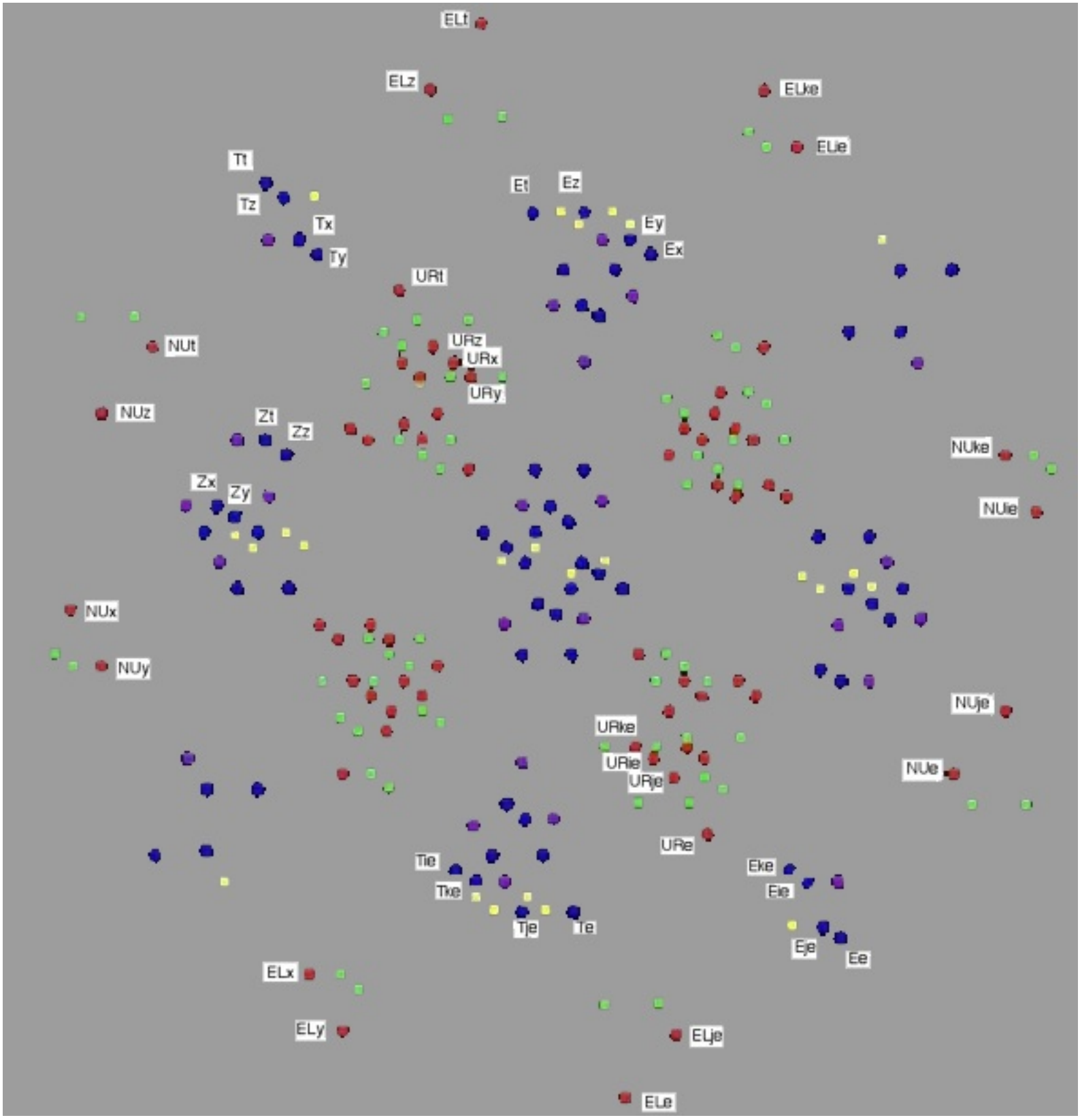
Physical Interpretations of E8 root vectors and 3 Generations of Fermion Particles and Anti-Particles



