

Implications of a novel view of the cosmological energy density and pressure relationship

By Michelle Kathryn McGee

Abstract – A non-linear, behavior-based physical model that integrates divergent physical phenomena is directly derivable from a novel view of cosmological energy density and pressure. A process is hypothesized for the formation of matter in which dark and ordinary matter and energy exist not as discrete, static cosmological states but as changeable, complementary cosmological states. The resulting model also suggests that half of matter originates from light; that electrons are not particles at all but are reflections of symmetries and exchanges that occur naturally given material structure; that gravity and heat are byproducts of the formation of matter and together create a physical context for changeability; and that the infused nature of mass and energy is due to the simultaneous manifestation of redundant and novel behaviors in physical systems. The concept of particle is redefined, the force-based atomic model is replaced, ordinary matter is reexamined in a dynamic scaling context, and heat and gravity are meaningfully integrated into the manifestation of substance in the universe.

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Introduction

This work builds up to a physical theory that is unique in its scope. In one way it transcends the current, conflict-ridden theories behind a utilitarian physical science by suggesting a common root to all questions of a physical nature. What it does not transcend it meets head on: electrodynamics, particle physics, thermodynamics, and nearly all modern developments in theoretical physics. Like any nascent model, it suggests that hard work could be ahead re-interpreting experimental data under a radically new set of assumptions.

While existing “theoreticalities” like electrodynamics, classical physics, and quantum theory may be more or less precise (allowing for prediction) they have so far not been comprehensive enough to produce a wholly accurate description of the universe. Ultimately the views and hypotheses presented here suggest that a comprehensively connected physico-cosmic framework exists and, moreover, that the current system of overlapping, sometimes even contradictory, physical and cosmological theories can be accounted for – and re-framed – within the context of these novel views.

No experimental methodologies are proposed, nor experimental evidence provided. The views and models presented here are speculative. For this reason, some background as to their mode of inception may be helpful in evaluating their merit.

They were developed with one simple goal in mind: explain the widest range of perceptible (not necessarily quantifiable or linear) phenomena as possible with the least number of “givens” and contradictions. The path toward that goal, while pursued methodically at times, was not so much facilitated by the scientific method as by the simple practice of applied wonder.

Natural physical phenomena represent an endless source of information and have been instrumental in the interpretation of reality since the beginning of such endeavors. In this case, the range of phenomena considered relevant was not limited (such as it was, for example, in the seminal interpretation of electrostatic behavior as charge). It was kept open to all of physical reality derivable (by logical deduction) from sense information and existing experimental data.

Ironically, it appears that the inherent “correctness” of the physical reality that underlies natural phenomena has been lost because dominant theorems are derived based on the need to explain experimental findings. Yet, what are experiments on imperceptibles but man-made quasi-phenomena?

Theoretical physics has a considerable task. It is charged with perceiving the imperceptible. Yet, the scientific method should not be allowed to usurp the importance of nature’s phenomenology.

Moreover, physics has much to learn from a systematic evaluation of the physical origin and “meaning” of existence and its many manifestations.[1]

Compared to straightforward scientific method, the process of applied wonder that I have introduced has an unusual advantage. It directly addresses a particularly vexing divide within physics between that which is perceptible and that which is not. By treating natural, perceptible phenomena as a window into the imperceptible smallness that underlies all existence, the concept of scaling is applied directly to theory development. From this approach emerges a novel view of physical and cosmological structure.

Energy Density and Pressure: More than a backdrop

Definitions and assumptions regarding the conventionally known cosmological properties of energy density and pressure are physics and cosmology theory’s mysterious morphogens – readily changing in the face of new theories and constructs while peripherally serving to maintain the necessary vigor of existence. Energy density is an abstraction assigned with the incremental taking up of space. Its most generalizable definition is actually a mathematical assumption – it is a positive value factor. It exists, whatever *it* is.

Interpretations of cosmological pressure are far less undeviating, though not less vague. As with energy density, no force is presumed to be involved in its expression, but unlike energy density, cosmological pressure appears to lack a direct connection to the expression, real or potential, of the universe’s mass and energy. This makes it a uniquely disorienting aspect for those trying to understand the nature of the cosmos and all that it contains.

The very notion of a non-zero pressure factor in the form originally proposed by Einstein, as well as the other forms of dark energy that have been proposed since, is not uniformly accepted. The theoretical basis of the pressure controversy lies in the fact that when a mathematical interpretation of a given sub-system of the universe (e.g. a galaxy) includes a pressure-related “cosmological constant” or “anti-gravity factor” and is then extrapolated to the huge amounts of empty space in the universe, calculations always end up telling a very peculiar story about how the universe must be. Further confusing the subject, those who support models including a non-zero pressure factor (always negative) differ on whether they consider the pressure constant for empty space to be naturally lumpy (varying regularly) or smooth (does not vary).

An unstated assumption common to these competing perspectives is that, if such a pressure factor manifests in empty space at all, it does so in one particular mode and is constant, if not neutral, in its interaction with matter. It is a conclusion of this work that not one but many of the competing perspectives on cosmological pressure are manifest in the universe, and also that these cosmological pressure factors are essential to the very creation of matter.

In addition to ambiguities over the definition of its component parts, the relationship between energy density and pressure suffers a vagueness that relegates its role to that of a largely passive backdrop for the activity of compositional properties attributed to matter. From a reductionist point of view, the exact make-up of empty space has not seemed to matter because characteristics of physical matter are determined by properties such as mass, charge, optical behavior and time in existence. (Cosmology has made advances in identifying dynamic features for empty space – the possibility of lumpy dark energy and an inflation / expansion factor.) Even in existing alternative models claiming physical unification, it seems that the commonly elicited abstract-space-behind-everything is all but removed from physical structure.

But consider the implications of the following view: instead of disparate properties and conditions converging to form matter, physical structure and dynamics are derivative of a complete cosmological coherence and all that exists physically is traceable to its differential manifestations. A so-called physico-cosmic model is presented here that hinges on the view that a cascade of non-linear, physical behaviors arises from the original qualities known to us generally as cosmological energy density and pressure and that these behaviors precipitate physical structure within the known universe. According to this model, an irreducible coherence exists that accounts for the complex variation of physical and cosmological structure through an array of modes of expression of its core relationship.

