TOPOLOGICAL GEOMETRODYNAMICS
p-Adic Physics

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p-Adic mass calculations

- **Mass calculations using p-adic thermodynamics for Virasoro generator L_0. Mass squared essentially thermal expectation value of the conformal weight (no problems with Lorentz invariance!). Quantization of p-adic temperature number theoretically when $\exp(-E/T)$ replaced with $p^{L_0/T}$, $T = 1/n$. Canonical identification maps p-adic mass squared to its real counterpart. Universal mass formula with real mass squared proportional to $1/p^n$.**

- **Reduction of fundamental length scales to number theory**. p-Adic length scale hypothesis: primes $p \sim 2^k$, k integer, preferred physically. Prime powers especially so, in particular Mersenne primes $M_n = 2^n - 1$ and Gaussian Mersennes $M^G_n = (1+i)^n - 1$.

- Charged leptons correspond to Mersennes or Gaussian Mersennes. e to M_{127}, μ to M^G_{113}, τ to M_{107}. Light quarks to M^G_{113}. Gluons to M_{107}, electroweak gauge bosons to M_{89}, graviton to M_{127}, the largest non-super-astronomical Mersenne.

- Reference: **p-Adic length scale hypothesis and dark matter hierarchy.**

Particle massivation by p-adic thermodynamics and Higgs mechanism

- Elementary particles as CP_2 **type vacuum extremals**: M^4 coordinates arbitrary functions of some CP_2 coordinate such that M^4 projection lightlike random curve. <u>Virasoro conditions</u>. More generally: partonic 3-surfaces lightlike. Super-conformal invariance.

- Lightlike randomness analogous to zitterbewegung. Gravitational momentum lightlike but changes direction. Inertial 4-momentum for a given space-time sheet as a time average of gravitational four-momentum. <u>p-Adic thermodynamics</u> describes the randomness.

- <u>Also Higgs needed to understand weak boson masses. Higgs as wormhole contact</u>: a piece of CP_2 type extremal connecting two space-time sheets with M^4 signature. Lightlike 3-surfaces associated with the contact carry fermionic and antifermionic quantum numbers and have opposite M^4 chiralities. Higgs contributes very little to fermionic masses. Couplings to fermions very weak: explains why Higgs not detected. Rate for Higgs production could be by a factor ~1/100 slower than in model.

Family replication phenomenon topologically

- Parton as 2-surface X^2 whose orbit is light-like 3-surface. **Handle number g of X^2, genus, labels particle families**. Topological mixing gives rise to CKM mixing. Thermodynanics in conformally invariant degrees of freedom contributes to particle mass. **Elementary particle vacuum functionals** which are **modular invariant**.

- **Why g>2 families experimentally absent?** Possible answer: **g≤2** surfaces always **hyper-elliptic** unlike **g>2** surfaces. g≤2 particles decouple from of g>2 particles in topology changing dynamics since the vacuum functionals for latter vanish for hyper-elliptic surfaces . g>2 particles dark matter?

- What about bosons? It seems that for gauge bosons maximal mixing of families occurs in p-adic thermodynamics. Possibly because p-adic temperature **T= ½** rather than **T=1** in modular degrees of freedom.

- Reference: **Construction of elementary particle vacuum functionals**

How to fuse real and p-adic physics together?

- **Generalization of number concept** by gluing of reals and **p-adics** along common rationals (algebraics for algebraic extensions of p-adics). Generalization of the notion of imbedding space by gluing real and p-adic imbedding spaces together along common rationals (algebraics).

- **p-Adic physics as physics of cognition of intention.** p-Adic space-time sheets correlates for intention and cognition. p-Adic-to-real transition corresponds to transformation of intention to action.

- Real space-time sheets possess effective p-adic topology: large number of common points with p-adic space-time sheet transforming in quantum jump to a real space-time sheet as intention becomes action! Only **zero energy ontology** (all states have vanishing conserved quantum numbers) makes possible these transitions!

