

Fundamental Physics of Consciousness

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Abstract

Because every physical theory assumes *something*, that basic assumption will determine what is ultimately possible in that physics. The assumed *thing* itself will likely be unexplained. This essay will assume one thing, a *primordial field*, to explain current physics and its many current mysteries. The derivation of physics from this entity is surprisingly straightforward and amazingly broad in its implications.

To pursue the ultimately possible, one must define the starting point or fundamental theory. Upon what must this fundamental theory of physics be based? If this question is asked of humans, it should be formulated in terms of human reality, not abstract formulations. Either it is based on *directly* and *immediately* sensed reality or it is based on some abstraction that is claimed to represent reality. Current theories are based on physics abstractions such as:

- | | | |
|--------------------|--------------------------|--------------------|
| ▪ Gravity | ▪ Quantum field theories | ▪ Extra dimensions |
| ▪ String theories | ▪ Strong and weak forces | ▪ Extra universes |
| ▪ Electromagnetics | ▪ Dark matter and energy | ▪ Consciousness |

Of these, only two, gravity and consciousness, are immediately sensible and directly experienced by humans. I am directly aware of gravity and I am directly aware that I am conscious. I have no direct, immediate, awareness of any other physics on the list (with the exception of a small range of electromagnetic radiation). All other entities, if they exist, are sensed through the medium of some measurement apparatus (as complex as the Large Hadron Collider or as simple as iron filings in a magnetic field)—yet none is directly sensed. Even muscular detection of a magnetic field is possible only through the medium of a held magnet. Gravity and consciousness are *directly* sensible, requiring no external apparatus, and hence are deemed suitable for the basis of a physical theory that does not depend upon belief in either equipment or logical argument. We know these two entities exist. All else should depend on these.

Why should we care? Because it is highly doubtful that many of the dozens of “fields” that are hypothesized today (quintessence, axion, Higgs, dark energy, possibly even color fields and some particle fields) even exist. Formulating a fundamental theory on such tenuous ground would seem unwise. In fact, a recent paper in *Physical Review Letters* uses a “postulated but never seen phenomenon” to explain another “postulated but never seen phenomenon.” It seems questionable to claim that this is really physics.

But how does one go about formulating any theory of physics—and, particularly, one that describes current physics and explains the mysteries of current physics? And, in response to the essay question, *what mysteries will ultimately remain?*

Begin by defining terms: Gravity is a field, \vec{G} , with energy at each point. Consciousness we define as awareness plus volition. Assume gravity and consciousness both exert physical force. The force of gravity is $\vec{F} = m\vec{G}$; but what is the force of consciousness? By analogy we might expect $\vec{F} = k\vec{C}$, but this implies some consciousness "stuff" k that sources the field, so we reject this. A look at well-known forces finds

$$\begin{aligned}\vec{F} &= q(\vec{E} + \vec{v} \times \vec{B}) && \text{Lorentz force equation} \\ \vec{F} &= m(\vec{G} \quad \quad \quad) && \text{Newton's force equation}\end{aligned}$$

which leads one to guess that the force of consciousness is $\vec{F} = m\vec{v} \times \vec{C}$, yielding

$$\begin{aligned}\vec{F} &= q(\vec{E} + \vec{v} \times \vec{B}) && \text{Lorentz force equation} \\ \vec{F} &= m(\vec{G} + \vec{v} \times \vec{C}) && \text{'GEM' force equation}\end{aligned}$$

The symmetry of these force equations is fascinating. Physicists 'want' such to be true, but where do such '*laws of physics*' come from? Does some 'ideal' realm support such laws, or are the 'laws' of physics simply anthropomorphic remnants of the King's law? '*The King*' has generally been deleted from physics, but anthropomorphic ideas of law remain. How to get around this?

