

An Introduction to the Papers

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Abstract

Because the papers themselves can be difficult for the uninitiated, in spite of my efforts to make them simple and clear, I have written a series of introductory papers designed as a guide to assist the interested reader in working through them. I will try to bring out the main points of the paper, its relation to the remaining body of work, and perhaps make a few comments on its history and structure. There is almost no mathematics in these papers; for the most part, the papers deal only with conservation principles, although of course I make reference to the mathematical theories which provide the formal basis for the conceptual synthesis of this work (Noether's theorem, Einstein's "Interval" and energy relations, the 1st and 2nd laws of thermodynamics, etc.).

Section I: Unification Theory - "Scientific" Section

(revised Sept., 2010)

(See also: Section 9: "[Symmetry: Noether's Theorem and Einstein's Interval](#)"; Section 10: "[Conservation](#)"; Section 13: "[The Sun Archetype](#)")

Paper:

[Symmetry Principles of the Unified Field Theory \(a "Theory of Everything"\) - Part I](#)

[Symmetry Principles of the Unified Field Theory \(a "Theory of Everything"\) - Part 2](#)

[Symmetry Principles of the Unified Field Theory \(a "Theory of Everything"\) - Summary](#)

Introduction

This is the "flagship" paper of the "scientific" unification section. It is one of my oldest papers and consequently has been reworked many times. The first version was written about 1982. When I revise a paper, I generally throw away the old version. Eventually, I often do not know either when the first version of a paper was written, or what was in it. This is also one of the longest papers, as I try to say something about everything. An earlier version of this paper was submitted to the Archives of Physics on 4 July 2000 (and has been updated many times since).

The first thing to note about this paper is its peculiar organizational format; it is written in sections which correspond to the rows and columns of a 4x4 table of "[Forces and Energy States](#)". Hence it is a good idea to look at the table and actually print it out for ready reference while reading this paper. This 4x4 "matrix" or "tabular" form of the theory is its earliest form, and remains particularly useful for organizing and sorting out the detail of the theory. In some ways it is like the Periodic Table of the Elements in its organizing function, and like that classical table, the very act of organizing the data in

a nontrivial manner carries with it a certain degree of information and explanatory power. In this regard it is important to note that the tabular sequence of horizontal forces and vertical energy states follows a purposeful order.

Columns

The four forces of physics head the vertical columns of the table. The first force is electromagnetic energy, the primal energy form of our Universe. That is followed by the dimensional forces of spacetime - inertia and gravitation. The logic here is that free electromagnetic energy (which I often refer to as simply "light") actually creates spacetime (as an energy-conserving metric or regulatory domain) by its [intrinsic \(entropic\) motion](#). Moreover, as a matter of General Systems organizational principle, I wish to keep the long-range "spacetime" force pair separate from the short-range "particle" force pair. The third force is the strong force, the primary source of quarks and of all massive forms of bound energy. Here we envision the creation of symmetric pairs of particles and antiparticles by the interaction of highly energetic light with the metric structure of spacetime in the very early moments of the "Big Bang". The fourth force is the weak force, responsible for breaking the symmetry of the particle-antiparticle pairs formed in column three, and by this action plunging the Universe into the asymmetric state of matter, time, and charge we are all familiar with. (The actual mechanism of particle formation and symmetry-breaking remains unknown, but possibly involves the "Higgs" boson, "leptoquarks", and the "X" Intermediate Vector Boson.) (See: "[The Particle Table](#)"; and: "[The Higgs Boson and the Weak Force IVBs](#)"; and: "[The Origin of Matter and Information](#)".)

Hence the columns of the table tell the story of creation in terms of the sequential action of the four forces. These forces are moreover organized in two pairs: 1) the long-range or "[spacetime forces](#)", electromagnetism and gravitation; 2) the short-range or "[particle forces](#)", the strong and weak forces of atomic matter.

Rows

The four horizontal rows of the table are likewise ordered in a purposeful sequence, consisting of four states of energy. The first row represents free energy (light) as expressed in the various modes of the 4 forces (see above). The second row is bound energy, "mass-matter", derived from the symmetry-breaking action of the weak force in cell 4 of row 1, again as expressed in various modes appropriate to the 4 forces. Row 2 therefore represents the conservation of the raw energy of row 1 in terms of the mass and momentum of particulate and atomic matter. Row 3 represents "charge"; these are the charges appropriate to each of the 4 forces as carried by the massive particles of row 2. These charges represent *the symmetry debts of light*, and are conservation consequences of the breaking of the symmetric energy state of light by the weak force in row 1, a conservation required by "Noether's Theorem". Hence row 3 represents *symmetry conservation* (via charge conservation and inertial forces) while row 2 represents *raw energy conservation* (via mass and momentum). Row 4 represents the "forces" generated by the charges of row 3 as they act to return the material system to its original symmetric state of light, fulfilling Noether's conservation theorem (and hence "paying" (discharging) the symmetry debts represented by their conserved charges). Row 4 therefore repeats row 1 (in terms of forces), but whereas in row 1 we see the forces in their creative modes (producing matter), in row 4 we see the same forces in their destructive modes, annihilating and returning matter to its original and more symmetric form, light. Hence the table represents a completed conservation circle, beginning and ending with a perfectly symmetric energy form, light.