In my E8 physics model, 64 of the 240 E8 root vectors (blue in the image above) are represented by 64 = 8x8 = 8 dimensions of full 8-dim spacetime x 8 Dirac Gammmas

- The 8 dimensions of full 8-dim spacetime are denoted here by basis {t,x,y,z,e,ie,je,ke} (or sometimes with capital letters {T,X,Y,Z,E,IE,JE,KE})to indicate how it appears after dimensional reduction to get {t.x.y,z} is the basis for 4-dimensional physical spacetime and {e,ie, je,ke} is the basis for 4-dimensional CP2 internal symmetry space.
- The 8 Dirac Gammas are denoted here by basis {1,i,j,k,e,ie,je,ke}.

A second set of 64 of the 240 E8 root vectors (red in the image above) are represented by 64 = 8x8 = 8 half-spinor fundamental first-generation fermion particles x 8 Dirac Gammmas or, equivlalently, the 8 covariant components of the 8 fundamental first-generation fermion particles.The 8 fundamental first-generation fermion particles are denoted here by

- electron = EL
- red up quark = UR
- green up quark = UG
- blue up quark = UB
- red down quark = DR
- green down quark = DG
- blue down quark = DB
- electron neutrino = NU

Therefore, the 8x8 = 64 covariant components of the fundamental first-generation fermion particles are:

```
ELt  ELx  ELy  ELz  ELe  ELie  ELje  ELke
URt  URx  URy  URz  URe  URie  URje  URke
UGt  UGx  UGy  UGz  UGe  UGie  UGje  UGke
UBt  UBx  UBy  UBz  UBe  UBie  UBje  UBke
DRt  DRx  DRy  DRz  DRe  DRie  DRje  DRke
DGt  DGx  DGy  DGz  DGe  DGie  DGje  DGke
DBt  DBx  DBy  DBz  DBe  DBie  DBje  DBke
NUt  NUx  NUy  NUz  NUe  NUie  NUje  NUke
```

A third set of 64 of the 240 E8 root vectors (green in the image above) are represented by 64 = 8x8 = 8 half-spinor fundamental first-generation fermion anti-particles x 8 Dirac Gammmas that can be represented by notation similar to that of the second set of 64 (red in the image above).

The 3 sets of 64 of the 240 E8 root vectors (blue, red, and green in the image above) are related by triality. To try to reduce confusing clutter, only some of the blue (8-dim spacetime) and red (fundamental first-gemeration fermion particle) root vector vertices are explictly labelled. I hope that enough labelling has been done to clearly indicate how the remaining blue, red, and green vertices should be labelled.

As to the 24 yellow and 24 purple vertices, they represent the root vectors of two copies of D4 (one D4 for Gravity and another D4 for the Standard Model) that live within the Spin(16) inside E8, with structure

E8 / Spin(16) = 64 + 64

Spin(16) / D4xD4 = 64

The spinor fermion term of the full 8-dimensional Lagrangian of my E8 physics model is of the form

INTEGRAL over {t,x,y,z,e,ie,je,ke} of SPINOR {ELt ,ELx ,ELy ,ELz ,ELe ,ELie ,ELje ,ELke} ...(other fermions)

After dimensional reduction according to the Mayer Mechanism from a uniform octonionic 8-dimensional spacetime with basis

{t,x,y,z,e,ie,je,ke}

down to a quaternionic 4+4 = 8-dimensional Klauza-Klein spacetime with basis

{t,x,y,z} of physical spacetime plus {e,ie,je,ke} of internal symmetry space

the spinor term of the Lagrangian breaks down into the sum of four parts

1 - INTEGRAL over {t,x,y,z} of SPINOR {ELt ,ELx ,ELy ,ELz} ...(other fermions)