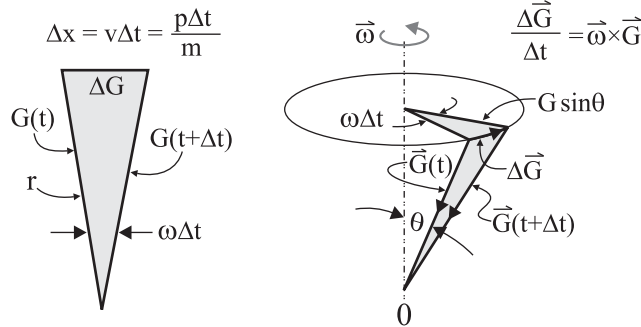
If we begin with a gravity field, \vec{G} , and *nothing else*, then the *laws of physics must derive from the field itself!* Thus any operation on the field must be simply the field interacting with itself. This statement yields the master equation:

$$\vec{\nabla} \cdot \vec{G} = \vec{G} \cdot \vec{G} \quad \text{the Master equation}$$

where $\vec{\nabla}$ is some relevant 'physical operator', which generates the physical behavior of the field. Experiment will eventually lead to two known realities: Maxwell taught that fields have energy proportional to the amplitude squared, $E \approx \vec{G} \cdot \vec{G}$, and Einstein taught that energy has mass, $E = mc^2$ where $c^2 = 1$. These (plus the negative aspect of gravitationally bound systems) immediately lead to

$$\vec{\nabla} \cdot \vec{G} = -m$$

implying that abstract operator $\vec{\nabla}$ is Newton's divergence operator, $\vec{\nabla} \equiv \partial_i$, and that the primordial field is identified as gravity. A vector operator has introduced itself, so we next look at the field \vec{G} in a rotating coordinate system with the well known result $d\vec{G}/dt = \vec{\omega} \times \vec{G}$, where $\vec{\omega}$ is rotational frequency.



Based on magnetic field curvature analogy, we postulate that field \vec{C} is a circulating field proportional to $\vec{\omega}$, and write: $\vec{G} \times \vec{C} = d\vec{G}/dt$ and use $\vec{G} \leftrightarrow \vec{V}$ to find:

$\vec{V} \times \vec{C} = \frac{d\vec{G}}{dt}$. Knowledge of electromagnetic duality might imply the dual:

$\vec{V} \times \vec{G} = \frac{d\vec{C}}{dt}$ but this would also imply that $\vec{G} \times \vec{G} \neq 0$ so we instead postulate

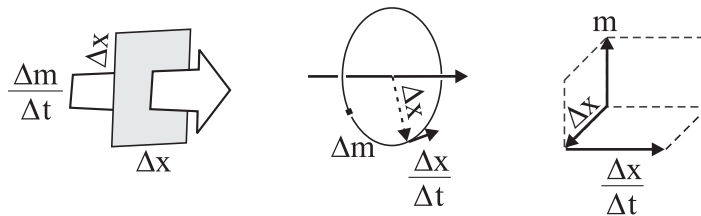
$\vec{V} \times \vec{G} = 0$. This modifies the *gravito-electro-magnetic* (GEM) field equations treated by Maxwell, Heaviside, Lorentz, and Einstein, among others. Tajmar's as yet unreproduced results seem to support our $\vec{V} \times \vec{G} = 0$, specifically the fact that the experimentally measured \vec{C} -field dipole does not fall off as rapidly as the analogous \vec{B} -field dipole.

Thus our master equation $\vec{V} \cdot \vec{G} = \vec{G} \cdot \vec{G}$ implies an associated field \vec{C} that, in Lorentz fashion, supports the *force field equation* that we have hypothesized for consciousness. Additionally, a generalized field $\vec{\phi} = \vec{G} + i\vec{C}$ (\vec{G} is radial; \vec{C} is circulatory), implies that $\vec{V} \cdot \vec{\phi} \Rightarrow \vec{V} \cdot \vec{C} = 0$.

