Conformal Dark Energy and 16 BSCCO Josephson Junction edges

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Abstract:

Conformal Dark Energy interacts with Josephson Junction BSCCO superconductors. Neutrino mass gives a cutoff at about 1.7 x 10^12 Hz. Using BSCCO crystals as edges, configurations such as 16-edge 5-dipyramid can be constructed in flat 3-dim Space to observe Dark Energy Curvature Distortion of 4-dim Spacetime.

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Conformal Dark Energy Phase of 2-Phase Universe and Josephson Junctions

I. E. Segal proposed a Minkowski-Conformal 2-phase Universe Beck and Mackey proposed 2 Photon-GraviPhoton phases

Gravity and Dark Energy come from the 15-dimensional Spin(2,4) Conformal Group, which is made up of:

3 Rotations
3 Boosts
4 Translations
4 Special Conformal transformations
1 Dilatation

Dark Energy comes from the 10 Rotation, Boost, and Special Conformal generators.
Dark Matter Primordial Black Holes come from the 4 Translation generators which define 4-dim physical spacetime and its curvature.
Ordinary Matter comes from the 1 Dilatation generator for Higgs mass.

The two phases are:

Conformal/GraviPhoton phase from the Dark Energy Special Conformal generators.
It has GraviPhotons and Conformal symmetry
(like the massless phase of energies above Higgs EW symmetry breaking)
With massless Planck the 1 / M_Planck^2 Gravity weakening goes away
and the Gravity Force Strength becomes the strongest possible = 1
so Conformal Gravity Dark Energy should be enhanced by M_Planck^2
from the Minkowski/Photon phase value of 3.9 GeV/m^3.
Minkowski/Photon phase from the Dark Matter Translation generators.
It is locally Minkowski with ordinary Photons and Gravity weakened
by 1 / (M_Planck)^2 = 5 x 10^(-39) so that we see Dark Energy as only 3.9 GeV/m^3

Christian Beck and Michael C. Mackey in astro-ph/0605418 describe
"... the AC Josephson effect ... a **Josephson junction** consists of two superconductors with an insulator sandwiched in between. In the Ginzburg-Landau theory each superconductor is described by a complex wave function whose absolute value squared yields the density of superconducting electrons. Denote the phase difference between the two wave functions ... by P(t). ...
at zero external voltage a superconductive current given by Is = Ic sin(P) flows between the two superconducting electrodes ... Ic is the maximum superconducting current the junction can support. ...
if a voltage difference V is maintained across the junction, then the phase difference P evolves according to d P / dt = 2 e V / hbar i.e. the current ... becomes an oscillating current with amplitude Ic and frequency v = 2 e V / h
This frequency is the ... Josephson frequency ... The quantum energy h v ... can be interpreted as the energy change of a Cooper pair that is transferred across the junction ...".

P A Warburton of University College London in EPSRC Grant Reference: EP/D029783/1, "Externally-Shunted High-Gap Josephson Junctions: Design, Fabrication and Noise Measurements", starting1 February 2006 and ending 31 January 2009 with £ Value: 242,348 said:

"... around 70% of the energy in the universe is in the form of gravitationally-repulsive dark energy. This dark energy is not only responsible for the accelerating expansion of the universe but also was the driving force for the big bang. A possible source of this dark energy is vacuum fluctuations which arise from the finite zeropoint energy of a quantum mechanical oscillator, hf/2 (where f is the oscillator frequency). …

dark energy may be measured in the laboratory using resistively-shunted Josephson junctions (RS-JJ's). Vacuum fluctuations in the resistive shunt at low temperatures can be measured by non-linear mixing within the Josephson junction. If vacuum fluctuations are responsible for dark energy, the finite value of the dark energy density in the universe sets an upper frequency limit on the spectrum of the quantum fluctuations in this resistive shunt. Beck and Mackey calculated an upper bound on this cut-off frequency of 1.69 THz. …

We therefore propose to perform measurements of the quantum noise in RS-JJ's fabricated using superconductors with sufficiently large gap energies that the full noise spectrum up to and beyond 1.69 THz can be measured. … Cuprate superconductors have an energy gap an order of magnitude higher than ... around 2.5 THz ... experiments ... would give ... confirmation (or ... refutation) of the vacuum fluctuations hypothesis. ...".