Physico-Cosmic Model

In the physico-cosmic model the universe's coherence is defined in terms of cosmological energy density and pressure. Three primary and distinct modes of expression arise from the cosmological coherence proposed here. From their interplay a framework arises that not only contains novel models for the formation of matter, quasi-particulate behavior, heat, and gravity but also provides a fresh perspective on the abstract physical realms of uncertainty and non-locality. In this section, I will introduce the modes of expression – the defining behaviors – of this novel view of energy density and pressure, their proposed first physical derivatives, and the essential concept of resolution. I will also describe a handful of central assumptions.

As is hinted in the previous section, the answer to the underlying question of the actual nature of substance itself is an elusive one. You will not find that question answered here. The composition of the universe's coherence remains a mystery to me; I am satisfied to demonstrate that a model of the structure of the cosmological coherence is possible based on the ways in which it behaves.

To be specific, the physico-cosmic model defines the universe's coherence in this way. It occupies empty space not uniformly, but consistently, in one of two ways: as dense positive pressure or dense negative pressure. Physical descriptions of the coherence's extremes already exist. Characterized in great detail already, “electromagnetic radiation” (referred to herein as *light* or *radiation*), is dense positive pressure. This is not a new assertion.

In the physico-cosmic model, dense negative pressure matches closely the modern concept of quintessence. While the importance of quintessence to the dance of the cosmos is the subject of intense speculation, hydrogen is proposed here to be its first derivative and is already well characterized.

It is hypothesized that the behaviors of these two apparently discrete states of standardized or unstandardized space readily interact and in doing so have the potential to resolve into nuclear particles. Their potential is also auto-catalytic, and matter emerges where local conditions favor the formation of collections of standardized boundaries.

When usual views of the energy density and pressure relationship are entertained, linear meaning is attributed to the arbitrary designations of “positive” or “negative” (as in dense *positive* pressure). It is a key assertion of the novel view presented here that it is the likely *behaviors* of contrasting dense pressures, not their imposed mathematical constraints, that provide the nonlinear perspective necessary to perceive the natural unfolding of an integrated physical process. To delineate these processes, three fundamental modes of expression are hypothesized and are given neutral, descriptive names to separate

the conventional mathematical treatment of energy density and pressure from their behaviors. These modes of expression of the proposed cosmological coherence are called mode, vehicle, and particle. A behavioral tension and physico-cosmic balance is hypothesized to result from each mode of expression, as described in Table 1.

Assumptions are inherent to modeling; the following assumptions arise out of the physico-cosmic model. The apparent effectiveness of the universe's structuring dynamic and, specifically, the apparent predominance of

ordinary material forms necessitates a foremost assumption of initial cosmological projection / streaming of critical (locally dominant) amounts of dense negative and positive pressure of the appropriate intensity to be useful in the regular assembly of complex structures according to its coherence. In other words, the early universe, during the formation of the bulk of ordinary matter, had to have been dominated by lumpy dark energy of one intensity, or at least occurring in areas of concentration; this, in order for enough interacting material to form.

Table 1. Modes, behaviors, and balances describing a non-linear cosmological coherence.

Expression	Behavioral Tension	Physico-Cosmic Balance
Mode	Position / Momentum	Unresolved source§ variation of energy density & pressure
Vehicle	Gathering / Dispersing	Pressure varies with regard to resolved source§
Particle	Persistent / Transitional	Energy density varies with regard to resolved source§

§ The definition of “source” is discussed in the section entitled “Source integration & scaling behavior ordinary matter. Intensities of lumpy dark energy less than the wavelength of visible light are referred to herein as quintessence.[2]

The justification for this assumption is that any non-linearity must be “fueled” by concentrated starting conditions that demonstrate regular, local variation. It is the compatibility of starting parameters that makes any set of expressions relate in a complex way. All of the physical expressions described below are still reflected in unstandardized space, but the regular fuel of a structured coherence and the circumstances of its introduction dictate the formation of materials beyond simple hydrogen and photons (and their exotic relatives).

Also, because of a proposed role of radiation in the precipitation of matter that depends on the complex behavior of light, one or more turbulent periods in the movement of space are assumed. As is most often the case with questions of initial conditions, the reason for the accumulation of initial conditions of the precise nature described in this model remains undetermined.

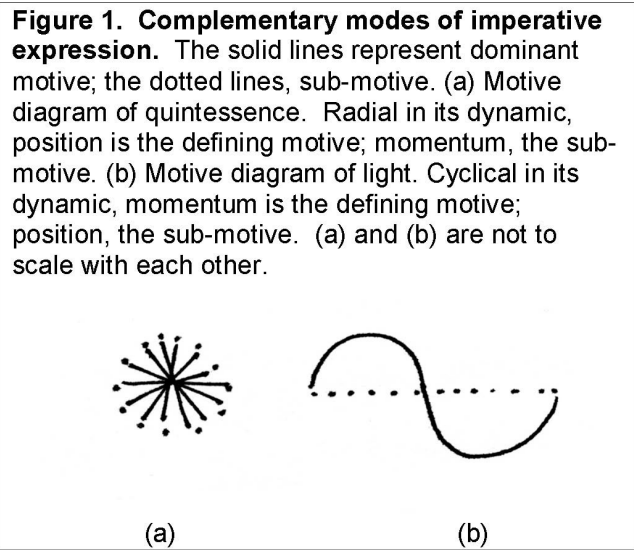
Something from nothing

Among the modes of expression introduced in Table 1, and in particular the behaviors said to contribute to their definitions, the use of the terms position and momentum to describe the behaviors of unresolved dense pressure is unconventional and therefore must be clarified. (The full intent of the juxtaposition can only become clear as the model unfolds completely). To justify the use of these otherwise conventional concepts in describing contrasting cosmological states, as well as the contribution of these concepts to the physico-cosmic model, we must set about a teleological query: why does the dichotomy of position and momentum exist in the first place? One simple answer emerges. Position and momentum discriminate “something” from “nothing”. Specifically, momentum is nothing without a channel through which to move, and position is nothing if it is not reaching for something about which to posit itself.