Danforth first showed that $\vec{V} \cdot \vec{G} = \vec{G} \cdot \vec{G}$ has the solution $\vec{G} = \frac{\vec{r}}{r^2}$, so $\vec{G} \cdot \vec{G} = \frac{1}{r^2}$ and $(r^2 G^2) = 1$. The time derivative of this leads to

$$\left(\frac{\Delta m}{\Delta t}\right)(\Delta x)^2 = 2mvr$$

where $r = \Delta x$ with at least three possible physical interpretations:



With no reason to choose one, we *assume all three are valid*, and hence, for arbitrary Δm , Δx , and Δt , must have the same value, \hbar , leading to $mvr = \hbar / 2$, (Bohr's quantum angular momentum), and to the *Quantum Flow Principle*. Thus

$$\begin{aligned} \vec{\nabla} \cdot \vec{G} &= \vec{G} \cdot \vec{G} && \text{Classical Field equation - continuum physics of fields} \\ \Downarrow &&& \\ \left(\frac{\Delta m}{\Delta t} \right) (\Delta x)^2 &= \hbar && \text{Quantum Flow Principle - quantum physics of observables} \end{aligned}$$

The quantum flow leads immediately to *Heisenberg's Uncertainty Principle*:

$$\begin{aligned} \Delta x \Delta p &= \hbar \\ \Delta t \Delta E &= \hbar \end{aligned}$$

By analogy with Maxwell's electromagnetic field equations (ignoring constants), we assume that, since \vec{G} is sourced by mass, \vec{C} is sourced by mass current, $\vec{p} = m\vec{v}$:

$$\vec{\nabla} \times \vec{C} = \vec{p} + \frac{d\vec{G}}{dt}$$

At this point we have only the field \vec{G} , its rotational aspect \vec{C} , and the associated mass, m , of these fields. If we assume that kinetic energy T and potential energy V are equal, $(T - V) = 0$, and that this positive energy is equal to the negative gravitational energy $T + V = -E$ leading to $p^2 c^2 + m^2 c^4 = 0$ ($= E^2$) at the big bang— Guth's 'free lunch'.

As perfect radial symmetry breaks, \vec{C} -field circulation appears, and if some arbitrary combination of parameters allows $\vec{F} = 0$, then $\vec{\nabla} \times \vec{C} = -\vec{G}$, providing the necessary (antigravitic) force of *inflation!*

Particle Physics:

Unlike the familiar electromagnetic fields, which interact with charge but not with themselves, \vec{G} and \vec{C} fields interact with mass and hence with themselves, and therefore satisfy *Yang-Mills gauge theory*. The \vec{C} -field vortex *self-interaction* will cause the vortex to shrink to an infinitely dense point (unless a limit to \vec{C} -field curvature of space-time exists.) We do not yet have 'particles' in our theory, so we now postulate that this vortex in the \vec{C} -field is a Z^0 boson. As the vortex shrinks, its mass condenses, and the collapsing \vec{C} -field circulation applies force to the resulting neutrino mass, accelerating the neutrino to near light speed via

$$\frac{d}{dt} (\vec{\nabla} \times \vec{C}) = \frac{d\vec{p}}{dt}$$

Interpreted in a '*Lenz law*' sense, this explains *conservation of linear momentum*.

Note that a *left-handed* \vec{C} -field produces only *left-handed* neutrinos (and bosons are left-handed.) If a limit to \vec{C} -field curvature of space-time does exist, it can be shown that this limit leads to *quantized charge creation*, bringing into existence electrons, electromagnetic fields and W^\pm (charged vortex) and explaining the derivation of the *fine structure constant*, α , and the (more complex) generation of up and down quarks. The limits to the curvature of these fields bring new phenomena into existence:

Limit to \vec{G} -field curvature \Rightarrow black hole

Limit to \vec{C} -field curvature \Rightarrow charged particle

Analogous to charge currents generating magnetic dipole fields, mass currents (solenoidally) create C-field flux tubes, which form the basis of nucleons and also of quark confinement, providing a strong force equivalent. Unlike QCD, these flux tubes do not terminate on quarks; instead quarks orbit and sustain the flux tube. The flux tube explains Veneciano's 'string-like' behavior of protons. But since *mass* is basic and *charge* derived, the theory requires no Higgs boson, obviating charge-based quantum field theory with its inability to explain mass—see *The Chromodynamics War* [1].