- **Effective p-adic topology** justifies the use of p-adic thermodynamics in p-adic mass calculations.
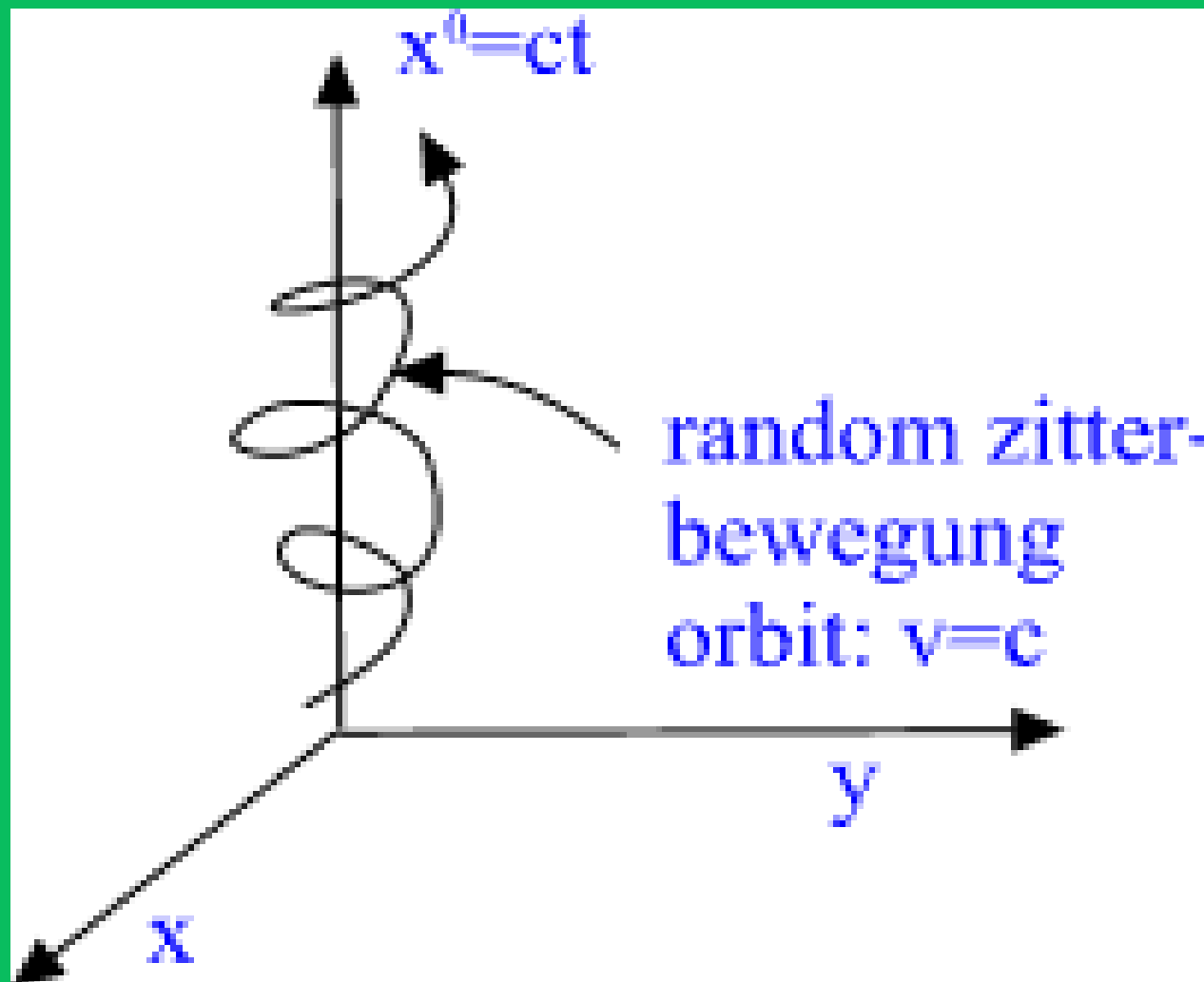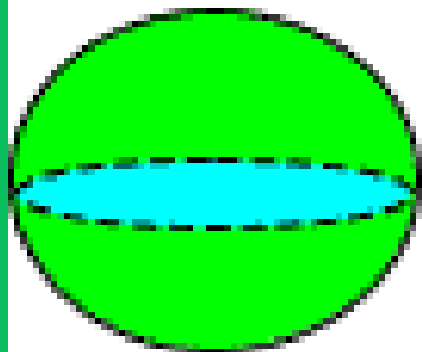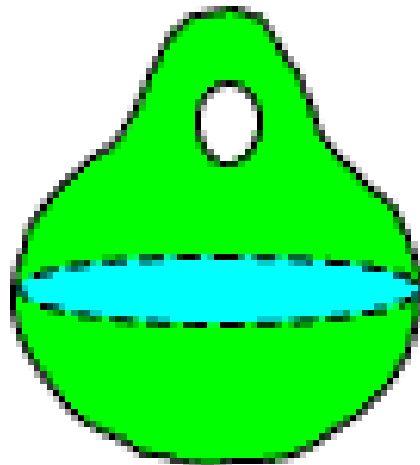
Higgs as a wormhole contact