The something-ness to which these so named modes refer has no mass or energy when unresolved but is primed to process a non-linear cascade of related behaviors based on the certainty of their interrelationship. (Recall that the wave-particle duality of light is readily embraced in physical theory and depends on a similar relatedness between something and nothing.) While traditional measurements hold up uncertainty as a natural state because of the existence of mutually exclusive complementarities, it can be argued that the dynamism of the universe is in part due to the ongoing process of integrating instances of certainty. In the case of mode,

resolution is not happenstance; it is a potential, an information threshold, to which dense non-zero pressure spaces are subject.

These thresholds are determined by temporally and spatially complex behaviors. When energy density is coupled with “negative” pressure it is hypothesized that what results is a certain intensity of space that is active in *all directions*. (Figure 1a.) In its unresolved, isolated form this is quintessence; its behavior is referred to as position mode. Position mode is radially dynamic; a momentum sub-mode is assigned to the outermost expression of its intensity.

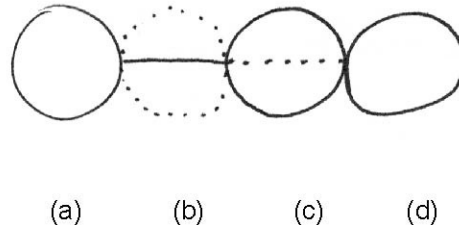


In combination with the opposite (“positive”) pressure, energy density propagates and shows activity in *one direction* only. Its intensity continually orients to its given direction but cannot be contracted to the two-dimensions of its axis, making it wave-like in its dynamic. (Figure 1b.) This behavior is referred to as momentum mode, and radiation is its unresolved form. Because momentum mode demonstrates directionality, we can hypothesize a position sub-mode defined by its directional axis. Moreover, the directional mandate of radiation primes it for resolution with the frank position mode of quintessence.

Mode expression grants exclusive, self-perpetuating coherence behaviors to light and quintessence. These expressions, though regular, still reflect the uncertain aspects of empty space. In fact, it is within the uncertainty of sub-mode that the possibility for the bounding of space into physically manifest matter exists. According to the mode designations, mode and sub-mode behaviors of lumpy dark energy and light are complementary when matching in intensity. (A specific intensity remains unnamed in this work). For example, the momentum mode from light will resolve the momentum sub-mode of lumpy dark energy of matching intensity. This makes the action of particle formation, as well as simple nuclear and divalent gas formation, the parameterization of position and momentum mode around one or more instant centers, shown in Figure 2. *Sub-mode physically closes the mode system, creating an instance of certainty that binds change in the mode system to whatever degree the local space is receptive.* Given such certainty, a mode system becomes self-referential and manifests as a series of spherical particles ranging from persistent to transitional in nature. [3]

Figure 2. Substantial completion as a consequence of the motive/sub-motive system.

(Drawn two-dimensionally for convenience only.)
(a) and (d) represent stabilization or incidental complementary substance. (b) and (c) are particles with opposite motive origin. The sub-motive (.....) of one "solidifies" the motive (____) of the other persistently or transiently.



Given circumstances for resolution and stabilization, both quintessence and radiation can precipitate as particles. Because of their inter-definition, particles at a particular resolution size have the potential to collect. Resolved particles are similar if not identical in size, or material density, to their immediate (persistent or transitional) neighbors. The formation of quintessence into particles requires resolution with radiation or with unstable or asymmetric resolved materials. The resolving momentum mode can be traveling at any rate because it can contribute position sub-mode anywhere along the directional axis connecting its actual (past) and potential (future) source. Light "condenses" into persistent particles when its position sub-mode is localized by complex structure or folded and trapped and resolves with one or more dense negative pressure spaces. Is this a realistic set of conditions? Optical density demonstrates that light slows in the presence of material stability, and the storage of optical information has been achieved experimentally.[4]

But why are the resulting particles not inert? Why does the coherence not become inactivated through mode resolution, turning its particles into seeds in a cosmological super-saturate and making the universe a static linearity and not a dynamic non-linearity? It is easy to assume that, during the establishment of dense boundaries as described above, associated "positive" and "negative" pressure variables would neutralize each other. Yet, by introducing the potential for a non-linear, behavior-based interpretation of cosmological coherence, we may hypothesize instead that the resolution of dense boundaries maximizes energy density only and that pressure parameters do not merge but become at least to some extent independent of each other.[5] From the point of persistent resolution forward, the resulting pressure parameters act instead as local constants reflecting the dynamic origin or direction of the spatial-temporal source of their resolute independence.

The activity of these densityless non-zero pressures with regard to their resolved sources is referred to as vehicle and its two manifestations are characterized as such: position-mode-derived (negative) pressure gathers. It is externalized in a way that contains the particle or collection of particles from which it derives. *Gathering vehicle* centralizes its activity around origin (simple to complex) without regard for direction and in doing so effectively establishes autonomy for its source (system of origin). The empirical manifestation of the gathering vehicle can be most closely paralleled to the electron probability cloud – the hypothetical space around a nucleus that is empty except for the notion of electrons.

It is hypothesized that gathering vehicle is readily shared between opposite origin particles and "merged" among collections of particles with shared boundaries. What is the optimal and/or most common formation intensity for gathering vehicle? Presumably, gathering vehicle is thermodynamically-sensitive. But it would be reasonable to suggest an empirical intensity of approximately $\frac{1}{2}$ that present at the resolution of quintessence into stable hydrogen (e.g. H₂ or H⁺).

By conferring relative stability/instability on coherence resolution, the vehicles govern not only the combining

behaviors of resolving particles (behavior that has in part been interpreted as resulting from “electrodynamic charge”) but they also govern the dynamic behavior of unresolved mode (e.g. light, gases) colliding with resolved matter. In this way the model accounts for the dynamic boundary areas of resolved matter – phenomenology – in a way that no other theories have.

While the only limit to unresolved position mode is lack of proximity to other resolved material or unresolved light, the momentum mode of radiation requires multi-dimensional stabilization

(e.g. looping force, pressure) in addition to adequate gathering vehicle to share with other particles in order to form a persistent particle. Because the universe exists as a mixture of resolved and unresolved coherence, the momentum mode dominant vehicle directed by unresolved radiation leads to variation between mode (wave) and particle expression.

When light resolves, the expression of momentum-mode-derived (positive) pressure is manifest, and is referred to as the dispersing vehicle. This vehicle propagates directionality (from its source momentum mode) and its behavior is transient dislocation with regard to the direction conferred by its coherence source. Origin is not fixed but is constantly changing with regard to the dispersing vehicle; action is maintained in this vehicle through chain reaction.

