E8 Integrated with Binary, Octonions, Particles, Wolfram’s New Kind of Science (NKS), and the Periodic Table of Elements
E8 Number Indexed by Clifford/Pascal Order

Octonion triads-fPi=11 Sign mask=1 Hex=00 R fp_sm=1

Flipped

{(1, 2, 4), (1, 3, 7), (1, 5, 6),
 (2, 3, 5), (2, 6, 7), (3, 4, 6), (4, 5, 7)}
HoffmanSingleton (Yellow)

Octonion triads-fPi=12 Sign mask=1 Hex=03 R fp_sm=4

Not Flipped

{(1, 4, 2), (1, 7, 3), (1, 5, 6),
 (2, 3, 6), (2, 5, 7), (3, 4, 5), (4, 6, 7)}
Coxeter (Cyan)

6/11/2013
E8 Algebra Root/Weight/Height

Octonion triads-fPi=11 Sign mask=1 Hex=00 R fp_sm=1
{(1, 2, 4), (1, 3, 7), (1, 5, 6),
(2, 3, 5), (2, 6, 7), (3, 4, 6), (4, 5, 7)}
HoffmanSingleton (Yellow)

Octonion triads-fPi=12 Sign mask=1 Hex=03 R fp_sm=4
{(1, 4, 2), (1, 7, 3), (1, 5, 6),
(2, 3, 6), (2, 5, 7), (3, 4, 5), (4, 6, 7)}
Coxeter (Cyan)

Flattened triad/mask bits
{1, 4, 2, 3, 5, 6, 7}  
{1, 1, 0, 0, 0, 0, 0}
Binary/E8/Physics
8 Dimensional Vertex Location

Octonion triads-fP=11 Sign mask=1 Hex=00 R fp_sm=1
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HoffmanSingleton (Yellow)

Octonion triads-fP=12 Sign mask=1 Hex=03 R fp_sm=4
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(2, 3, 6), (2, 5, 7), (3, 4, 5), (4, 6, 7)
Coxeter (Cyan)
Wolfram’s NKS Cellular Automata (CA)

Octonion triads-fpi=11 Sign mask=1 Hex=00 R fp_sm=1

\{(1, 2, 4), (1, 3, 7), (1, 5, 6),
(2, 3, 5), (2, 6, 7), (3, 4, 6), (4, 5, 7)\}

HoffmanSingleton (Yellow)

Octonion triads-fpi=12 Sign mask=1 Hex=03 R fp_sm=4

\{(1, 4, 2), (1, 7, 3), (1, 5, 6),
(2, 3, 6), (2, 5, 7), (3, 4, 5), (4, 6, 7)\}

Coxeter (Cyan)
### Periodic Table
#### Element & Structure

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**Multiplication Table**

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6/11/2013
Octonion Fano Plane, Cubic, & Multiplication Table

Octonion triads-\( fP1=11 \) Sign mask=1 Hex=00 \( R_{fp.sm}=1 \)

\[
\{ (1, 2, 4), (1, 3, 7), (1, 5, 6), \\
(2, 3, 5), (2, 6, 7), (3, 4, 6), (4, 5, 7) \}
\]

HoffmanSingleton (Yellow)

Octonion triads-\( fP1=12 \) Sign mask=1 Hex=03 \( R_{fp.sm}=4 \)

\[
\{ (1, 4, 2), (1, 7, 3), (1, 5, 6), \\
(2, 3, 6), (2, 5, 7), (3, 4, 5), (4, 6, 7) \}
\]

Coxeter (Cyan)
E8, Binary and the Pascal Triangle

Octonion triads-fPl=12 Sign mask=1 Hex=03 R fp_sm=4
{(1, 4, 2), (1, 7, 3), (1, 5, 6), (2, 3, 6), (2, 5, 7), (3, 4, 5), (4, 6, 7)}
Coxeter (Cyan)