To reprise the vertical sequence of rows: symmetric light interacts with a spatial conservation metric (of its own creation), producing symmetric particle-antiparticle pairs whose symmetry is broken by the weak force during the early moments of the "Big Bang" (this is the original wave-particle duality of

light, expressing the potential of electromagnetic energy to exist in two related forms, light and matter, or free and bound electromagnetic energy: $h\nu = mc^2$). These particles (quarks and leptons) conserve the raw energy of light in their mass and momentum, and in addition bear conserved charges - charges which generate forces acting to return the asymmetric material system to its original symmetric immaterial state (light). The forces therefore exist to pay the symmetry debts of free energy represented by the conserved charges of matter, in obedience to "Noether's Theorem": charge conservation = symmetry conservation. *The charges of matter are the symmetry debts of light.* The invariance of charge, as required by charge and symmetry conservation, is the key to understanding the "local" compensating activities of the forces ("local gauge symmetry currents") - magnetism, time, quark confinement, IVB mass, etc.). The four final energy states are described in terms of the actions (produced by the field vectors) of each of the 4 forces. In cybernetic terms, the rows are ordered as "input" (energy, row 1), "thruput" (conservation of raw energy and symmetry, rows 2 and 3), and "output" (system resolution and symmetry debt payments, row 4).

The Unified Matrix

The 4x4 matrix is a "well ordered" system (in the sense of ordered data sets such as the Periodic Table of the Elements), which tells the story of the creation of matter horizontally, and the return of matter to its symmetric origin in light vertically. The matrix essentially plots the various symmetry debts of light (horizontally) against the conservation modes of light (vertically) - it is a "light crystal" telling the story of the devolution and evolution of free energy in the Cosmos. This is why the 4x4 matrix is such a special and valuable form, why it is ordered in this particular way, and why it can give us so much information.

The program of unification consists of the identification of light's symmetry debts as held by matter in the form of conserved charges - one charge and symmetry debt corresponding to each of the four forces. Each charge is identified in terms of a specific broken symmetry of light which it represents, carries, and conserves. Unification subsists in tracing all the forces back to their common origin as (broken) symmetries of light (including gravity).

The unification of the forces, however, is not the whole story of the Cosmos, nor indeed, of unification. In addition to the four forces, there is a deeper layer of conservation law which regulates and orchestrates the activity of the forces within an evolving universe. Four major conservation principles and their corollaries relating the forces to each other and governing their activity are discussed in this and other papers. These four principles are: 1) The Conservation of Energy; 2) The Conservation of Symmetry; 3) Entropy; 4) Causality (the Law of Cause and Effect - "Karma"). The interrelationship of these 4 conservation principles and corollaries constitutes a further expression of unification, at a level of abstraction, generality, and significance anterior to the four forces, and is extensively discussed in the section on the [Tetrahedron Models](#) of the conservation laws of energy. (See also: "[The Tetrahedron Model](#)".)

Finally, any unification model must address the phenomenon of life and the evolution of information systems. To this end the overall 4x4 form of the [force unification table](#) is specifically directed: this form is part and parcel of the fractal series of forces and energy states which make up our Universe, as discussed in the section on the "[Fractal Organization of Nature](#)". Hence the [force unification table](#), by virtue of its 4x4 fractal form, is embedded in the organizational structure and dynamic of the wider Universe, indeed forming the base of the fractal series as the "prime iteration" and motivator of the cosmic fractal algorithm, the fundamental note, frequency, or vibration of a resonant universal harmonic, a distinction which confirms our expectation for the essential role of the Unified Field Theory.

Connections Between the "Tetrahedron Model" and the "Standard Model"

I see now (after 33 years' work) that most of my effort toward unification has been concentrated on the "rebound" or evolutionary phase of the Universe, as we find it today, driven by gravitation, entropy, symmetry conservation, and biological evolution, simultaneously building complex structures while returning asymmetric matter to its original symmetric state, light. Conversely, most of the effort of the physics "establishment" toward unification has been concentrated on the ["cascade" or devolutionary phase of the Universe](#), the stepwise descent from the perfect symmetry of the Multiverse and Planck scale unity, as the forces decoupled from one another in an entropy-driven rush toward our familiar electromagnetic "ground" state. The electromagnetic "ground" state is the common domain from which both unification efforts began, but I worked my way forward in time toward the ultimate macroscopic symmetry of the "Big Crunch", while the "establishment" worked backward in time toward the ultimate microscopic symmetry of the "Big Bang". My symmetries are (mostly) conceptual, involving the long-range forces and the macro-world, theirs are (mostly) mathematical, involving the short-range forces and the micro-world. The two systems are neatly joined by the synthetic power of General Systems, both expressed in a 4x3 and 4x4 matrix format. (See: [The 'Tetrahedron Model' vs the 'Standard Model' of Physics: A Comparison](#) ".)

I explore the General System form of the micro-world, the "Big Bang", and the full energy spectrum of the weak force in the "[Higgs Cascade](#)" papers. The macro-world is modeled in a General Systems format in such papers as "[The Information Pathway](#)", "[The Fractal Organization of Nature](#)", and "[Nature's Fractal Pathway](#)". Humanity's role in all this is considered in "[The Human Connection](#)". The general principles of physical law which underlie all our unification models, whether conceptual, mathematical, macro, or micro, are explored (also in a General Systems format) in the papers "[Symmetry Principles of the Unified Field Theory](#)" and "[A Tetrahedron Model](#)". The interaction between "non-local" light and "local" matter is considered in the "[Global vs Local Gauge Symmetry](#)" series of papers, which also suggest connections between my work and "establishment" unification models (through the common theme of charge invariance and "local gauge symmetry currents"). The joining of both micro- and macro-unification models within a common General Systems 4x4 format illustrates once again the synthetic power of General Systems, as well as the great value of investigating a common problem from more than one perspective.

Links:

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[\(Postscript and Commentary on paper above\)](#)

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