

E8 Root Vectors - Physical Interpretation

Frank Dodd (Tony) Smith, Jr. - 2015 - viXra 1508.xxxx

Garrett Lisi has proposed (arXiv 1506.08073) that the 240 Root Vectors of E8 have a Physical Interpretation, saying "... Spacetime is ... part of the Lie group ... When all fields and particles of General Relativity and the Standard Model, including three generations of fermions, are described ... as excitations of the ... Lie group E8(-24), having 248 dimensions ...

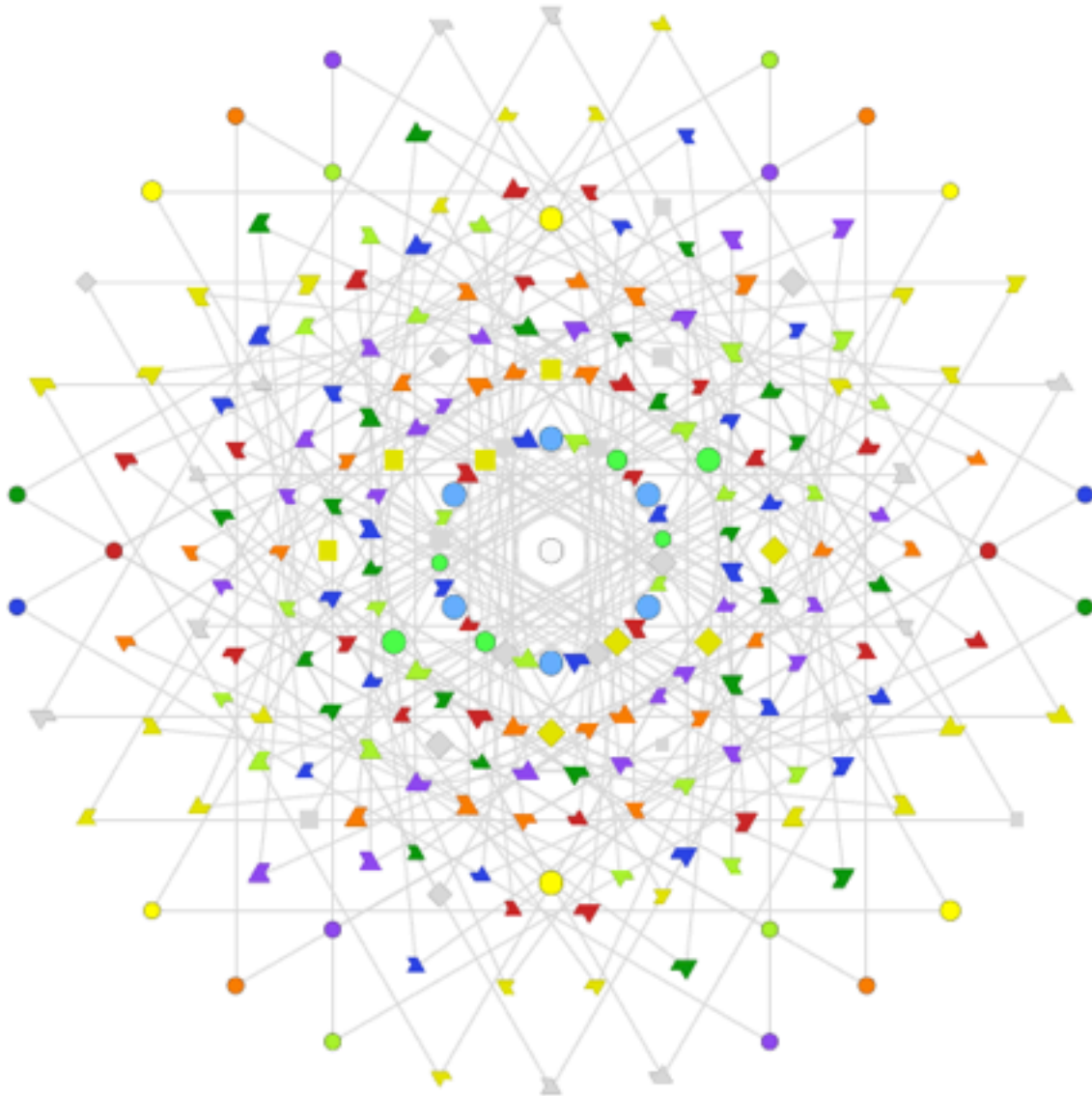


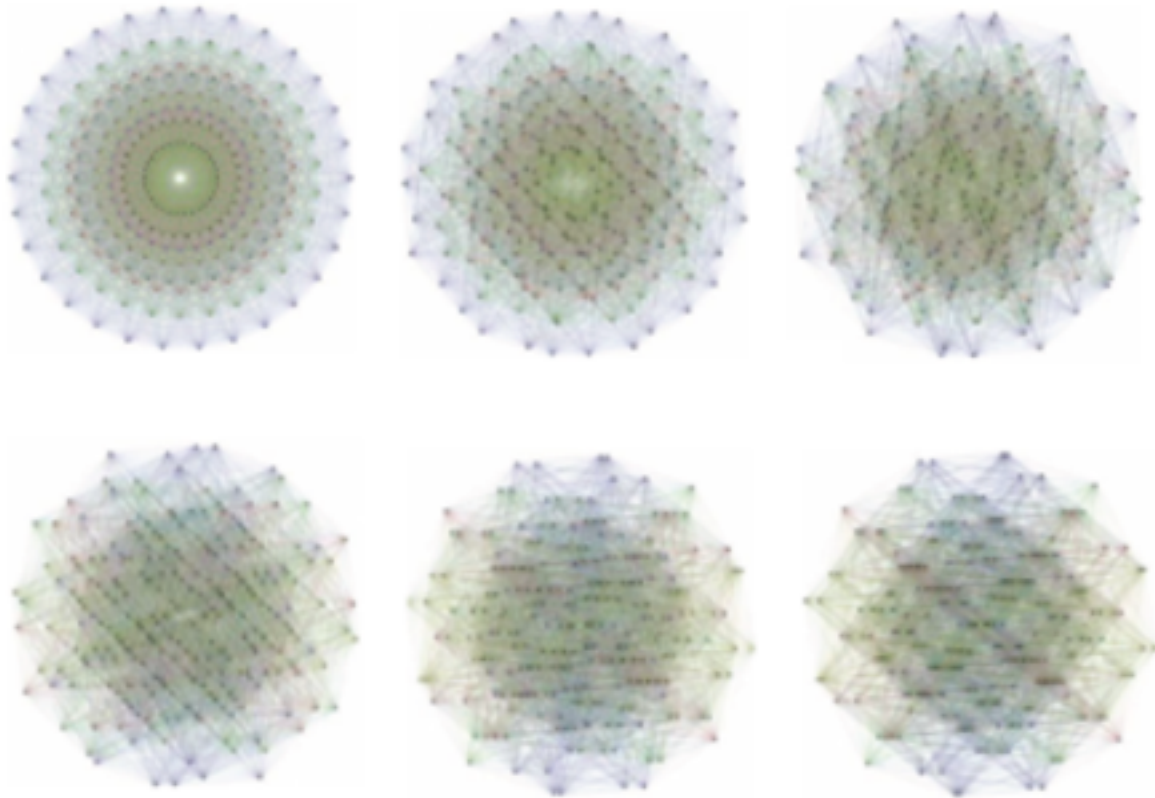
Figure 1. The E_8 root system, with three generations of particles related by triality. These particle states are meant to be suggestive rather than definitive. The detailed assignments of elementary particle states to E_8 roots, views of other rotations, and other unification models, are available at the Elementary Particle Explorer: <http://differentialgeometry.org/epe/>

... there is one new, colored gauge boson and its antiparticle ...”.

Garrett represents the 240 Root Vectors of E8 as projected from 8-dim to 2-dim in the form of 8 concentric circles of 30 Root Vectors each.

He also (around 2007) produced a video from mathematica code that shows a transformation from the 2-dim projection 8 Circles of 30 Root Vectors to another 2-dim projection with Square Geometry related to Cube Geometry.