Neutrinos give Dark Energy density Josephson Junction Cutoff

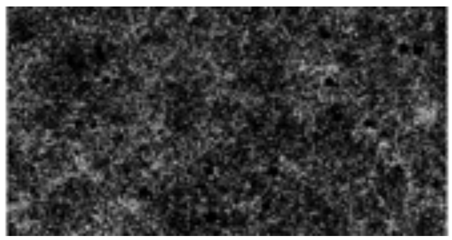
Beck and Mackey in astro-ph/0406504 said "... We predict that **the measured spectrum in Josephson junction experiments must exhibit a cutoff at the critical frequency nu_c** ... [corresponding to the observed Dark Energy density 0.73 x critical density = 0.73 x 5.3 GeV/m^3 = 3.9 GeV/m^3]... If not, the corresponding vacuum energy density would exceed the currently measured dark energy density of the universe. ... The energy associated with the computed cutoff frequency nu_c ...[about 1.7 x 10^12 Hz]... E_c = h nu_c = (7.00 ± 0.17) x 10^(-3) eV ...
coincides with current experimental estimates of neutrino masses. ...".

If Josephson Junction frequencies were to be experimentally realized up to 2 x 10^12 Hz, then, if the photon vacuum fluctuation energy density formula were to continue to hold, the vacuum energy density would be seen to be 0.062 x (20/6)^4 = about 7 GeV/m^3 which exceeds the total critical density of our universe now.
To avoid such a divergence being physically realized, **neutrinos should appear in the vacuum at frequencies high enough that E = h nu exceeds their mass of about 8 x 10^(-3) eV, or at frequencies over about 1.7 x 10^12 Hz**

Dark Energy Conformal Graviphotons and BSCCO superconductors

Such J**osephson Junction Arrays effectively act as controllable superconductors**. As Beck and de Matos suggested in arXiv 0707.1797, superconductors are examples of Conformal Dark Energy Phases within the Gravitationally Bound Domain of our Inner Solar System. They said: “… this model can account simultaneously for the anomalous acceleration and anomalous gravitomagnetic fields around rotating superconductors measured by Tajmar et al. and for the anomalous Cooper pair mass in superconductive Niobium, measured by Cabrera and Tate …[Effectively]… gravitationally active photons obtain mass in the superconductor …”.

On a large scale (billions of light years), Gravitationally Bound Domains are traced out by **Galaxies and Clusters of Galaxies** (similar images in Universe 4ed Kaufmann Freeman 1994)



so the the white dots **would be the Gravitationally Bound Domains**
like rigid pennies on an expanding balloon, or rigid raisins in an expanding cake.
The black background would be the Universe’s Conformal Expanding Domain.

Clovis Jacinto de Matos and Christian Beck in arXiv 0707.1797 said:
"... A non-vanishing cosmological constant (CC) Λ
can be interpreted in terms of a non-vanishing vacuum energy density

rho_vac = (c^4 / 8 pi G) Λ

which corresponds to dark energy with equation of state w = -1.
The ... astronomically observed value [is]... Λ = 1.29 x 10^(-52) [1/m^2] ...
Graviphotons can form weakly bounded states with Cooper pairs,
increasing their mass slightly from m to m' .

