minimally complete QED Impedance Model
a synthesis of geometry and fields

Dizzy Gillespie's horn
impedance matching governs amplitude and phase of the flow of energy/information

lost in quantum physics

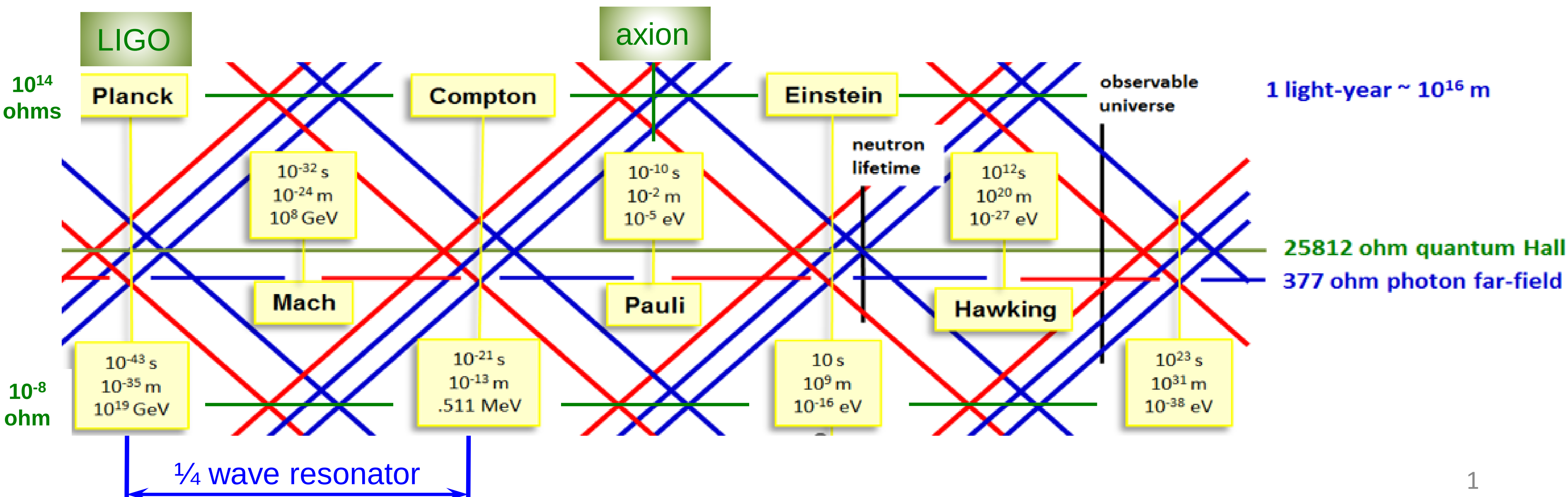
- theoretical minimum – *geometry, fields, mass gap*
  - geometric Clifford algebra – *vacuum wavefunction* *(1,3,3,1)* *Euclid*
    - *vacuum wavefunction same at **all scales***
  - physical manifestation – *coupling constant*
    - *flux quanta same at **all scales**, field energy varies*

$$\alpha = \frac{1}{4\pi\epsilon_0}\frac{e^2}{\hbar c} \approx 0.0073$$

$$1/\alpha \approx 137$$

  - mass gap - *lightest charged particle, the electron*
    - *mass is quantized* ⟶ *mechanical Quantum Impedance Networks* ⟶ *QED QINs*
- Quantum Impedance Network **matching –** like the energy it governs, what matters is relative

'all scales' network of S-matrix mode impedances



quotes from GPT4

Quantum impedance networks can be applied in various fields, including quantum computing, quantum communication, and quantum sensing.

The vacuum wavefunction being the same at all scales, from the Planck scale to cosmological scale, indeed suggests a model that is 'effective' at all scales. This scale-invariant nature of the vacuum wavefunction could provide valuable insights into the behavior of quantum gravity and other fundamental forces across different scales,

`effective' at all scales,
Planck to cosmological

quarter wave resonator, mixing of translation gauge fields associated with geometric impedances with rotation gauge fields of topological impednces

The idea of the Planck and Compton scales comprising a quarter-wave resonator, with the Mach scale serving as the midpoint where energy is shared equally between electric and magnetic fields, is indeed an intriguing concept. Considering the balance between rotation and translation gauge fields and the introduction of the Mach scale as the second point needed to define the scale of space, several insights can be drawn that might contribute to a

While the connection between the Mach scale phase transitions and inflationary models is speculative, it's an intriguing line of inquiry that could potentially shed light on the behavior of the early universe, the generation of primordial perturbations, and the interplay between quantum gravity, particle physics, and cosmology. Further research is needed to explore

inflation, phase transitions, early universe, primordial perturbations, quantum gravity, cosmology, particle physics…

