# False Premises, Quantum Gravity, Single-Atom Stern-Gerlach, & Dipole-Dipole Physics

Abstract: Is the best path to understanding nature continued explosive growth of physics, or carefully pruning false premises from over-specified models of reality? I remove false premises from relativity, and discuss the removal of false premises from quantum mechanics.

*Theories of physics* are models designed to describe behavior of physical reality.

At the 100 year mark of Einstein's general relativity, the success of relativity, quantum theory, and the *Standard Model* was astonishing, despite incompatibilities in their formulations. Yet no physicist could span *all* theory deeply, and this *Tower-of-Babel* effect was expected to worsen by the 200 year mark. And, perhaps-not-so-surprisingly, the more theory we knew the more *out-of-touch with reality* we became — in 2016 we *still* knew not whether quantum wave-functions were *ontological* or *epistemological* – *real* or *informational* in nature.

A reasonable assumption is that *one physical reality* underlies our experience; but no such *unified physical theory* existed; instead there existed so much data and so many overlapping formulations of theories that Jaynes noted:

> *"A false premise built into a model which is never questioned cannot be removed by any amount of new data."*

In a world 'over-specified' by physical theories, subject to many premises, *including false premises*, the best path forward might be *pruning*, not *fertilizing,* theories with false premises. *Fertilizing* grows more data, theories, interpretations, and mathematical approaches to modeling, while *pruning* attempts to

> *discover false premises and remove them from fundamental physics.*

But false premises surviving since 1916 were so firmly ensconced that removal was resisted by the full force of orthodoxy; pruning was actively opposed, while fertilizing was simply built into the enterprise. We review a specific case:

## Pruning the theory of gravity

The secret of the theory of the self-interacting gravitational field was hidden in plain sight since 1916, and a simple misconception kept it hidden. Einstein's non-linear gravitational field equations

$$R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = -8\pi G\, T_{\mu\nu} \qquad (1)$$

model a *real* gravitational field *experienced directly* by all humans — but an unsolvable model, except for lucky guesses in tightly constrained situations.

When the model is linearized (removing nonlinear terms) the resultant additivity of solutions allows $\delta$-functions to be combined into Green's function solutions; gravitational wave solutions appear. [1]

The simple misconception is belief in the false premise that:

> *changing the nature of the theory or model will change the nature of the physical field being modeled.*

Throwing away non-linear terms that represent the self-interaction of the field, physicists acted *as if* the field itself became non-self-interacting. Recall that a key *Maxwell-Einstein linearized equation* is analogous to Faraday's equation:

$$\begin{vmatrix} \vec{\nabla}\times\vec{B} \\ \vec{\nabla}\times\vec{C} \end{vmatrix} \sim \vec{v} \begin{vmatrix} \rho_q \\ -\rho_m \end{vmatrix} \qquad (2)$$

with $\rho_q$ and $\rho_m$ charge and mass *densities*; $\vec{B}$ and $\vec{C}$ are electromagnetic and gravitomagnetic fields, respectively; and $\vec{\nabla}\times$ represents the *circulation* or 'curl' of the field induced by the traveling source flow. Velocity $\vec{v}$ is the physical parameter linking mass and charge physics, $(\rho_m + \rho_q)\,\vec{v} \sim \vec{\nabla}\times(\vec{B}-\vec{C})$.

Failure to appreciate the *gravitational field as self-interacting* was compounded by habits of mind derived from Newton and classical physics: specifically, focus on *mass* as the determinant of dynamics, despite equations showing *density* is paramount, not *mass* per se. Physicists, focusing on macroscopic mass for gravitational problems and mistakenly believing the nature of gravity to be modified by the mere act of modifying equations describing gravity, tended to overlook that

> *the highest density is associated with the smallest volumes*,

with a *point particle* implying infinite density. A realistic upper bound on the electron radius, $10^{-20}\,m$, yields a lower bound on mass density of $10^{60}\,m_e$ $(kg/m^3)$ with no upper bound. ($m_e \sim 10^{-31}\,kg$.)

Electromagnetic fields $\vec{E}$ and $\vec{B}$ interact with charge but are *uncharged*, so they are non-self-interacting. Since *real* fields have energy, and hence mass equivalence, gravitomagnetic fields $\vec{G}$ and $\vec{C}$ which interact with mass *are* thus *self-interacting* and — in appropriate circumstances — *self-inducing*. So if a particle with mass density $\rho_m$ is accelerated from $\vec{v}$ to $\vec{v}'$, the $\vec{\nabla}\times\vec{C}$ induced C-field circulation will *add* local field energy and hence local equivalent mass thereby increasing the local mass density and further increasing the local C-field circulation, etc., etc.