The binding energy is Ec = u c^2 : m' = m + my - u

... Since the graviphotons are bounded to the Cooper pairs, their zeropoint energies form a condensate capable of the gravitoelectrodynamic properties of superconductive cavities. ... Beck and Mackey's Ginzburg-Landau-like theory leads to a finite dark energy density dependent on the frequency cutoff v_c of vacuum fluctuations:

rho* = (1/2) (pi h / c^3) (v_c)^4

... in vacuum one may put rho* = rho_vac from which the cosmological cutoff frequency v_cc is estimated as v_cc = 2.01 THz
The corresponding "cosmological" quantum of energy is: Ecc = h v_cc = 8.32 MeV
... In the interior of superconductors ... the effective cutoff frequency can be different ... h v = ln 3 k T ... we find the cosmological critical temprature Tcc = 87.49 K
This temperature is characteristic of the BSCCO High-Tc superconductor. ...".

Xiao Hu and Shi-Zeng Lin in arXiv 0911.5371 said: "... The Josephson effect is a phenomenon of current flow across two weakly linked superconductors separated by a thin barrier, i.e. Josephson junction, associated with coherent quantum tunneling of Cooper pairs. ... The Josephson effect also provides a unique way to generate high-frequency electromagnetic (EM) radiation by dc bias voltage ... The discovery of cuprate high-Tc superconductors accelerated the effort to develop novel source of EM waves based on a stack of atomically dense-packed intrinsic Josephson junctions (IJJs), since the large superconductivity gap covers the whole terahertz (THz) frequency band. Very recently, strong and coherent THz radiations have been successfully generated from a mesa structure of Bi2Sr2CaCu2O8+d single crystal which works both as the source of energy gain and as the cavity for resonance.
This experimental breakthrough posed a challenge to theoretical study on the phase dynamics of stacked IJJs, since the phenomenon cannot be explained by the known solutions of the sine-Gordon equation so far. It is then found theoretically that, due to huge inductive coupling of IJJs produced by the nanometer junction separation and the large London penetration depth ... of the material, a **novel dynamic state is stabilized in the coupled sine-Gordon system, in which +/- pi kinks in phase differences are developed responding to the standing wave of Josephson plasma and are stacked alternately in the c-axis**. This novel solution of the inductively coupled sine-Gordon equations captures the important features of experimental observations.
The theory predicts an optimal radiation power larger than the one observed in recent experiments by orders of magnitude ...".

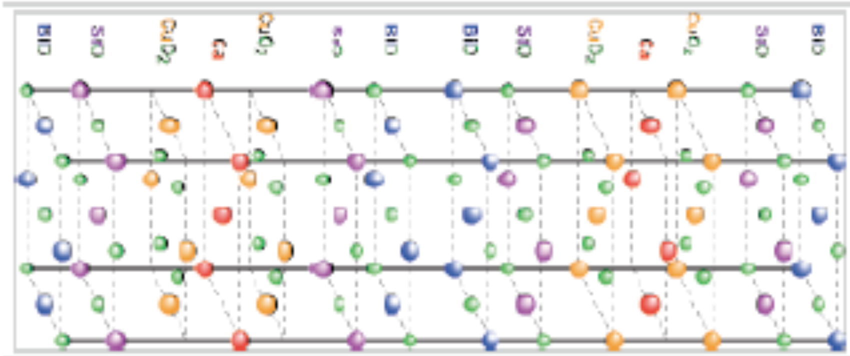
Xiao Hu and Shi-Zeng Lin in arXiv 1206.516 said:
"... to enhance the radiation power in teraherz band based on the intrinsic Josephson Junctions of Bi2Sr2CaCu2O8+d single crystal ... we focus on the case that the Josephson plasma is uniform along a long crystal as established by the cavity formed by the dielectric material. ... A ... pi kink state ... is characterized by static +/- pi phase kinks in the lateral directions of the mesa, which align themselves alternatingly along the c -axis. The **pi phase kinks provide a strong coupling between the uniform dc current and the cavity modes, which permits large supercurrent flow into the system at the cavity resonances, thus enhances the plasma oscillation and radiates strong EM wave** ... The maximal radiation power ... is achieved when the length of BSCCO single crystal at c-axis equals the EM wave length. ...".