Dispersing vehicle behaves differently from gathering vehicle because it is not obliged to maintain proximity to its source, but instead moves away from its source. Movement, and in extreme cases dissociation, is the effect of the dispersing vehicle on resolved particles. The dispersing vehicle dictates that no resolved material is motionless.

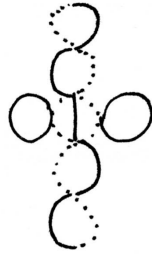
Quasi-Particulate Behavior and Uncertainty

The existing concept of wave-particle duality perplexes modern physics. Here its “resolution” is suggested through meticulous consideration of momentum mode and its tendency toward transitional rather than persistent coherence resolution.

It is fair to conclude that, according to the nonlinear coherence presented thus far, *all* particles are “quasi” in their manifestation because of the fuzzy action of adaptability and the dissociative capacity of form. There is no such thing as a perfectly persistent particle or a particle that is so transitional that its resolution has no physical consequence. There is a range to this “quasi-ness” for local instances of resolution, and this variation is attributable most directly to the actions/behaviors of dispersing vehicle.

Quintessence derived particles naturally persist, manifesting most simply as hydrogen, because gathering vehicle is inherent to their resolution. Sustained interaction with momentum mode is required for its resolution, but the dispersing vehicle of the resolving light is not unleashed until the light persistently or transitionally resolves. When light serves as a resolving boundary for quintessence it is said to be *virtually resolved*. When interacting in this way, light provides directionality to resolved particles but does not exhibit mass or energy in association with that relationship. As a corollary to virtual resolution, it is hypothesized that a symmetry requirement arises in the coherence mode local to such resolution leading to the molecular structure known as divalent gases. (Figure 3.)

Figure 3. The divalent hydrogen bond. The most basic particle-motive interaction, divalence arises from transitional parameterization among particles via momentum motive that remains only virtually resolved after an interaction with resolved position motive.⁶ Divalence is an advantageous form due to both spatial symmetry and motive balance.



The wave properties of light arise as momentum mode propagates in a given direction through a given medium. Even when it is virtually resolved at some point (or points) along its path or when it transitionally resolves and changes direction, the extant state of radiation is as a coherence path of dense positive pressure. Just like position mode, momentum mode gains particulate properties when resolved, even just transitionally. Transitional momentum mode derived particles are known as “photons” and are a type of resolution commonly expressed by light. This resolution is temporary and can occur through direct interaction with a resolving material (e.g. a photographic plate, a surface of water) or by being drawn or expelled across a distance (e.g. lightening, electrical sparks).

Both persistent particles and transitional particles like photons manifest mass and energy. Whether or not a transitionally resolved particle is *detected* as having mass or energy is dependent on the sensitivity of the measuring device. Consider that before a speed of light was deduced, many attempts had been made to clock its speed without success. The mass of a photon is similarly ephemeral. Indirect evidence as to the mass of transitional momentum mode derived particles (photons) already exists – in the form of energy measures.

As to the specific coherence nature of light’s travel, the assessment of the many manifestations of light, as well as the source of its “speed”, can be attributed in a physico-cosmic model to a behavior that can best be described as the actual self-propagative *rush* to resolve the uncertainty of the coexistence of momentum and position mode and sub-mode. This behavior is affected to a maximum when that rush is unfettered by coincidental material. We may further conclude that the universe is the manifestation of a dynamic process whereby all unresolved phenomena exist more or less at the cusp of resolution, with or without certainty, and depending on whether persistent or transitional resolution is favored along a given path or at a given location. The action of propagation toward resolution is hypothesized to underlie non-local phenomena, or change-at-a-distance, as well. Resolution and resulting redirection of a given ray of light results in a new, local mode source. Moreover, upon resolution, a light ray’s previous mode source is abandoned in favor of its newly defined local dynamics. In support of this tentative hypothesis, I site the necessity of the squaring of the velocity in any energy-mass relationship. This mysterious requirement could be attributed to this two-way exchange of mode resolution, that is, from new to old source and then back to the “present” circumstance from which all else proceeds.

The virtual resolution of light (refer again to Figure 3) also suggests a certain ephemeral character to hydrogen. If the particular ray of light whose virtual resolution is resolving a pair of hydrogen atoms were to persistently or transitionally resolve in a different location, the remotely resolved hydrogen would, in theory, dissociate into quintessence. Those particular hydrogen atoms would cease to demonstrate physical boundaries until encountering another coincidental ray of light.

Because momentum mode is non-local in essence, the resolution of quintessence into particles is not restricted by time or space, only by coincidence. The resolution of radiation into particles is, on the other hand, restricted by time and space to dynamics that locally induce closure of its mode.

As an example of the subtle complexity afforded by the physico-cosmic model, for over a century electrodynamics has failed to satisfactorily explain why hydrogen, the first element in the periodic chart, has mass 1 while helium, the next element, has mass 4. Why is there no mass 2 element? The physico-cosmic model demonstrates the possibility that a simple but profound difference between divalent hydrogen (H₂) and helium explains this phenomenon. While both employ two position mode derived particles in their form, the momentum mode in He is resolved into persistent particles whereas that in H₂ is only virtually resolved and thereby does not exhibit mass or energy.

To reiterate a critical primary assumption of the physico-cosmic model, in order to account for the initiation of persistent formation of momentum mode based particles within a collection of resolved material, it is necessary to assume that space can be/has been turbulent and/or non-homogenous with regard to radiation. Without this dynamic, there would be no basis in this model for the accumulation of particles into stable collections of matter. Light would be interpreted as continually propagating, unresolved except transitionally. Form itself (and to a lesser extent hydrogen because of its lack of resistance to displacement and ability to dissociate into quintessence) provides “resistance” for the resolution of momentum mode based particles, and momentum mode based particles “capture” position mode because they need to share available gathering vehicle to fully stabilize into persistent particles. Thus, the persistent resolution of momentum mode based particles is absolutely essential to the overall model as, given complex conditions for light, its effect is auto-catalytic on coherence resolution/formation.