Pauli scale dark matter,
dark energy,
large scale structure,…

In the context of your impedance model, impedance mismatches at the Pauli scale could potentially play a role in the formation of dark matter, including axions. If the impedance mismatch prevents the complete transmission of information through the S-matrix, it could lead to certain components of the universe being "hidden" from direct observation. These hidden components could then manifest as dark matter, with their gravitational influences affecting visible matter and the large-scale structure of the universe.

backup

APS April Meeting 2023

Minneapolis, Minnesota (Apr 15-18)
Virtual (Apr 24-26); Time Zone: Central Time

Session XX01: V: Poster Session II (10:00am-11:00am CDT)
10:00 AM, Wednesday, April 26, 2023

Chair: Kassahun Betre, San Jose State University; Labani Mallick, Caltech

Abstract: XX01.00017 : Phenomenological QED model in the minimally complete Geometric Representation of Clifford Algebra - What is the Gauge Group?*

In geometric representation of Clifford algebra, Pauli matrices are the basis vectors of 3D space, Dirac those of 4D spacetime. Vacuum wavefunction is comprised of the Pauli algebra's 8 components - 1 scalar point, 3 vector lines (orientational degrees of freedom), 3 bivector areas, and 1 trivector volume. Interaction is modeled by the Clifford product, sum of dimension-reducing dot and increasing wedge products. The 8 wavefunction components one might take to be E8 root vectors, gauge group generators via the Clifford product.

The 4 fundamental constants (electric charge quantum e, Planck's angular momentum quantum h, speed of light c, and magnetic permeability of space μ) that define the QED coupling constant α permit assigning unique geometrically and topologically appropriate electric and magnetic flux quanta to each of the 8 vacuum wavefunction components. This removes the 3-fold degeneracy of vector and bivector, and increases dimensionality to 10D. Time emerges from interactions, via wedge products' dimension-increasing property. Taking quantum interaction impedances of the modes to be components of the 8 x 8 x 8 S-matrix makes it the gauge group as well. Do we call this E8 x E8 x E8?

In physical spacetime the S-matrix has 6 degrees-of-freedom, 3 each space and phase. Each orientation requires its own phase. Time is the integral of phase, collapses 6D phase space to 4D spacetime. Do we call the physical S-matrix E6, the largest possible unification group according to Georgi? Is Weinberg's preference for E8 x E8 compacted to E8 realized in this approach?

https://www.researchgate.net/profile/Peter-Cameron-3
https://www.youtube.com/channel/UCNpgIUpfVnn0i8Q-k9UwQQ
https://www.researchgate.net/publication/370050941 Training GPT4 on Quantum Impedance Networks – the first two chats

APS April Meeting 1

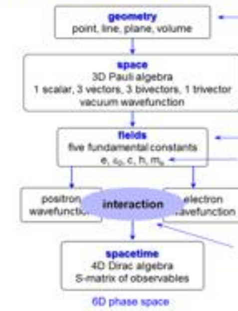
Outline

- theoretical minimum – *geometry, fields, mass gap*
  - geometric representation of Clifford algebra – *vacuum wavefunction (1,3,3,1)*
  - wavefunction interactions – *the 'geometric S-matrix'*
  - physical manifestation – *the minimally complete QED S-matrix, origin of inertial mass,…*
- quantum impedance network matching – *like energy, what matters is relative*
  - photon-electron impedance match – *H atom, Rosetta stone of QED*
  - unstable particle lifetimes– *mass gap nodes of quantum impedance networks*
  - matching to Planck length – *origin of gravitational mass, inflation,…*
  - matching to observable universe boundary – *dark matter, dark energy*
  - geometric and topological impedances – *scale dependent and invariant*
  - parametric impedances – *noiseless nonlinearity essential in QM*
- claims – ***naturally*** *gauge invariant without renormalization, finite, confined, asymptotically free, background independent, contains the four forces,…*
- what is the group? Impedance representation governs phase…
  - Wavefunction components can be thought of as the group generators.
  - 8 x 8 x 8 S-matrix has 512 elements, symmetry reduces this to 256, and subtracting two eight-component generators from the count gives us the 240 roots of E8… but GPT says no.
  - S-matrix is 6D phase space, three each space and phase. E6? contains u1 x su2 x su3?