Flattened triad/mask bits
{(1, 4, 2, 7, 5, 6)}
{(1, 1, 0, 0, 0, 0, 0)}
E8 and the Lisi extended Standard Model (eSM) Particle Assignments
Bitwise
Quantum
Particle
Assignments
E8 Algebra
Roots (+/- 120)
E8 Roots to Chemical Elements
(- are “Anti-Elements”)
Assignment of 256 to NKS CA
Quantum Particle Symmetries of Octonions
28 Octonion Fano Plane Triangles

28 Trott Quartic and Dual Curve Bitangents

Electron Orbital Probability Density Legendre Functions
Quantum Particle Symmetries (pType and Gen)
Quantum Particle Symmetries (Anti)
Quantum Particle Symmetries (Color)
Quantum Particle Symmetries (Spin)
MyToE model
Theoretical and Experimental Mass/Lifetime

A More Natural Reference Model
Integrating Relativity and Quantum Mechanics

J. Gregory Meerson

Dated: Original — April 15, 1997
Corrected — November 22, 1997

M Theory and/or Loop Quantum Gravity hold the promise of resolving the conflict between general relativity and quantum mechanics but lack experimental connections to predictability in physics. A connection is made to these and other theories for the title of a "Theory of Everything" by questioning the value of the traditional Planck unit reference point for the scales at which they operate. It also suggests a cosmological model which has acceleration as being fundamental. It provides for an intuitive understanding of the Standard Model and its relationship to particle masses and the structure of the atom. The prediction of particle mass and lifetimes is a good indicator for its validity.

PACS number: 04.65, 04.20. — q, 11.25. — v, 11.27. — r, 12.10. — c, 13.10. — 0, 95.30. — s, 95.35. — s, 95.75. — w, 95.85. — k.

Keywords: M Theory, LQG, ES, Quantum Mechanics, Relativity, Cosmology, Standard Model, CKM

I. INTRODUCTION

This paper will present a new "more natural" reference model for integrating General Relativity (GR) and Quantum Mechanics (QM) by contrasting it with the development of a reference model based on the more traditional Planck units. The new unit of measure (UnM) is based on the non-linear expansion or acceleration of the universe [1]. It provides a testable framework for particle mass prediction in support of the Standard Model (SM) as well as M Theory (MTh), Loop Quantum Gravity (LQG) and A. Garret Liu's recent "An Exceptionally Simple Theory of Everything (esToE)" based on an ES Lie Group Theory [2].

The fact that the universe is found to be accelerating indicates that an exponential model which accommodates this acceleration could be more natural than the traditional linear model. The key to defining this new model relies on deriving "units" as the center of scales for length (L), time (T), mass (M), and charge (Q) that are exponentially expanding.

Grand Unified Theories (GUTs) hold in high regard the Planck scale for its natural proximity to the unification energies. This scale is set by setting the fundamental parameters of the velocity of light (c), Planck's constant (h), and Newton's Constant (G) to unity. Planck units are derived by combining powers of these constants into their dimensions of L, T, M, and Q. In terms of space-time, it seems to identify a possible lower limit to the length scale at one unit Planck length (l_p = \sqrt{Gh^4/8\pi^3}).

Cosmological models logically define an upper limit based on the age and extent of the universe. In addition to an upper and lower limit (e.g. infinity (\infty) and zero=1/\infty respectively), an exponential model should identify a center (unity) in order to be well defined. In physics, the upper limit is naturally thought to be indicated by the macro world of G and GR. The lower limit is the micro world of h and QM. Fortunately, it is at home in both the micro and macro worlds. In the Planck unit model, the expansion between unity and zero is where GR and QM require the "new physics" beyond SM. As a reference model for scaling the universe, it offers no direct prescription for phenomena associated with atomic scales; therefore, using Planck units as a reference frame for the "center" of an exponentially scaling model seems counter-intuitive.

A new model is offered that uses some general approach in defining natural dimensions but with interesting results achieved by associating with it two more fundamental parameters - the macro Hubble (H) and the micro fine structure (\alpha). This approach does not detract from the significance of the Planck scale and its associated theoretical frameworks, however, it adds a point of view that puts it properly at the micro edge of an accelerating universal expansion.