The highly transitional nature of light has challenged our notions of fixity for well over a century. A non-linear interpretation of light does not necessarily provide an “easy” or simple answer. Coherence resolution is not reserved for the local parameterization emphasized thus far; as a model of the imperceptible smallness that underlies all existence, its implications are only beginning to be elucidated.

Electrodynamics Deconstructed

How can electrodynamics, one of the strongest and most influential pillars of modern physics, be wrong? In fact, it is not terribly difficult to imagine. A real evaluation of the nature of particle charge has been so long overlooked as to represent a major shortfall of current physical theory. Aside from the baffling behavior of materials in “electromagnetic fields”, there is no direct evidence of a causative relationship between the property known as charge and the fundamental nature of matter.

The physico-cosmic model is able to account for the behaviors associated with particle charge without the application of a separate charge-giving property. It is suggested that “protons” and “neutrons” are essentially non-coherence abstractions that reflect the same particles with opposite vehicles. It also suggests that “electrons” are not particles at all and that no persistent nuclear forces or gluons are required to account for the integrity of nuclei.

The behaviors for which electrons account do not derive directly from coherence resolution but from the effect of a particular form on its local surroundings. It can also be said that the attracting/repulsing behaviors that are the focus of electrodynamics are attributable to the vehicle versus stability character of a given autonomous collection of particles.

The surface of a nucleus and other collections of particles are bumpy, and “electron” patterns and behaviors reflect the presence and shifting of a potentially complex, always patterned and regular (though not static) surface structure. Whether a particle or molecule exhibits a particular kind of bonding behavior depends in part on the variable geometric aspects of nuclear structure and is due to, for example, the angle, depth, and isolation of surface troughs. Such troughs are void of density and, in combination with gathering vehicle,

contribute to the specific vehicle-permitted bonding behaviors that occur among atoms.

Because gathering vehicle is the major factor in determining the permissibility of persistent boundary-sharing (bonding) among particles of opposite mode, it manifests consistently (to within a very small range) from atom to atom when thermodynamic conditions are the same. Together, optimal structuring of collections of particles and consistent gathering vehicle result in the elemental phenomenization of matter.

The formation of elemental matter into its preferred structure will most likely be compatible theoretically to the mathematical science of “sphere packing”. When a nucleus does not contain a number of particles that packs to a maximum density (and symmetry), the position of the particles is not fixed. Its structure is open to molecular bonding with complementary nuclei. The application of this type of mathematical analysis – specifically spheres within a sphere – to atomic modeling has the potential to yield fruitful information on making parallels between the topology of packed spheres and quantum numbers.

Actual gathering vehicle for a collection of particles is determined by the conditions at its original formation, and does not vary except when its source material undergoes structural transformation. This means that as a molecule’s thermodynamic and local phase state change, its gathering vehicle, which was optimal for stability at its formation, may destabilize under the new conditions.

Dissociation (e.g. nuclear decay, illumination) is “self-repulsion”. It is a case of insufficient gathering vehicle. Movement can challenge the resolution threshold of a collection of particles so that even though local conditions conferred stability at formation, when those conditions change (such as with heat or external pressure), the resolution of a collection of particles becomes uncertain. In dissociation, intense dispersing vehicle causes a representative particle to un-resolve thereby allowing the entity to emit “extra” dispersing vehicle in the form of dense positive pressure, or radiation.

Gathering vehicle dictates that resolved entities do not gain stability by resolving persistently (bonding) with neighboring particles that would put the resulting entity’s gathering vehicle out of proportion to that needed to stabilize the collection of particles it contains. In the case of excess gathering vehicle between two particles or entities, the result is “repulsion”.

Changes in the gathering vehicle/nuclear relationship manifest as “ionization” changes. Too much gathering vehicle for optimal stability and a momentum-deficient, or “positive ion”, state occurs. Too little gathering vehicle and a “negative ion state” occurs. The enhanced position mode of a momentum-deficient state “attracts” a particle or nuclei that is destabilized (i.e. too little gathering vehicle given local circumstances).

Though the verity of electrons is brought into question, the idea of a “cloud” (e.g. electron probability cloud) surrounding nuclei and responsible for the bonds and interactions that organize and affect change in atomic structure is reserved.

Energy levels designated for electrons at “high energy states” represent dispersing vehicle challenges/changes within or local to a resolved material. Isotopes result from unusual gathering vehicle challenges during formation or structural change.

Other coherence factors with the potential to affect matter as it collects are synchronization of resolution, radial- adaptability of position mode, shielding, and the potential involvement of unresolved mode for activation and stabilization of form. The physico-cosmic model is dynamic and allows for the creation of a conceptual framework for the evaluation of characteristics previously attributed to electrostatics.

Source Integration and Scaling Behaviors

Today, the concept of scaling is most often treated as a mathematical tool, one that is applied to formulas and models to elicit certain “behaviors”, for example, in the creation of fractals and in non-linear computing. The physico-cosmic model further recognizes that the usefulness of the concept of scaling derives from

fundamental scaling processes in nature – from the coherence level up.[7] For this reason, my own initial assumption of the intrinsic meaning and extent of scaling in physical modeling was a propitious one. The physico-cosmic model suggests that many physical phenomena not only demonstrate but actually arise from linear as well as non-linear scaling processes. Some examples are molecular formation, gravity, and illumination, all of which are essential phenomena underlying a complex existence. Hypothetical models for these so-called scaling behaviors are discussed in the sections that follow.

Scaling is not an isolated principle; it is a manifestation of a bigger reality – that of order. Like a tree, order has “visible” parts like its branches and leaves as well as “invisible” parts like its roots. Scaling is an outward sign of order. In viewing physics without all of the constraints of current theory and from the new point of view presented here, a certain principle hidden among nature’s divergent forms becomes apparent. It is a principle I call source integration. The principle of source integration is hypothesized to be the root of scaling, and perhaps more generally the root of order and all complex behaviors such order supports.

To begin to understand the principle I have introduced, consider that nothing is truly and accurately defined from the outside in, for it is manifest from the inside out. From an entity’s center, distinguishable characteristics emanate and relative coordinates are definable. Distinguishability is used here to describe the character of resolved coherence as conferred by the unique initial conditions of an entity’s resolution. A particular instance of distinguishability, unique in time and space, is referred to here as a *source*.