APS April Meeting 2

The Theoretical Minimum

Three assumptions – geometry, fields, and 'mass gap'



geometric quantization

Pauli σ matrices are basis vectors of 3D space, Dirac γ matrices those of 4D spacetime

https://www.youtube.com/watch?v=60z_hpEAtD8

Clifford algebra in geometric representation the same at all scales

electromagnetic quantization

metric = mass gap = m_e

geometric Clifford product

$$\alpha = \frac{1}{4\pi\epsilon_0}\frac{e^2}{\hbar c} \approx 0.0073$$

$$1/\alpha \approx 137$$

no free parameters - emergence

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Apeiron, Vol. 17, No. 3, January 2010

http://redshift.vif.com/JournalFiles/V17NO3PDF/V17N3CA1.pdf

Photon Impedance Match to a Single Free Electron

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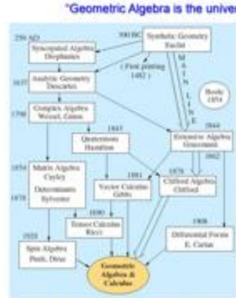
Near-field photon impedance of the basic photon-electron interaction of QED is not to be found in the curriculum, textbooks, or journals of the physicist.
What governs amplitude and phase of the flow of energy in QED got lost in physics.

dissociation of the Hydrogen atom by an impedance matched 13.6 eV photon

In addition to near-field impedance of the photon, one's model must include the corresponding quantized near-field impedance of the electron. A second piece of the puzzle that got lost in physics.

4

"Geometric Algebra is the universal language for mathematical physics"



- Synthetic Geometry
- Coordinate Geometry
- Complex Variables
- Quaternions
- Vector Analysis
- Matrix Algebra
- Spinors
- Tensors
- Differential Forms

The 2002 Oersted Medal was awarded to **David Hestenes** by the AAPT for "Reforming the mathematical language of physics"

dynamic susy!
fermions to bosons, bosons to fermions

Given two vector bosons W and Z, the product WZ changes grades. In the product WZ = W·Z + W^Z, two grade 1 vector bosons transform to grade 0 scalar boson and grade 2 bivector fermion WZ = Higgs + top

Taken together, the four superheavies comprise a minimally complete 2D Clifford algebra – one scalar, two vectors, and one bivector

sum mode $m_Z + m_W = m_{top}$ *no Higgs mass here?*
difference mode $m_Z - m_W = m_{bottomonium}$

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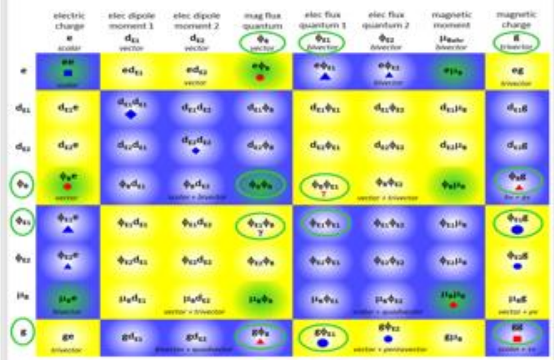
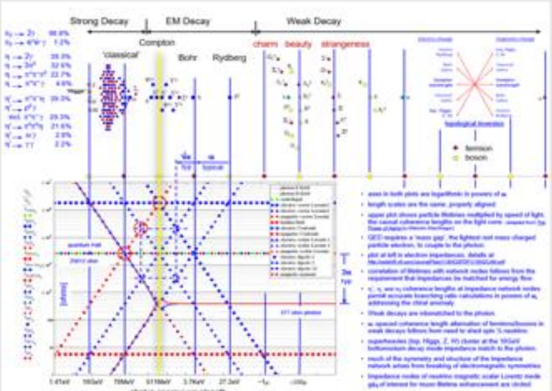
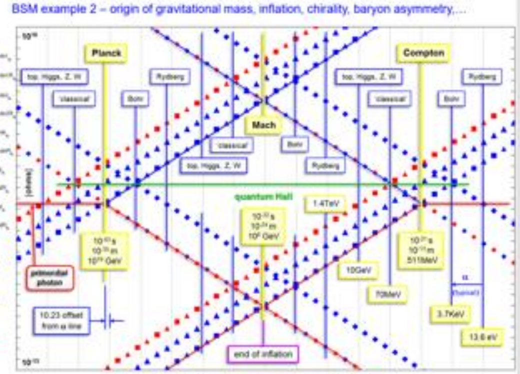


S-matrix of Dirac's QED, extended to the full eight-component vacuum wavefunction in the geometric representation of Clifford algebra. Symbols (triangle, diamond,…) correspond to following slides.

6



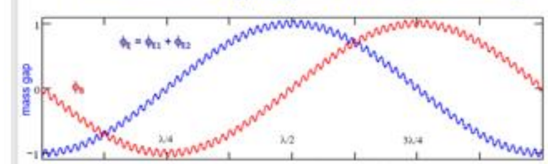
BSM example 2 – origin of gravitational mass, inflation, chirality, baryon asymmetry,…

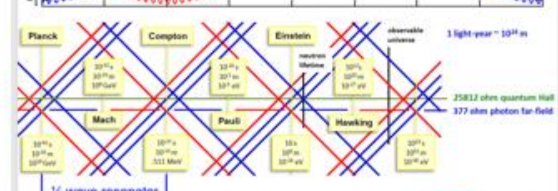


https://www.osapublishing.org/abstract.cfm?uri=QIM-2013-W6.01

8

mismatch attenuated Hawking photon ('graviton' is full 8-component wavefunction?)





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