2 - INTEGRAL over {t,x,y,z} of SPINOR {ELe ,ELie ,ELje ,ELke} ...(other fermions)

3 - INTEGRAL over {e,ie,je,ke} of SPINOR {ELt ,ELx ,ELy ,ELz } ...(other fermions)

4 - INTEGRAL over {e,ie,je,ke} of SPINOR {ELe ,ELie ,ELje ,ELke} ...(other fermions)

First Generation

1 - is just the usual Standard Model spinor fermion term for 4-dim physical spacetime and first-

generation fermions, so 1 represents first-generation fermions. The 8 first-generation fermion particles and antiparticles each correspond to the 8 octonion basis elements, so that the first-generation ferrmion particles and the first-generation fermion antiparticles each correspond to the **Octonions O**.

Second Generation

2 - differs from the usual Standard Model in that the SPINOR has components in the {e,ie,je,ke} internal symmetry space instead of in the {t,x,y,z} physical spacetime. Transformation from the SPINOR with components in the {e,ie,je,ke} internal symmetry space to a SPINOR with components in the {t,x,y,z} physical spacetime introduces a 4x4 matrix

```
    t x y z
e   * * * *
ie  * * * *
je  * * * *
ke  * * * *
```

Introduction of those new 4x4 = 16 degrees of freedom of that Transformation corresponds to introducing a new octonion corresponding to a second copy of the 8 fundamental fermion particles and a new octonion corresponding to a second copy of the 8 fundamental fermion antiparticles, so that the second-generation fermion particles and the second-generation fermion antiparticles each correspond to **pairs of Octonions OxO**.

3 - differs from the usual Standard Model in that the base manifold spacetime has components in the {e, ie,je,ke} internal symmetry space instead of in the {t,x,y,z} physical spacetime. Transformation from the base manifold spacetime with components in the {e,ie,je,ke} internal symmetry space to a base manifold spacetime with components in the {t,x,y,z} physical spacetime introduces a 4x4 matrix as described in 2. Introduction of those new 4x4 = 16 degrees of freedom of that Transformation corresponds to introducing a new octonion corresponding to a second copy of the 8 fundamental fermion particles and a new octonion corresponding to a second copy of the 8 fundamental fermion antiparticles, so that the second-generation fermion particles and the second-generation fermion antiparticles each correspond to **pairs of Octonions OxO**.

Third Generation

4 - differs from the usual Standard Model in that the SPINOR has components in the {e,ie,je,ke} internal symmetry space instead of in the {t,x,y,z} physical spacetime AND the base manifold spacetime has components in the {e,ie,je,ke} internal symmetry space instead of in the {t,x,y,z} physical spacetime. Transformation from the SPINOR with components in the {e,ie,je,ke} internal symmetry space to a SPINOR with components in the {t,x,y,z} physical spacetime introduces a 4x4 matrix

```
   t x y z
e  * * * *
ie * * * *
je * * * *
ke * * * *
```

Introduction of those new 4x4 = 16 degrees of freedom of that Transformation corresponds to introducing a new octonion corresponding to a second copy of the 8 fundamental fermion particles and a new octonion corresponding to a second copy of the 8 fundamental fermion antiparticles.

Transformation from the base manifold spacetime with components in the {e,ie,je,ke} internal symmetry space to a base manifold spacetime with components in the {t,x,y,z} physical spacetime introduces a second 4x4 matrix

```
   t x y z
e  * * * *
ie * * * *
je * * * *
ke * * * *
```

Introduction of the second new 4x4 = 16 degrees of freedom of that Transformation corresponds to introducing a second new octonion corresponding to a second copy of the 8 fundamental fermion particles and a second new octonion corresponding to a second copy of the 8 fundamental fermion antiparticles, so that the third-generation fermion particles and the third-generation fermion antiparticles each correspond to triples of Octonions OxOxO.

There are no further Generations beyond 3.

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