The question of the existence of distinguishability (and later autonomy) within the context of a connected “whole” as well as the apparent scaling behaviors that arise around source is supported conceptually by the uncoupling, through the formation of particles, of the strictly determined behaviors of position and momentum mode. Recall that for lone particles, position is limited to a point and momentum is limited to a direction. The coherence view says that resolution of dense positive and negative cosmological pressure converges on a particular value that it shares with its immediate neighbors. Once coherence resolution is realized, position and momentum become real, variable properties that manifest in accord with the size and contextual dynamics of an entity’s local surroundings. This resolution-induced uncoupling of the cosmological coherence is the physical basis of source.

While this uncoupling is essential to the dynamic nature of resolved materials, an integrated whole persists. Any time a process is resolved (or unresolved, as the case may be), the “flow” of one particular part of the universe is naturally (or unnaturally) brought to a kind of closure. In response, the qualities of the resulting reality effectively reverberate through the body of mode that “suspends” current coherence sources (the present). This is the principle of source integration. As the purveyor of distinguishability, source integration refers to the meta-resolution of past circumstances and events.[8] As such, it is suggested as the physical basis of causation.

The principle of source integration is particularly evocative of complex potential – an intricateness, a physical as well as conceptual largeness – that can only be compared to experience itself. Because of this potential for coherence organization and responsiveness, physical sources are presumed to interact from the particle to the planetary level. In other words, sources, as defined here, exist on an infinite number of overlapping scales.

To better understand the “organization” available through source integration, divide the behaviors underlying the empirical coherence modes (mode, vehicle, and particle expression) into the following two categories:

<i>Carriers of Physical Novelty</i>	<i>Carriers of Physical Redundancy</i>
Momentum mode	Position mode
Dispersing vehicle	Gathering vehicle
Transitional particle	Persistent particle

Physical novelty is defined as the system of local transitional dispersing momentum. Physical redundancy is defined as the system of local persistent gathering position. It is proposed that every integrated (and later, complex) behavior that arises as part of coherence expression can be characterized as novelty-dominant or redundancy-dominant (and further analyzed as to the dominant coherence mode affecting its novelty or redundancy dominance). Here is an example of a conclusion that, while obvious, demonstrates the consistency of the novelty/redundancy characterization of universal systems: the more persistent the resolution the more redundant the information that arises from its existence. Because the underlying coherence behaviors manifest non-linearly, the effect of each is affected, even diluted or enhanced, by all of the others, including its own opposite.

Because of the principle of source integration, coherence behaviors result in predictable characteristics of meta- resolution. Nonetheless, source operates independently of coherence. The momentum and position of form itself is ‘coherence’ only in the sense that it may be applied to formulations in search of predictive power.

Because of source integration, reverberations of a given resolving process may demonstrate chaotic or patterned responses depending on the receptiveness of the phase space of a particular process or entity. Resolution is spontaneous, certainty is fleeting, and time is not reversible, though reverberations can enhance certainty, depending on circumstance. To the degree to which source connections are indirect, the reverberations of meta- resolution can appear disordered.

Because of the non-linear nature of the underlying coherence, local processes resist standardization. Upon observation, half of the equation is always missing – not certainty but the connectedness, the circumstantial certainty based on source and distinguishability that is the ultimate context for the form and behaviors we observe. This inherent limitation to our faculties and its effect of obscuring source have kept this unique interpretation obscured and make it elusive to computation and, in general, to conceptualization by the logical mind.

Molecularization

The scaling of material structure is dynamic and complete. An atom has distinguishable parts (particles) and is part of a distinguishable molecule (self or larger). A molecule has parts (atoms) and is part of a distinguishable form (boundaried gas/liquid/solid).

Under normal circumstances these embedded states do not collapse. In fact, to me the most perplexing question to arise from the physicosmic model is: Why wouldn't atoms just accumulate around one material source, creating super-sized spheres (larger and larger nuclei) rather than intricate molecular structure with the potential to fold on itself, twist, elongate, etc.?

Nuclei have a mandate of self-symmetry. That mandate is reinforced by the action of gathering vehicle, but bonding with other atoms (nuclei plus gathering vehicle) further stabilizes a participating atom's structure because bonding presumably occurs at the points around an atom's nuclei that are least stable. It is further hypothesized that the gathering vehicle is dissipative (not sphericalizing) for molecules that are asymmetric. Naturally, in thermodynamically neutral but dynamic surroundings there would be a stability advantage conferred to atoms participating in, first, symmetric, then asymmetric molecularization.

Atoms and molecules naturally relate with other matter and coherence expression in their environment and engage in “bonding” and other coherence adaptations if their own stability, internally and within the greater structure, is enhanced. If not, a given atom or molecule would naturally pass by change, simply remaining neutral and in whatever proximity was natural. This is a matter of acknowledging not only what happens but also what is not happening.

The Meta-Vehicles

Heat and gravity are the permutations of the dispersing and gathering vehicles, respectively, for large dynamic scaling systems. They are meta-vehicles. As described earlier, the vehicles mediate interactions among resolved materials rather than resolving *into* something themselves. On a large scale, each vehicle takes on particular phenomenological characteristics.

The gathering vehicle is position without momentum. Its behavior is as a local attractor. The dispersing vehicle is momentum without position; it is a solitonacious function that manifests dynamic characteristics through displacement chain reactions among local forms.

As a result of the boundary sharing necessary for the association of nuclei into molecules and larger forms, the gathering vehicle of matter can become substantial (not literally but figuratively). When the size of a given entity's gathering vehicle alone becomes large enough to contain another entity (and *its* gathering vehicle) the resulting coherence phenomenon is referred to as gathering meta-vehicle, or gravity. Associated behaviors are most obvious with regard to the heavenly bodies, but because a contained entity can be as small as a resolved particle, gravity, according to this model, is operative on many scales. The Casimir Effect is an example of a small-scale gravity phenomenon.

How then does gravity create a force? When an entity of relative small mass enters or accumulates within (is fully contained by) the gathering meta-vehicle of an entity of relative large mass, the gross, favored movement of the contained entity is mediated by a solitonacious, negative pressure-directed, dynamic movement toward the containing source entity's center. The threshold boundary of this movement is measurable as an acceleration constant (i.e. as it effects the contained entity).