Here is a sequence of images from that video:



In viXra 1405.0030 I use the Square/Cube 2-dim projection to visualize a Physical Interpretation of the 240 Root Vectors of E8, somewhat different from Garrett's (for example, I only represent the First Generation of Fermions directly with the 240) to get:

128 = 64 + 64 = 8 8-dim spacetime components of 8 fermion particles +

+ 8 8-dim spacetime components of 8 fermion anti-particles

112 = 24 D4 Root Vectors containing D3 = A3 Conformal Gravity + Dark Energy +

+ 24 D4 Root Vectors containing A3 which contains A2 Color and A1 Weak Forces

+ 64 = 8-dim spacetime position x 8-dim spacetime momentum

This is consistent with the full unprojected 8-dim picture of the 240 Root Vectors:

1 at North Pole

56 nearest neighbors of North Pole

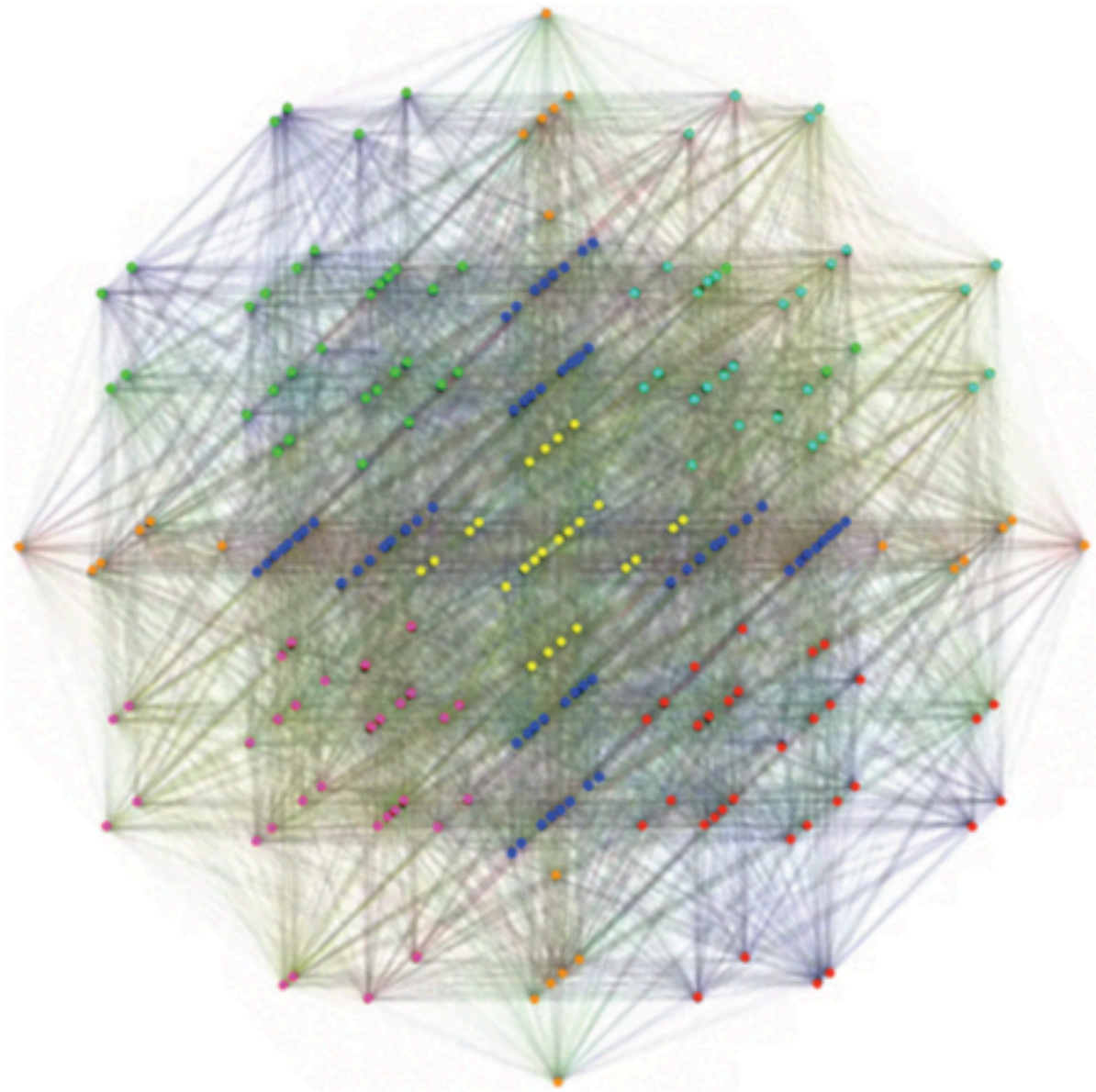
126 next-to-nearest neighbors of North Pole