BSCCO superconducting crystals are natural Josephson Junctions. Josephson Junction control voltage acts as a valve for access to BSCCO Dark Energy. (an idea due to Jack Sarfatti)

**Dark Energy accumulates in the superconducting layers of BSCCO.
Dark Energy expands Spacetime of our Universe
and also expands Spacetime of the BSCCO.**

BSCCO crystals as edges in Josephson Junction Arrays

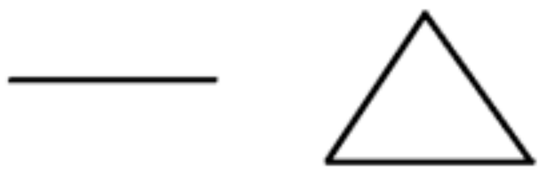
Each long BSCCO single crystal looks geometrically like a line



(BSCCO image from Wikipedia)

so configure JJ Arrays using BSCCO crystals as edges.

Dark Energy expansion of a 1-dim BSCCO edge or a 2-dim BSCCO triangle



or a 3-dim BSCCO tetrahedron is a uniform expansion of the configuration.
There is no distortion of Spacetime (only a scale dilation that is hard to measure).

Feigelman, Ioffe, Geshkenbein, Dayal, and Blatter in cond-mat/0407663 said:
“... Superconducting tetrahedral quantum bits ... qubit design ...
emulates a spin-1/2 system in a vanishing magnetic field,
the ideal starting point for the construction of a qubit.
Manipulation of the tetrahedral qubit through external bias signals translates into application of magnetic fields on the spin;
the application of the bias to different elements of the tetrahedral qubit corresponds to rotated operations in spin space. ...

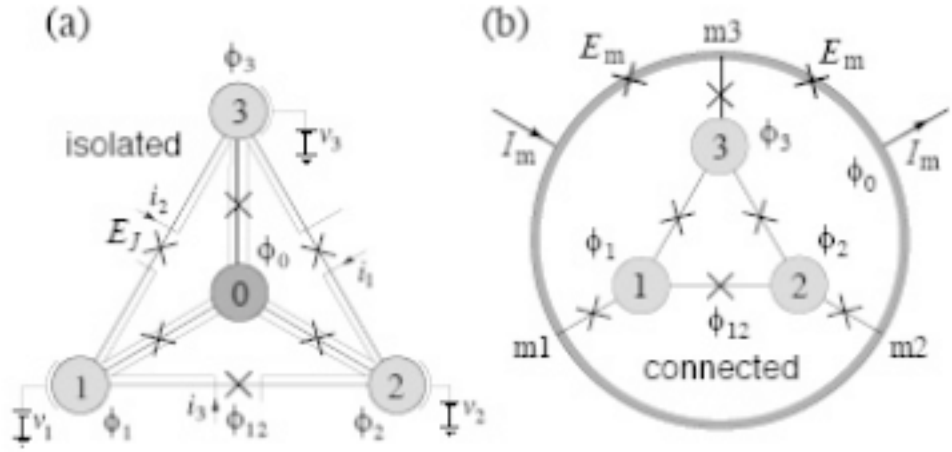
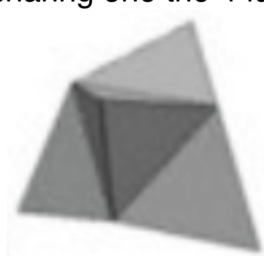


FIG. 1: (a) Tetrahedral superconducting qubit involving four islands and six junctions (with Josephson coupling E_J and charging energy E_C); all islands and junctions are assumed to be equal and arranged in a symmetric way. The islands are attributed phases ϕ_i, $i = 0, \ldots, 3$. The qubit is manipulated via bias voltages v_i and bias currents i_i. In order to measure the qubit's state it is convenient to invert the tetrahedron as shown in (b) — we refer to this version as the 'connected' tetrahedron with the inner dark-grey island in (a) transformed into the outer ring in (b). The measurement involves additional measurement junctions with couplings $E_m \gg E_J$ on the outer ring which are driven by external currents I_m (schematic, see Fig. 6 for details); the large coupling E_m effectively binds the ring segments into one island.