But why does this differ from current particle physics? Because the 20th century was based on slamming 'point particles' together (from $-\infty$) and looking at the results (from $+\infty$). This was sufficient to discover the entire particle zoo and to symmetrically (and hence via the use of matrices) determine transformations that occur. The 'points' themselves have no physics per se, only features represented by the interactions of quantum fields at a point and surrounding polarized space-time.

The C-field based particles obey the quantum flow principle, consistent with the KSS [2] conjecture and the unexpected RHIC discovery of perfect fluid plasmas, and provides understandable physics in place of purely formal prescriptions. The theory provides an explanation of particle families and intuitive prediction of decay products.

Maxwell wrote the GEM equations from symmetry, but did not know that $E = mc^2$ and so could not derive the theory. The self-interaction is *new physics* leading to a constant, $\kappa = \alpha(l_e/l_p)^2 = 10^{31}$, a value found experimentally by Tajmar [3], (α = fine structure, l_e = electron radius, l_p = Planck length) Our final GEM equation, with constants, is:

$$\frac{c^2}{\kappa} \vec{\nabla} \times \vec{C} = \frac{\vec{p}}{\mu_0} + \frac{\partial \vec{G}}{\partial t}$$

An unexpected aspect of this equation is that the \vec{C} -field is a *function of local mass density*, with the consequence that \vec{C} -field effects are vastly different in interstellar space, at the atomic level, and in the nucleus, accounting for the unsuspected range of \vec{C} -field phenomena, from cosmological constant to nuclear forces.

Why, one might ask, should any of this be taken seriously? The *Master equation* seems reasonable, and the *Quantum Flow Principle* straightforwardly follows, and even the hand waving derivation of Maxwell's (modified) GEM equations, but why claim that a \vec{C} -

field vortex is a Z^0 boson? Compute the change in Z^0 mass with time over the Z^0 lifetime. Obviously the entire mass changes in that time:

$$\frac{\partial(mc^2)}{\partial t} = \frac{91 \text{ GeV}}{10^{-26} \text{ sec}} = \frac{Z^0 \text{ energy}}{Z^0 \text{ lifetime}}$$

$$\frac{\partial m}{\partial t} \approx \frac{10^{11} \text{ eV}}{10^{-26} \text{ sec}} \left(\frac{1}{c^2} \right) \approx \frac{10^{-15} \text{ eV sec}}{10^{-35} \text{ m}^2} \Rightarrow \frac{\partial m}{\partial t} \approx \frac{\hbar}{(10^{-18} \text{ m})^2}$$

As 10^{-15} eV sec is roughly Planck's constant, \hbar , and 10^{-35} m^2 is close to $(10^{-18} \text{ m})^2$, the approximate size of elementary particles. If $\Delta x^2 = (10^{-18} \text{ m})^2$ we obtain:

$$\frac{\Delta m}{\Delta t} (\Delta x)^2 \approx \hbar. \quad \left(\frac{Z^0 \text{ mass}}{Z^0 \text{ time}} \right) (Z^0 \text{ size})^2 = \hbar$$

So a *purely phenomenological* derivation, based on the two most significant parameters of the Z^0 boson, *mass* and *lifetime*, maps directly into the basic *Quantum Flow Principle* derived from the Master equation.