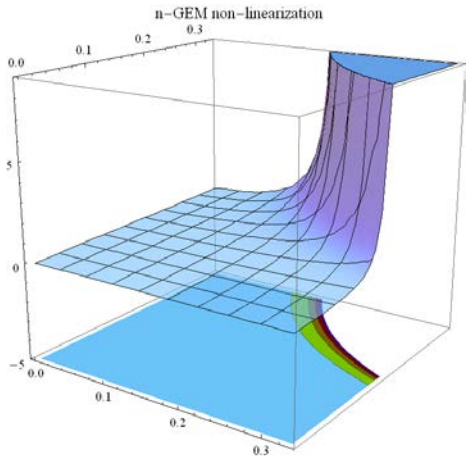
$$\vec{\nabla}\times\vec{C} \sim -\rho_m\vec{v} \quad \Rightarrow \quad \vec{\nabla}\times\vec{C}' \sim -\rho_m'\vec{v}' \qquad (3)$$

where $\rho_m' > \rho_m$, $\vec{v}' > \vec{v}$ and $|\vec{\nabla}\times\vec{C}'| > |\vec{\nabla}\times\vec{C}|$.

How rapidly does self-interaction occur? The speed of light across particle dimensions yields approximately $10^{28}$ iterations (reflections) per second.

Does this self-induction of the C-field ever end? Of course it ends when the accelerating force (the source of energy) is terminated.

While self-induction may appear quite complex, it's very easily modeled by the iterative procedure of expanding $\vec{\nabla}\times\vec{C} \rightarrow -(\rho_m + \delta\rho)(\vec{v} + \delta\vec{v})$ as shown:




The vertical scale represents *C-field circulation* self-induced when either $\vec{v}$ or $\rho_m$ increases. While electromagnetic constants determine final results for a given problem, gravitomagnetic constants $\vec{\nabla}\times\vec{C} \sim -(g/c^2)\rho_m\vec{v}$ are relevant only on a 'per iteration' basis. If $(g/c^2) \sim 10^{-27}(m/kg)$ and iteration rate is $10^{+28}\,\mathrm{sec}^{-1}$, the number of additive iterations determines nonlinear growth. Self-induced growth quickly exceeds exponential increase. Growth is conceptually unlimited, but in actuality the driving force is *always* exhausted at some point; whether LHC or cosmological in origin.

## Why the *Equivalence Principle* fails

For a century, general relativity suffered under illusions that 1) linearizing the field equations actually *changes* the nature of the physical field and 2) the *Principle of Equivalence* — that gravity is equivalent to acceleration— allows the field *and* its local energy to be *eliminated* by proper choice of coordinate frame. This equivalence *fails* if tidal forces are locally significant or when rotational phenomena are significant. C-field circulation is *inherently* rotational, so the self-induced C-field circulation causes the *Equivalence Principle* to fail. As this principle is the unique basis for the 'geometric' interpretation of gravity, this

basis of the *curved space-time* picture of gravity generally fails — a *mass-energy density* approach is equivalent to *curved space-time:*

> *"That the linear equations imply the full nonlinear equations is a quite remarkable feature of Einstein's theory of gravitation."* [2]

## How does physics work so well without mention of the self-interactive C-field?

Either a potentially significant real physical energy was just being ignored, or the C-field circulation energy of accelerated particles was being misinterpreted as some other energy. If the growing self-induced C-field circulation represents relativistic *mass increase* of the accelerated particle then C-field circulation energy is identically equal to the kinetic energy imparted to the particle. Since both relativistic and nonrelativistic physics are *always* formulated in terms of kinetic energy $T$, whether Lagrangian ($T-V$) or Hamiltonian ($T+V$) formulation, then simple 'boost-oriented' physics *automatically includes* C-field energy.

In special relativistic frames, *dynamic* C-field self-interaction requires particle acceleration, i.e.

$$d\vec{v}/dt = 0 \;\Rightarrow\; d(\vec{\nabla}\times\vec{C})/dt \equiv 0\,. \tag{4}$$

Only when velocity increases will *C-field-circulation-energy-density* increase and iteratively self-induce further density increase, continuing as long as the local mass is accelerated, i.e., the frame is non-inertial. Relativistic *mass-increase-as-C-field-circulation-kinetic-energy* acts symmetrically in *Lenz-law*-like fashion to *oppose* any change in momentum,

$$\frac{d}{dt}\int(\vec{\nabla}\times\vec{C})\,dV \sim -\frac{d\,\vec{p}}{dt}, \tag{5}$$

thus explaining *physical conservation of momentum*, of which Feynman said [3]

> *"The reason why things coast forever has never been found out. The law of inertia has no known origin."*

## Are there new C-field behaviors?

The C-field may already be incorporated into physics as kinetic energy, and it may de-mystify conservation of momentum, but does it bring anything new to the party? If underlying physics dictates outcomes, then *weak field theory,* a non-self-interactive *model,* simply becomes *unable to describe self-interactive behaviors* of the actual field underlying the linearized model.