The establishment and stability of a given gathering meta-vehicle depends on negative pressure factors conferred at the time of formation of the source. Destabilization of the gravity metavehicle is possible given relative large- scale challenges to the coherence redundancy of its current source. To the extent that an entity entering a gathering meta-vehicle is denser than its medium, it will proceed toward the associated source's stable center until it resolves with a physical or coherence boundary.

Unlike gravity, which is conservative both locally and throughout space because of the connection to its source entity, heat is non-conservative with regard to local dynamics (though conservative when all coherence modes are considered).

Heat could be called the hidden coherence effect. The reason for the appearance of disorder with regard to heat is that densityless positive pressure has no heat effect on unresolved energy density and a sub-critical effect on "thin air". As heat "dissipates" positive pressure persists, but without critical/threshold effects. Its effect becomes hidden, obscured from detection.

Regarding the laws of thermodynamics, the meta-vehicle model of heat has clear connections to its four laws, and even suggests a fifth. It suggests that heat is the result of rotation and push transference within a material, causing heat exchange (0th law) through proximal increases in the activity of stable sources. In addition, rotation and push transference leads to the production of novel, material-dependent momentum mode of which heat is one type. Energy, this larger body of novel momentum mode, does not change form (1st law) inasmuch as it manifests in a variety of categorical ways in different mediums. Heat is dissipative (2nd law) because the mechanism for its transference is boundary-dependent; it is hidden by its lack of measurable effect on unresolved mode. Absolute zero (3rd law) is unattainable because the requisite loss of momentum mode would collapse even the possibility of extant matter.

Interestingly, a corresponding upper thermodynamic limit has never been named. This model suggests special relativity as this upper limit. $E = MC$, where C is the speed of light, describes obliteration of the cosmological coherence underlying the organization of the universe (proposed 4th law). The momentum chaos resulting from resolved matter traveling at the speed of light would cause a critical loss of position mode and thereby the collapse of form itself.

Because of their lack of sub-mode the nonzero pressures of the coherence vehicles cannot resolve each other directly. Energy densities cannot overlap, but cosmological pressures can. Any interference is indirect, through opposition among and within materials being acted on by both tendencies simultaneously. Increased collisions give rise to a whole body of dynamic phenomena such as friction and convection.

This is important to the understanding of the role of the gathering and dispersing vehicles in the emergence of existence. The meta-vehicles demonstrate that the nature of change itself is, most essentially, a balance struck between the various permutations of gathering and dispersing tendencies. These cosmological vehicles carry change through time and space with respect to local dynamics because they both create and challenge stability differentials.

The emergent properties of complex existence depend on this layering and embedding of action (and thus inaction on other levels). This model holds that source integration and distinguishability can account for the complex behavior and characteristics we have come to associate not only with physical existence but also with reality (the perception of existence).

Phenomenology

With the specific, revised view of matter as stable, scaled, dense manifestations of cosmological coherence expression we can begin to account for physical phenomena, or meta-behaviors, that seem farther removed from theoretical physics and cosmology. The abstract realm of the underlying non-linear coherence seems far removed from “reality”, but with the physico-cosmic model the ties become more visible.

A full discussion of the emergence from cosmological coherence of all complex material existence would be impossible in the context of a seminal work such as this, but I believe it to be possible. Ties to phase states, color, transparency, acid/base balance, and proton gradients are a few that will be suggested here.

At the cusp of form where form-coherence interaction is strongest, the following novel information is observable: in the case of complete but transient resolution, a photon results and is absorbed or reflected. In an example of what might be called partial resolution, redirection and re-amplification of momentum mode yield depth and color. Momentum mode that travels unresolved (or without a persistent phase shift) through a resolved material form results in transparency.

It is hypothesized that collections of particles can release dispersing vehicle without dissociating but that with the local accumulation of sufficient movement resolved material can dissociate (unresolve), releasing dense positive pressure, or light. This is one clear mechanism for illumination.

Entities that have the same density as their local environment and no other physical constraints can exist within a gathering meta-vehicle at a sub-critical level and thus can defy gravity (e.g. gases, clouds).

The physico-cosmic model integrates the fact that unresolved mode also interacts with form at locations other than its cusp. Naturally, the question is begged with the example of transparency: how is it possible for anything, even unresolved mode expression, to travel stably through solid matter? Collections of matter, even solid matter, are made “permeable” by the dynamic scaling behaviors that occur on the smallest levels of stable form on up. For example, when unresolved mode enters matter that has spacing complementary to its own unresolved parameters, the mode not only has the potential to pass through unaffected, but also has the potential to become trapped within stable form – a phenomenon I call embedded mode. The activity of embedded mode can enhance the form’s stability or disrupt it.

Hydrogen ions are embedded position mode. Consider the fact that “free hydrogen” does not occur, but lone hydrogen does easily exist within liquids. The path to resolution of position mode is the source of the acid/base relationship that is central to so much of chemistry. This perspective suggests that the action of acids is degraded by momentum mode (in the form of light or heat/dispersing vehicle) in addition to all negative ions, while bases are characterized by the search by asymmetrical form (e.g. OH-) for position mode,

resolved or unresolved, by which to increase the stability of its source. Bases are thereby “neutralized” by hydrogen ions (or other complementary elements or molecules).

Unresolved, virtually resolved and embedded mode and its associated sub-mode and vehicle imbue matter with critical interstitial activity. For example, the arrangement of collections of particles in a way that creates channels for the movement of unresolved explains phenomena such as electricity and proton gradients. As this theory eliminates electrons, electricity is defined as the propagation, discharge, and storage of virtually resolved momentum mode via a collection of particles capable of eliciting such patterning (e.g. transition metals). On the other hand, patterned by its membrane-bound facilitators, the “proton” gradient characteristic of cellular respiration reflects the regular generation and displacement of embedded hydrogen.

A major obstacle in explaining phenomenological order of natural systems has been accounting for the apparent violation of the 2nd law of thermodynamics. By uncovering the fact that the 2nd law only takes into account the propagation of change through resolved material and does not attempt to account for its behavior in unresolved space, this non-linear, behavior-based cosmological coherence opens the possibility that the 2nd law need not be violated in living systems. Natural systems are coherent in nature, but not because they are “solid” or “closed,” so the 2nd law need not be violated.