But this may be simply a weird coincidence, so let's look more abstractly, using the physicist's basic measurement units, the Planck measures:

Planck length	Planck mass	Planck time
$\Delta x = \sqrt{\frac{\hbar G}{c^3}}$	$\Delta m = \sqrt{\frac{\hbar c}{G}}$	$\Delta t = \sqrt{\frac{\hbar G}{c^5}}$

If we plug these into the *Quantum Flow Principle* we obtain a Planck Identity:

$$\frac{\Delta m}{\Delta t} (\Delta x)^2 = \hbar \Rightarrow \left(\frac{\sqrt{\frac{\hbar c}{G}}}{\sqrt{\frac{\hbar G}{c^5}}} \right) \left(\sqrt{\frac{\hbar G}{c^3}} \right)^2 = \hbar$$

Whether *fundamental* or *phenomenological*, our quantum flow condition, derived from our Master equation, seems connected to particle physics and explains more than 30 currently mysterious aspects of the Standard Model of Physics as presented in detail in *The Chromodynamics War*.

And look at the following table from Kerson Huang [4]:

Interaction	Strength	Range
Strong	10	Finite
Electromagnetic	10^{-2}	∞
Weak	10^{-5}	Finite
Gravitation	10^{-36}	∞

Our theory computes the fine structure constant that describes the electromagnetic strength $\alpha \approx 10^{-2}$. In the theory the G-field provides gravity and the C-field the weak force. Note that this ratio of strengths is:

$$\frac{\text{weak}}{\text{grav}} = \frac{10^{-5}}{10^{-36}} \Rightarrow \frac{C}{G} = 10^{31}$$

The factor of 10^{31} between gravity and the weak interaction coincides with $\kappa = 10^{31}$, and of course, the G-field has infinite range, while the C-field vortex is only local. So the weak force that transforms particles is seen to be potentially based on the C-field.

Cosmology:

The \bar{C} -field equation (less our κ constant) derives from Einstein's linearized General Relativity equations and we can derive the FLRW equation from the C-field equation [5].

Many currently mysterious cosmological phenomena are qualitatively explained:

- The FLRW equation derives from the C-field equation
- Explanation of inflation and late inflation
- Flat rotation curves and Pioneer orbits
- CMB 'earth-centric' axis (of 'evil')
- Complex nebulae and 'jets'
- Dark matter and dark energy and cosmological constant

From the inflationary big bang, to nebulae and cosmic jets, flat rotation, Pioneer orbits, Tajmar's results, and CMB earth-centric axis, the C-field qualitatively explains current cosmological mysteries. At the particle level the C-field explains neutrinos, electrons, up and down quarks and three particle families, plus nucleon structures, fine structure constant, quantized charge, quark confinement, and relative masses, completely compatible with Yang-Mills gauge theory. For a detailed description of these cosmological phenomena, see *Gene Man's World: A Theory of Everything* [6].

Consciousness:

Unlike particle physics, investigated by a well-defined subset of physicists, consciousness has been investigated by philosophers, electrical engineers, neuro-anatomists, psychologists, and a dozen other specialties, *yet no one has ever explained how consciousness is derived from matter.*

Our theory explains how matter (neutrinos, electrons, and quarks) derives from a consciousness field!

And the force of the consciousness field (roughly 20 nano-eV at the atomic level) explains the *origin of life* at the cellular level as almost inevitable, whereas, lacking such a force, the odds of a living cell forming are astronomically unlikely.

There is no question that 'thinking' occurs in the brain, but no one has ever proposed a mechanism whereby awareness and volition 'emerges from' the brain. Consciousness is

not *derived from* but *interacts with* material constructions (brains) as well as with itself (self-awareness) and with changes in the gravitational field. In fact:

Life is almost defined by it's ability to oppose gravity ($\vec{\nabla} \times \vec{C} = -\vec{G}$), from slime mold stalks to giant sequoias, from birds and bees to space flight.

The “volition” aspect of consciousness, at the quantum level, also explains the unpredictability of quantum phenomena. Even Schrödinger discussed this possibility [7].