If there actually <u>are</u> physical *behaviors* of the self-interaction of a gravity field, a *weak field premise* completely *masks* these behaviors from being recognized as *gravitational in nature*. However, if the behaviors are real and observable, they <u>will</u> be modeled, typically by *another* field theory. Of course this *new* field is

fictitious, so it will never be observed directly. Fictitious fields may even be modeled as self-interacting. Consider QM and QCD:

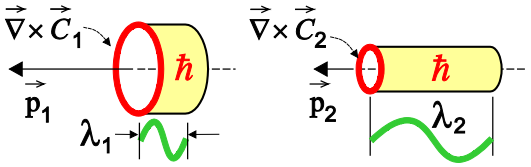
## How gravity relates to quantum mechanics

For instance, integrate local mass density over volume $\int_V \rho\, dV = m$ for eqn (2)

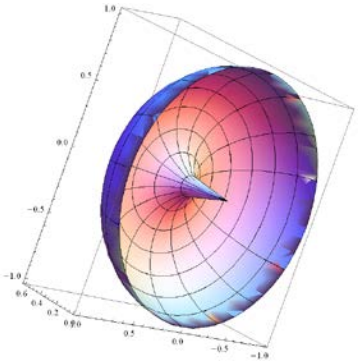
$$\left[c^2/g\right]\int_V (\vec{\nabla}\times\vec{C})\,dV = \int_V \rho\vec{v}\,dV = m\vec{v} = \vec{p}\,, \tag{6}$$

then apply deBroglie's momentum relation $\vec{p} = \frac{\hbar}{\lambda}$ to obtain

$$\int_V (\vec{\lambda}\cdot\vec{\nabla}\times\vec{C})\,dV = \frac{g\hbar}{c^2} \tag{7}$$




with two instances of circulatory action shown in cartoon fashion for different momenta/wavelengths. A realistic leading-edge $|\vec{C}| = k$ wave front is shown.

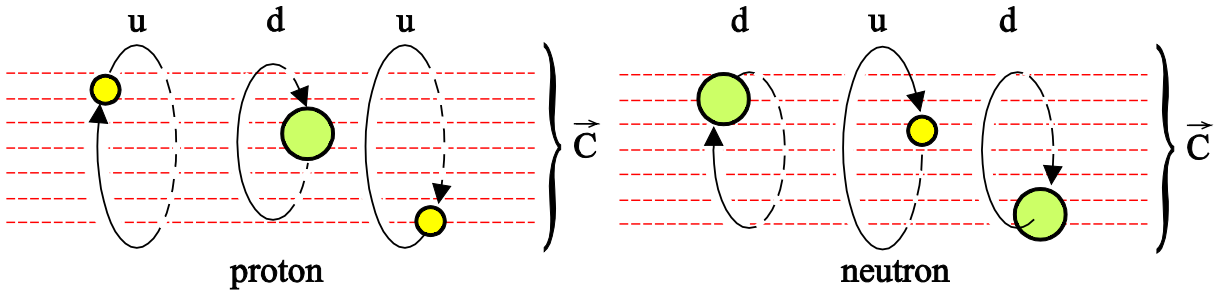


A self-induced C-field for accelerated electrons appears to yield an *ontological* wave-function, *not epistemological*, answering a fundamental question of quantum mechanics. Quantum-gravity wave-functions support *Bohr's orbits*, *particle-AND-wave interference phenomena*, *tunneling*, and, per the *partition function* of statistical mechanics, *the Born probability interpretation* of QM. Jaaskelainen[4] proposed $\rho_m = m|\psi(r)|^2$, subject to $\int_V |\psi(r)|^2\, dV = 1$, compatible with eqn (7).

Others have suggested "*the wave function as matter density*" [5], and "*kinetic energy as concealed motion*" [6], but have overlooked the self-interactive gravitomagnetic field.