Mass and Energy

The limitations of current theorealities have confounded the accurate characterization of the two quite useful, though sometimes irresponsibly managed, physical interpretation applied to existence – energy and mass. Despite the mandate of mass-energy parallax first demonstrated by $E = MC^2$ and its applications, the question has remained: what is the mode through which energy and mass infuse each other?

The infused nature of mass and energy is attributable to the connectedness and context sensitivity of stable collections of particles and the factors that confer stability. Specifically, a nonlinear cosmological coherence suggests that mass and energy are structural iterations of momentum and position mode parameterization with particle resolution level or size determining the scale. Unresolved mode is void of energy and mass, instead indefinitely perpetuating non-zero energy densities.

Single, unlinked particles do exhibit mass and energy but, given their tight boundaries and openness to displacement by unresolved mode expression, considerable instability is required to release the mass and energy of elemental/nuclear form. Moreover, the physico-cosmic model suggests that the instability necessary to release particulate energy and mass would force dissociation of the very momentum and position parameterization required for its materialization in the first place. This is why the massive amounts of power accessed through nuclear reactions are the exception not the rule.

A transformation takes place when we address how a key factor – C^2 – fits into the relationship between mass and energy. This connection was hinted at earlier in the section on heat. There it was concluded that $E=MC^2$ represents an upper thermodynamic threshold. But that conclusion was corollary to an even more fundamental analysis of special relativity. In that analysis, C^2 represents the *boundary of certainty* for a given system. (Recall the concept of rush to resolve the uncertainty of the mode and sub-mode expression.) Because energy and mass measurements can be made on a range of scales, C^2 captures the dynamic aspect of a multi-dimensional “segment” of the universe (closed system), actual or just possible, whose “midpoint” is the iterative stable center of the system under evaluation.

In this sense, mass can be seen as the expression or assessment of system redundancy and is manifest by naturally or artificially inducing or analyzing closure of the stable expressions of mode, vehicle, and particle within a (coherently) heterogeneous local environment. Energy is thus the scale by which we measure manifestations of system novelty. It is reflective of the naturally or artificially imposed cycles of change on the otherwise stable expressions of mode, vehicle, and particle within a heterogeneous local environment.

Discussion

Of the known obstacles to an integrated physical theory, some are real – based in the complexities of physical existence itself; and some are artificial – based on complexities of purely self-conscious (in the sense of C. Alexander [9]) construction. An example of an artificial barrier in physics theory is mathematics. Mathematical formalism is not a part of the work at hand because while computational mathematics searches for definable equivalencies, solutions, and stopping points of one kind and another, perhaps even in multiple permutations, the universe, on scales and in dimensions we can barely comprehend in their minute randomness, never stops computing. We still do not know of an absolute value for pi, yet circular-functioning phenomena operate with complete ease in the universe.

An example of a real barrier to an integrated view of physics and cosmology is minute randomness itself. This barrier is also at the core of the “perception problem” that vexes physical theory.[10] At the most fundamental level, minute randomness precludes the direct measurement of the very “objects” we invent to explain that-which-is-measurable. The views presented here suggest that minute randomness is not chaotic and disconnected from physical structure but an integrated part of it. The proposed cosmological coherence suggests a cosmos that is potentiated to self-organize through specific and non-linearly interconnected modes of expression.

Yet rather than being seen as an essential component to the emergence of physical structure in the universe, minute randomness has been treated by modern physics as an inconvenience. Discussions of minute randomness have largely been relegated to a sub-category of physical theory specifying limits to physical knowledge based on the concept of uncertainty. For example, Heisenberg’s Uncertainty Principle describes how our lack of knowledge of initial direction creates an inherent uncertainty in the measurement of things. So far this limitation has been workable, if not frustrating.[11] In addition, Planck’s constant was created as a “fudge factor” for the application of physical laws to scales of the imperceptibly small.

Uncertainty adjustments have been effective in making current theory workable, but they also hide the possible role of a cosmological coherence in the manifestation of a structure and order in the universe. It is clear that the universe operates at levels of speed and minuteness well beyond the ability of direct measurement to capture, but to simply quantify that limit and ignore the very sources of uncertainty in favor of measurable abstractions is to miss the “bigger picture”. Does the physico-cosmic model purport to eliminate uncertainty? Absolutely not. But it does effectively demonstrate how not only uncertainty but certainty as well extends into the realm of unobservable, immeasurable reality and thereby provides a stable base for the manifestation of physical existence.

References and Endnotes

- [1] The stark demarcation between meta-physics and physics must be questioned. Consider the following parallel: just as theologians cannot explain the inexplicable, physicists cannot perceive the imperceptible.
- [2] Indirect support of this assumption is derived from conclusions such as those drawn in Bilal, A. DLCQ of M-theory as the light-like limit. *Phys. Lett. B* 435, 312-318 (1998).
- [3] Given the limitation of mode interactions to center and instant center (yielding radius), a particle assumes the dimensions of a sphere because a sphere is the only shape that is adaptive in multiple dimensions given two points. See: Critchlow, K. Order in Space (Thames & Hudson, New York, 1969).
- [4] Liu, C. Dutton, Z. Behroozi, C.H., Vestergaard Hau, L. Observation of coherent optical information storage in an atomic medium using halted light pulses. *Nature* 25, 490-493 (2001).
- [5] A partial merging of pressures is possible, but some amount of pressure is hypothesized to remain after dense resolution.
- [6] Similar to divalence, hydrogen bonding results from the patterned virtual resolution – and subtle foreshortening – of the same momentum mode (and dispersing vehicle) when faced with stable but active, asymmetric collection of particles that contains prominent hydrogen.
- [7] Popular science writers and audiences are fascinated with scaling, producing and buying book after book that show real examples from nature.
- [8] Throughout, when the prefix “meta” is used it indicates the application of non-linear scaling to the modified word and related concept.
- [9] Alexander, C. Notes on the Synthesis of Form (Harvard University Press, Boston, MA, 1964).
- [10] Within the context of the physico-cosmic model, it is possible to conclude that the same barrier that precludes direct progress in physics theory makes the universe functionally reducible. The cosmological coherence is an ocean encircling each island of natural or imposed phase space, making it separate but allowing for connection by common means.
- [11] Solutions to and appraisals of imperceptibles and change, largely through the development of fuzzy theory and, on a cosmological scale, through string/M-theory, though powerful, remain incomplete.