If the ‘artificial’ explanation of consciousness is replaced by a ‘fundamental’ explanation, then we need only explain how consciousness couples to matter. Consciousness is *fundamental*, not *artificial* or derived from matter.

Intelligence, in this theory, is defined as:

$$intelligence = consciousness + logic$$

Intelligence is dependent upon matter, because logic circuitry (silicon, neural, or protein) is an artifice and is not fundamental.

But how can a field become conscious? How can a gravity field ‘know of’ a sun 93 million miles from the earth? Equations do not answer the question. The essential nature of gravity and consciousness is mysterious—equations are descriptive of behavior, not of ultimate essence. Since $\nabla \cdot G = G \cdot G$ describes a self-divergent mass/energy field whose essential aspects are the G- and C-field, everything else in our universe—including math and logic—is derived from these fields. That is, all other physical phenomena are (potentially) explainable in terms of the interaction of \vec{G} and \vec{C} with themselves, as will become more apparent when the Higgs boson fails to appear and it is realized that *charge-based physics* must be replaced by *mass-based physics*. The key equations (with constants suppressed) are:

$$\left[\begin{array}{l} \nabla \bullet G = -m \\ \nabla \times G = 0 \\ \nabla \bullet C = 0 \\ \nabla \times C = \Delta m / \Delta t + \Delta G / \Delta t \end{array} \right] + \left[\begin{array}{l} \nabla \bullet E = q \\ \nabla \times E = -\Delta B / \Delta t \\ \nabla \bullet B = 0 \\ \nabla \times B = \Delta q / \Delta t + \Delta E / \Delta t \end{array} \right]$$

Including logic, math, and the four laws of thermodynamics (referenced by key concept) plus the four key elements of biology (the DNA bases), the field-based model of our universe is shown as follows:

Const	Param	Boson	Particle	Field	Logic and Math			Laws	DNA
\hbar	m	γ	v	E	<i>and</i>	+	0	<i>temp</i>	\tilde{A}
c	q	Z^0	e	B	<i>or</i>	-	1	<i>energy</i>	\tilde{T}
g	x^μ	W^+	u	G	<i>not</i>	*	n	<i>entropy</i>	\tilde{C}
α	∂^μ	W^-	d	C	<i>equ</i>	/	∞	<i>>zero</i>	\tilde{G}

Computing, Counting, and Thermodynamics

But how do we justify including logic and math and the thermodynamics ‘laws’? Logic and math are explained in *The Automatic Theory of Physics* [8] as physical artifacts. Physical logic gates are developed and implemented as *DNA logic*, *silicon logic*, or *neural logic*, and then this universal logic element is used to show that logic is physically embedded in a real universe, and is not an abstract construct in an ideal universe.

Counter logic is derived and, via counting, *all integers* are physical artifacts—in contrast to Kronecker’s famous statement that “*God made the integers, all the rest is the work of man.*” The sense behind this statement is that, *given integers*, we can represent fractional entities as the ‘ratio of two integers’, and thus rational numbers become the basis of ‘rational’ thinking, whereby men can obtain the same results as other men and check these results ‘rationally’. Such rational thinking led to the discovery of *gaps* between rational numbers, and the development of logico-mathematical means of *filling the gaps* with ‘irrational’ numbers, which led to *limiting processes* and from this the rest of mathematics flowed, enabling physicists to describe *bulk properties of matter* as Peter Atkins [9] explains in *Four Laws that Drive the Universe*. Importantly, these thermodynamic laws and the experiments that define them are such that: *all of the associated thermodynamic measurements can be stated as differences of the positions of mass in a gravitational field!* That thermodynamics equates to differences in the positions of mass in a gravitational field follows from the fact that *a falling weight* can be used in the thermodynamic experiments as the calibrated source of energy, and therefore

Thermodynamics falls out of our $\nabla \cdot G = G \cdot G$ Universe!