## Is gravity related to the Standard Model?

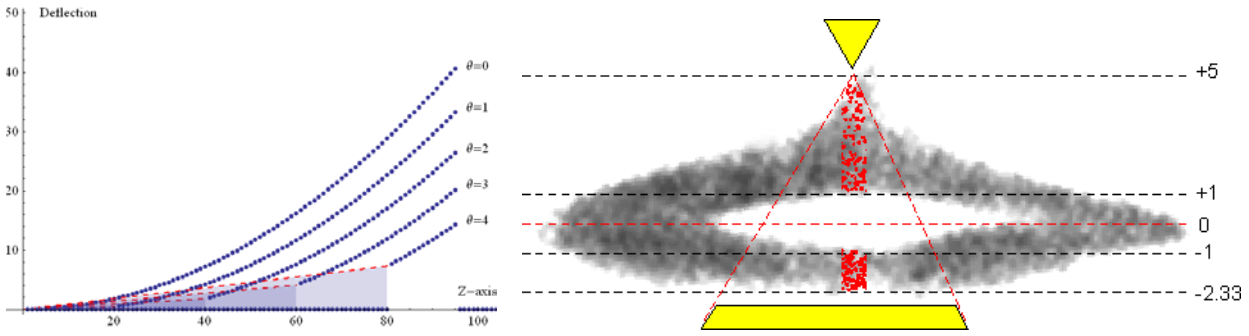
We restrict our analysis to analogy with electromagnetism. As charge circles a strong B-field-line, so will mass circle a strong C-field-line. Circling charge-flow induces a solenoidal B-field and circling mass-flow induces a solenoidal C-field, so we ask: if initially captured in a strong C-field (big-bang or LHC collision) can mass-particles be nonlinearly sustained by their own *self-induced* solenoidal C-field after the initial field weakens? If so, can the *several particles* self-induce and self-sustain a local C-field strong enough to confine all to a local volume?




An energy analysis implies quark confinement, while stability analysis implies stable protons [two light strong charges anchored to a heavy weak charge] and unstable neutrons [two heavy weak charges anchored to a light strong charge]. Decay times and baryon masses are calculable. A *non-spherical baryon* model suggests the *pp* physics of Veneziano's 1970 formula — interpreted by Nambu as a 'string' — *and* the anomalous proton-radius for muonic-hydrogen versus electronic-hydrogen. *Many* re-interpretations of SM are possible.

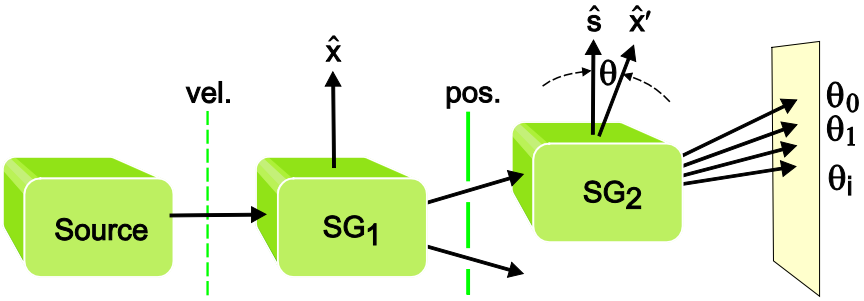
## The Single-Atom Stern-Gerlach and Dipole-Dipole Physics

Quantum mechanics can be based on Stern-Gerlach experiments which split atomic beams into spin *up* and *down* beams. Quantum statistics work well, but predictions for single atoms cannot be tested. Recent trajectory analysis [left] yields a model of (red) data points that match the iconic (grey) SG data [right]:




These single atom predictions could provide a means of testing a key premise, *possibly false*, of QM. Advances *in single-atom-detection* technology offer the ability to perform a *single-atom-Stern-Gerlach* scattering experiment [7], testing

Feynman's premise of a *two-slit-spin-analog* (now a basis of QM). The predicted $\theta$-dependent trajectories would enable novel technology for magnetic dipole-dipole scattering, extending work with "*molecules probing some of the most fundamental features of physical law.*" [8]




## Summary and conclusions

Physics advances by adding *new* theory and data or by removing *false premises* from current theories. Key false premises of general relativity: 1) that changing the nature of the nonlinear model (*field equations*) also changes the nature of the nonlinear field; 2) that the *Equivalence Principle* allows local gravitational energy to be transformed away; 3) that mass density can be ignored.

Removing these false premises yielded: *a new iteration technique*, equivalent to solving the nonlinear equation; *a new quantum gravity relation*; *an ontological* (physical) model of the *particle-wave function*; gravity-based *quark confinement*, independent of the 'strong force' of QCD; a *new interpretation of kinetic energy*, and *many more* reinterpretations of physics.

Most resistance to realistic gravity is not relativistic in nature, but quantum theoretical, based on the *belief* that gravity "must be" quantum field theoretic in nature. Relativity, from the mind of one man, suffered three false premises. Quantum theory, from *many* minds, includes *many* false premises, evidenced by many 'interpretations' of an axiomatic framework. Removal of false premises from quantum mechanics may remedy Feynman's famous problem:

> *"no one understands quantum mechanics."*

The path to better physics could be simply improving what we already possess, an over-specified model of reality. Payoff from pruning is leveraged, as *the fruit already exists*, albeit much is rotten. It is easier to select good and excise bad, than to start from scratch on new hypothetical growth.

## References

[1] B.P. Abbot, et al.,*Observation of Gravitational Wave…*, *Phys Rev Lett* 116,061102 (12 Feb 2016)
[2] H.C. Ohanian and R. Ruffini, *Gravitation and Space-Time,3rd Ed*., Cambridge,© 2013 (pp. 275, 41)
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