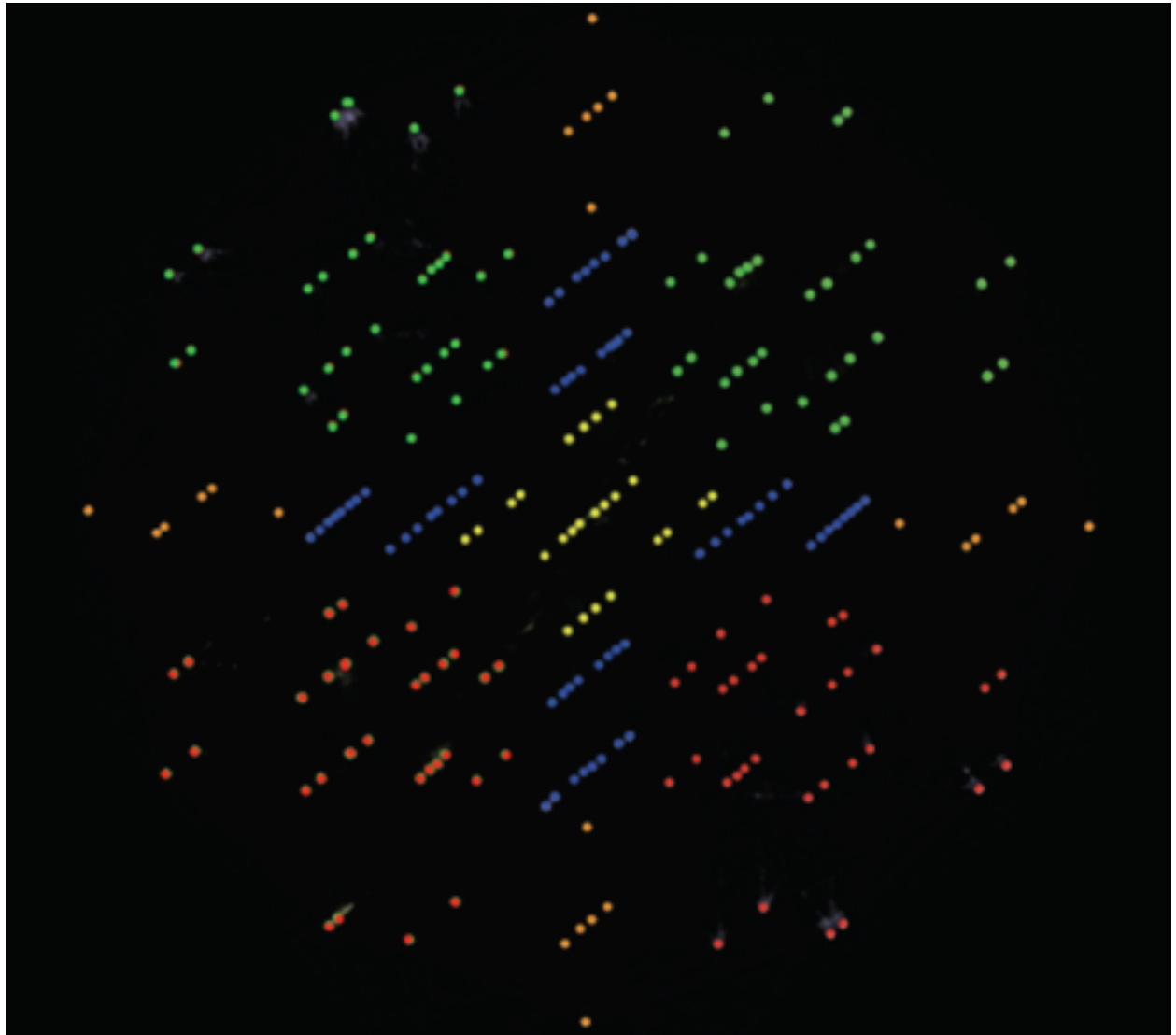
56 next-to-next-to-nearest neighbors of North Pole (nearest neighbors to South Pole)