Those familiar with quantum theory may ask: How can massive particles be compatible with “superposition of states”?

The Copenhagen interpretation of QM is one of at least four possible interpretations, and the C-field introduces a fifth. In fact, a recent *Phys Rev Letters* paper, “*Non-Dispersing Bohr Wave Packets*” [10] indicates that the classical/quantum distinction appears to be a function of signal-to-noise ratio in the environment, based on experimentally maintaining non-dispersing electrons in an atom. This is compatible with C-field physics but difficult to reconcile with “superposition of states”.

Summarizing: From a single field \vec{G} and rotational aspect \vec{C} we derive an inflationary cosmology; explain current astrophysical mysteries; and explain elementary particles and consciousness (defined as *awareness plus volition*).

The material arrangement of particles can produce logic and numbers and these can produce computing ‘machinery’ (protein, neural, or silicon) that can store information (the ‘past’) and project the ‘future’. Pattern recognition and learning principles explain the development of physical theories, but do not explain awareness or volition.

Awareness is always of now (including current ‘ideas’ of past and future); and volition, or ability to act freely, is also centered in the local present.

Local moving constructions (in a cell or in a brain) can enhance and stabilize local concentrated consciousness and thus living things can endure. Because we distinguish

awareness from *thinking* (requiring logical machinery) we can postulate that elementary particles, such as nucleons, may be somewhat ‘aware’ but certainly do not ‘think’. The ‘self-awareness’ of the quark-based proton is certainly miniscule, but, per Chalmers[11],

...there is probably a continuum of conscious experience from the very faint to the very rich; but if something has conscious experience, however faint, we cannot stipulate it away.

Thinking involves logical machinery, which first appears in a self-sustaining manner in the biological cell, with DNA/protein logic. The 50 trillion cells of the human body are separately alive and also constitute a conscious living body that is best explained by the existence of a fundamental consciousness field.

Teleology

A theory in which consciousness plays a fundamental role is significantly different in many respects from current materialist theories in which consciousness is assumed to ‘emerge’ from matter. While such respects do not necessarily support historical religions, neither do they support modern anti-theistic materialism.

Mankind ever asks

“what’s it all about?”

and

“how does it work?”

The first is global, the second local. The global answer, always in the past filled by religion—as the accumulated wisdom of the ages—has recently been countered by the anti-religion of the locally obsessed. Materialistic theories are based on ‘randomness’, meaning that things happen for no reason at all. Consciousness field theories allow for the possibility of meaning in a universe. For a discussion of the differences between materialist theories and a theory based on our primordial field see *The Atheist and the God Particle* [12].

Conclusion:

We began by stating that *the ultimate possibility of physics* is limited by \vec{G} and \vec{C} and noted that humans directly experience both \vec{G} and \vec{C} and hence these are appropriate phenomena on which to base our theory of physics. The program outlined above is sufficient to explain current particle physics and cosmology, including almost fifty currently mysterious aspects of physics.

What is ultimately impossible is to explain gravity and consciousness; the *essence* of \vec{G} and \vec{C} (self-attraction, self-awareness, and ability to act) will forever remain mysterious. This defines the ultimate possibility of physics.

Bibliography:

The concepts outlined herein, and their relevant equations, are fully expanded upon in several recent books listed at http://www.geneman.com/books/klingman_book_list.htm [1,5,6,8,12].

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Edwin E Klingman was a NASA Research Physicist (atomic and molecular physics) whose 1979 PhD dissertation, *The Automatic Theory of Physics*, described how a robot would derive a theory of physics. After 30 years, this same theme is appearing in *Science* (see '*Automating Science*'). The founder of several Silicon Valley companies, the author holds over 20 technology patents and has published two university texts, *Microprocessor Systems Design, Vol I and II* (Prentice-Hall). His recently published physics books address the disparate problems of physics, while introducing qualitative solutions to unsolved mysteries, and, most importantly, making testable predictions.