Gauge boson
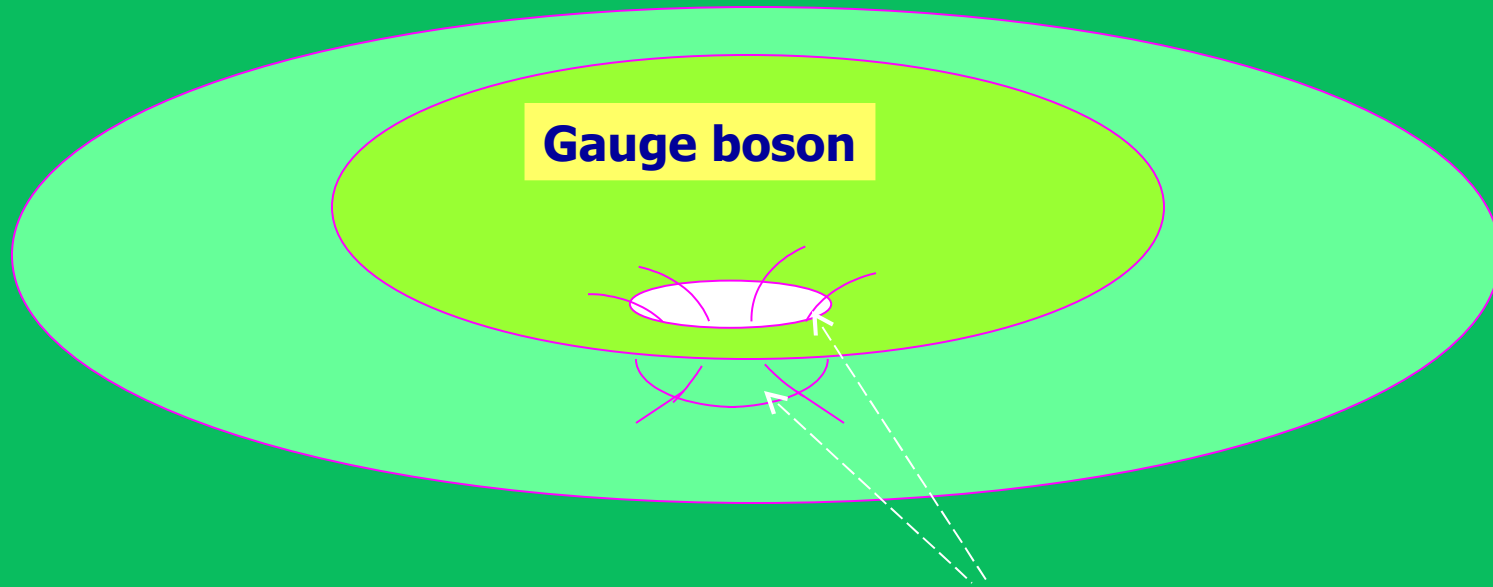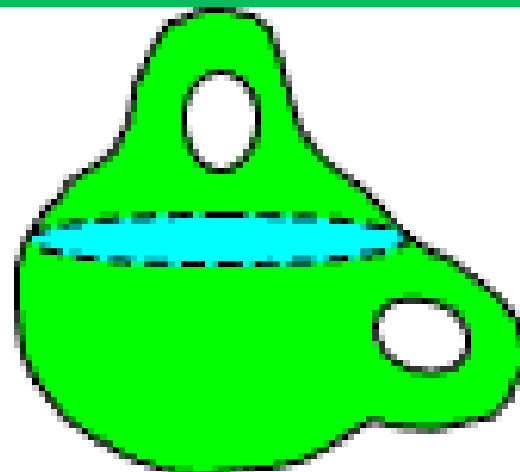
Partonic 2-surfaces acting carrying quantum numbers of fermion and antifermion with opposite M^4 chiralities.
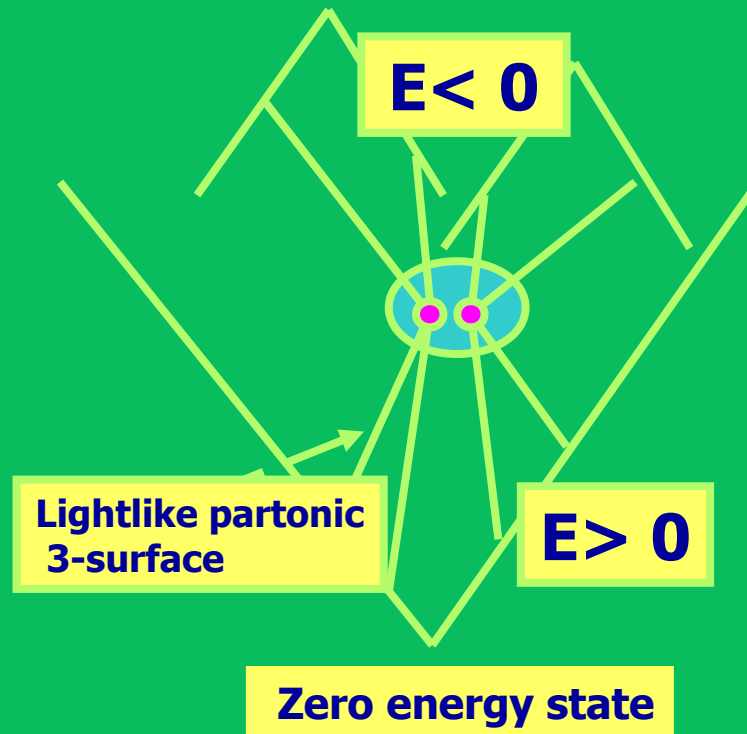
(e, ν_e)
(u, d)

(μ, ν_μ)
(c, s)

(τ, ν_τ)
(t, b)

S-matrix in zero energy ontology

E< 0

Lightlike partonic 3-surface

E> 0

Zero energy state

- Partonic 2-surface X^2 = <u>intersection of incoming lightlike partonic <u>4-surfaces (!)</u></u>. Note that their interiors do <u>not</u> intersect! Necessary for realizing quantum classical correspondence.

S-matrix unitary entanglement matrix: SS^Σ =Id, Tr(Id)=1.