq. 3 $$Emc(xi) = \tfrac{1}{2}\, kc \cdot z(xi)^2.$$

Internal to the material of the apple we can therefore define an energy field attributable to the mass-charge separation induced by the external gravito-electric

influences. Though we performed the qualitative description of its calculation using the properties of particles in a single example the result is equally valid for any object. Differences in between electric and gravitational forces produce internal adjustments to mass charge distributions. It is the energy field buried inside all material that Cognitive Action Theory proposes as the physical implementation of awareness and ultimately consciousness.

If this proposition is correct a mechanism for primitive awareness is built into material and therefore eventually encompasses the entire Universe. Thus as Menas Kafatos has argued the whole universe would be conscious (Kafatos 1990). It is well known that the hard problem of consciousness can be solved by adopting a pan-psychic world view. Our proposal provides an explicit physical mechanism to implement such a view. Are we claiming that material objects have a choice? Does material sense influences from external sources and adjusts its shape to produce its behavior rather than mechanically respond to blind physical forces? The prospect would require a reformulation of physics to include some level of want and desire. This is a work in progress. Initial efforts in this direction have been made in several works (Baer 2010,11,13,14) in the following section the relationship between geometric structures and elementary particles is addressed.

4) MASS CHARGE CONFIGURATIONS AND ELEMENTARY PARTICLES

If charge–mass densities form underlying density structures including elementary particles, then in order to explain the existence of solid time stable objects certain configurations of such densities would need to satisfy the force conditions specified in equations 2a and 2b above. The satisfaction of these equations by all parts into which an object can be divided would have their internal mass charge locations in exactly the places at which the combination of internal and external forces want them to be. Such configurations may change since the forces are not necessarily propagated instantaneously but to be stable the changes would need to repeat exactly. When densities are cast into mass-charge centers in coordinates frames consisting of volume cells the paths of the centers in each cell would have to repeat exactly. Such dynamic configurations would be largely self contained i.e. the influences from mass charge sources of fields to their sinks would be held within the repeating structures.

That the wave function of quantum mechanics could be interpreted as real charge and mass density distributions was initially put forward by E. Schrödinger himself until the probability interpretation of the Copenhagen School became popular. Discussions with Richard Sears showed that the density configuration interpretation was not completely dead (Sears 2014). In fact his initial PhD proposal offered precisely an investigation of the possibility that stable self contained geometric mass-charge

structures could form the basis of both elementary particles and aggregations of them into macroscopic systems. During the early stages of string theory several investigators, liberated from the point particle dogma of both classic and visualizations of quantum physics, carried out series of investigations which showed that deformable spheres could act as models for elementary particles (Hara 1968). It was shown that the ground state and the low lying levels of such a sphere can he described in terms of excitons which describe the rotation and the deformation of the spheres. Such excitons according to Hara could be identified with quarks and antiquarks. The deformable sphere model was later applied to hadrons(Hara 1970). It was claimed that "such a model leads to a unified understanding of almost all known levels of both baryons and mesons."

If charge-mass density structures are fundamental then elementary particles should be conceived in terms of geometric structures and deformations of such structures should correlate to energy levels of such particles or be identified as different particles altogether. Such visualization does not in itself add new physics, but provides as O. Hara stated a "unified understanding". Alternative understandings are subject to fashion and whims of the pertinent community and the deformable sphere model was put on the shelf until recent times, when G. Miller experimented with electron proton collisions. He found the angles of recoil could not be explained by a spherical uniform proton but required shapes resembling a peanut, a rugby ball, or even a bagel to account for the reflected angular distributions (Miller 2003). Such experimental evidence may give new importance to the spherical deformation model developed by O. Hara thirty years ago.

In any case the concept that geometric structures of mass and charge could exist in stable self contained structures that correspond to elementary particles suggest that an underlying visualization of quantum phenomena could be achieved. This possibility is further strengthened by the fact that fields of stable classic systems when perturbed slightly will oscillate in eigen modes that can be described by the Schrödinger equation (Goldstien 1965). This means that if a stable field of mass charge displacements exists such that positions of the masses and charges either stay at equilibrium points or equilibrium trajectories then small disturbances will generate quantum waves in the media. Mathematically the expansion around an equilibrium mass-charge separation distance can be written as a perturbation expansion around the equilibrium position z0 as follows,

Eq. 4 $$z = z_0 + \delta(1)z + \delta(2)z + \text{higher order terms.}$$

The first order term however must vanish since by definition of the equilibrium point the energy is a minimum. The second order term will in general not vanish but lead to small oscillations around the equilibrium point. It is therefore very suggestive that such oscillations in a field of systems can be identified as the deBroglie waves of quantum theory and defined by Schroedinger's wave function Ψ. The mass-charge cells derived from the division of material discussed earlier are precisely a field of systems influenced by both internal and external forces. The interpretation of second order mass-charge separation distance as the wave function of quantum theory is highly suggestive.

5) SUMMARY

We have proposed that the energy field associated with mass-charge displacements inside material is the physical implementation of consciousness. Such a displacement would double the degrees of freedom available to any material structure since mass and charge would be treated as two separately moving entities. The proposal is consistent with current physics in that stable configurations of mass and charge densities can be identified with elementary particles and presumably aggregated into larger systems. Displacements from equilibrium due to small disturbances in such fields produce oscillations that can be identified as a physical interpretation of the wave function of quantum theory. The internal forces holding charge and mass together exactly balance the external forces of electricity and gravitation and thus provide a physical accommodation to those external influences. That a living being accommodates influences from a past sensory and future command signals, thus living in a perpetual and ever changing NOW between the these two sides of time has replaced the computer input-process-output analogy of brain functioning. Paraphrasing Nagel, "Consciousness is what it feels like to be our internal energy configuration". Thus the world we see and experience in our everyday lives is mapped directly into our charge –mass energy field. That field is projected into the brain of a second person when looking at it from the outside. This projection provides us with a physical consciousness mechanism underlying biochemical structure we traditionally call our brain and thus answers the challenge of the hard problem of consciousness.

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