1 at South Pole

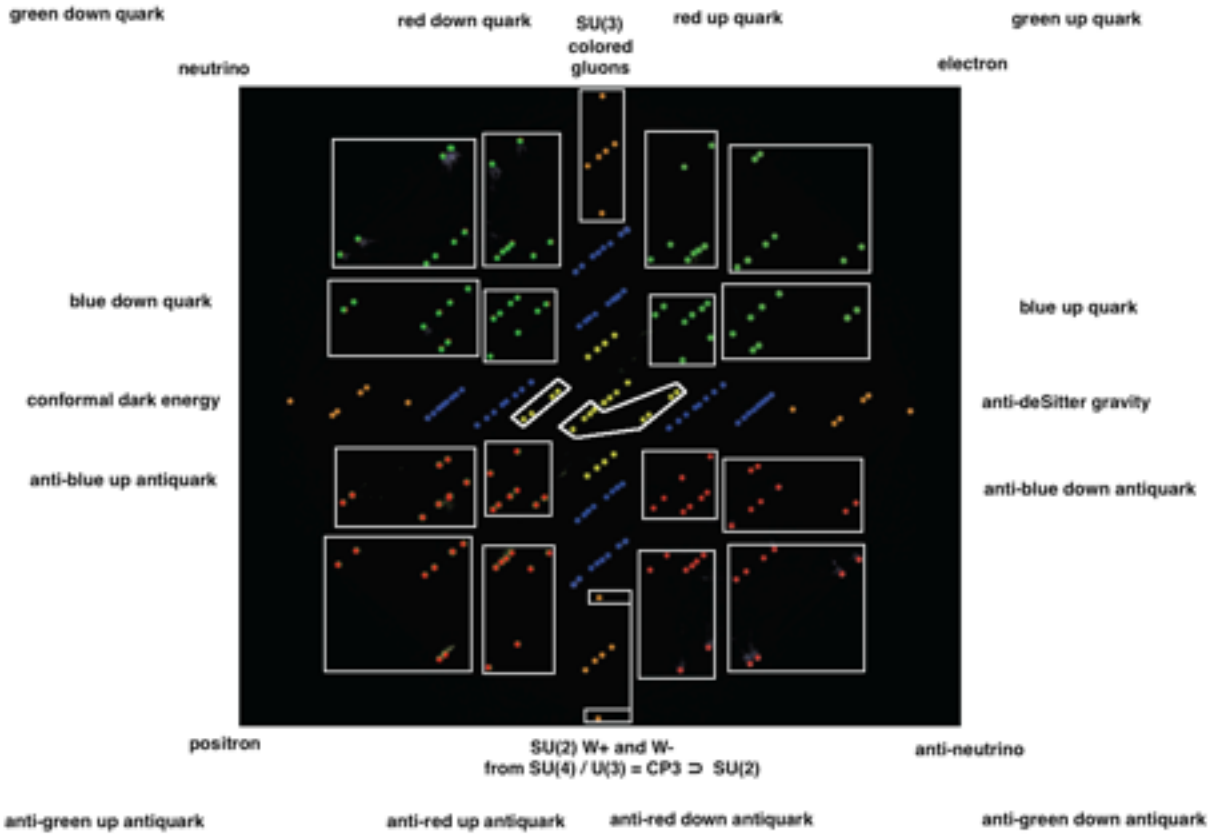
If the 4+4 Cartan Subalgebra elements of E8 are added to the 56 and 56
you get a $1 + 60 + 126 + 60 + 1$ grading of 248-dim E8 in which
 $60 + 60 = D8$ and $1 + 126 + 1 = E8 / D8 = (OxO)P2$

Here is a larger-scale image of the Square/Cube 2-dim projection that I use,
followed by graphics showing the Physical Interpretation of each of its Root Vectors:





Quarks and Leptons each have 8 Components
with respect to $M4 \times CP2$ Kaluza-Klein Spacetime



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