II. DEFINING THE NEW MODEL

Except for the Hubble parameter, the fundamental parameters of H, c, G, h, and \alpha are typically thought to be constant. A new model based on an accelerating universe is achieved by considering that all of these fundamental parameters vary with time t. It is also necessary to redefine the relationships between the measurable aspects or dimensions of our reality.

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[1] Measuring synchronous time variation of multiple fundamental constants is problematic due to the principle of covariance. Time variation per constant is \Delta t = 1.24x10^{-16}\times 10^{37}.
Binary, E8 and Physics Coordinates
E8 Lie Algebra
Root/Weight/Height and the Hasse Diagram
Chemical Element Quantum Numbers and the Stowe-Janet-Scerri Periodic Table with 3D Spherical Harmonic Electron Density Probability Contours
Octonion Triads and the Fano Plane
Fano Plane and Fano Cubic
### Fano Plane and Multiplication Table

**Octonion triads** = 11

- Sign mask = 1
- Hex = 00

**Flattened triad/mask bits**: 

1, 4, 2, 3, 7, 5, 6

**Not Flattened**

1, 4, 2, 7, 3, 5, 6

**HoffmanSingleton** (Yellow)

**Octonion triads** = 12

- Sign mask = 1
- Hex = 03

**Flattened triad/mask bits**: 

1, 4, 2, 7, 3, 5, 6

**Coxeter** (Cyan)

**Octonion triads** = 12

- Sign mask = 1
- Hex = 03

**Flattened triad/mask bits**: 

1, 1, 0, 0, 0, 0, 0

**Mult. Table**

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**Ref. Symbols**: 2D, 3D
Assigning flattened triads to the Fano Plane Mnemonic
Flattened Triad Procedure
“Flipped”

Fano Plane

nodes give 2 to 1 cover of E8
“Not Flipped” has the same Bitwise Quantum Particle assignment
Sign Mask
Triad Element
Reversal
Sign Mask
Triad Element
Reversal
E8 with Color-Shape-Size based on Lisi Particle Assignments
The Rhombic Triacontahedron, Zn-Mg-Ho QuasiCrystal Electron Diffractions
The H4 600 Cell, its dual the 120 Cell E8 folds to H4 at Golden Ratio Projection.
2D Projections

Not found in E8: 27, 28, & Prime factors above 8 {11, 13, 17, 19, 22, 23, 26, 29}
3D Platonic Solid Projections

3-Simplex = Tetrahedron

3-Cube

3-Orthoplex = Octahedron

Icosahedron

Rhombic Triacontahedron

Dodecahedron

6/11/2013
4D Perspective Projections

8-Cell=4-Cube=Tesseract (orthographically projects to a 3-Cube)

+ 

16-Cell=4-Orthoplex= 4-Cube dual (orthographically projects to an Octahedron)

= 

24-Cell

Not Found in E8: 600-Cell, 120-Cell
5D Perspective Projections

5-Cube = Penteract
(orthographically projects to a 3-Cube)

5D Projections

5-Orthoplex = 5-Cube dual
Orthographically projects to the Octahedron, facets contain 4-Simplex = 5-Cell
6D Perspective Projections

6-Cube=Hexeract
(orthographically projects to a 3-Cube)

6-Orthoplex=6-Cube dual
Orthographically projects to the Octahedron, facets contain 5-Simplex

6-Cube Projection using the Golden Ratio (orthographically projects to a Rhombic Triacontahedron)
7D Perspective Projections

7-Cube = Hepteteract (orthographically projects to a 3-Cube)

7D Projections

7-Orthoplex = 7-Cube dual
Orthographically projects to the Octahedron, facets contain 6-Simplex
8D Perspective Projections

E8 in 6-Cube Golden Ratio projection

Same as above in Orthographic Projection

8D Projections

8-Orthoplex=8-Cube dual
Orthographically projects to the Octahedron, facets contain 7-Simplex

Not Found in E8: 8-Cube, 8-Simplex