...".

If you fit 5 tetrahedra with 4 each sharing one the 4 faces of the 5th,



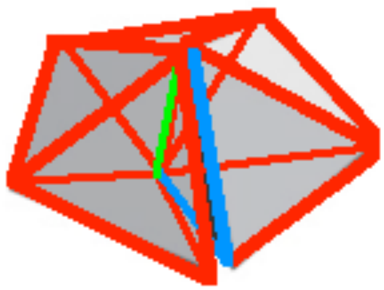
then you also have an exact fit and Dark Energy gives no distortion of Spacetime.

Dark Energy Spacetime Distortion
for configurations beyond Tetrahedron

If you fit 5 tetrahedra all sharing a central edge, you do not get an exact fit

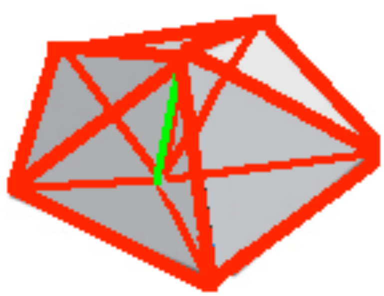
(image from Conway and Torquato PNAS 103 (2006) 10612-10617)

but there is a gap between 2 faces whose angle is 7.36 degrees.
The gap can be eliminated by Dark Energy Spacetime curvature
in which case the exact curved Spacetime configuration would have
1 central edge, 5+5 = 10 edges from central edge to perimeter, and 5 perimeter edges.



Using 16 identical BSCCO Josephson Junction segments as edges
you can in flat 3-dim Space construct the 15 red and 1 green configuration
which does not have the 2 blue edges, so that in flat 3-dim Space it is incomplete.

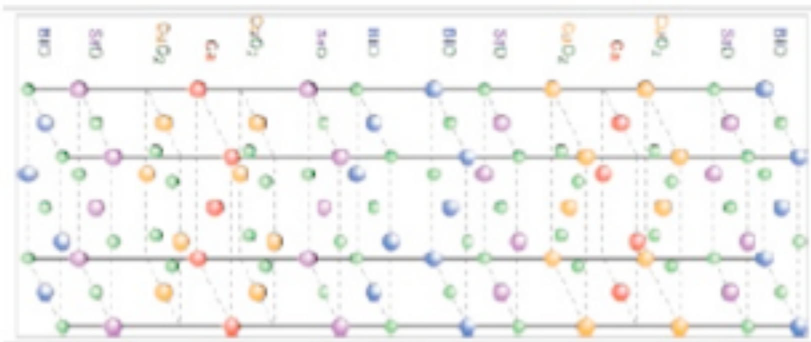
If the BSCCO Josephson Junctions collect enough Dark Energy to curve Spacetime
they can close the configuration in curved Spacetime



This 16-edge configuration is a simple example of constructing
a configuration that is incomplete in 3-dim space
but
can be completed by Dark Energy to a closed configuration in curved Spacetime.

The 16-edge BSCCO Josephson Junction configuration
is a simple tool to observe and control Dark Energy.

According to the ideas of Beck and Mackey (astro--ph/0703364) and
of Clovis Jacinto de Matos (arXiv 0707.1797)
the superconducting Josephson Junction layers of the 16 BSCCO crystals



(BSCCO image from Wikipedia)

will bond with Dark Energy GraviPhotons that are expanding our Universe.

My idea is that the Dark Energy GraviPhotons will not like being configured as edges of an incomplete configuration in our flat 3D space
and
they will use their Dark Energy to make all 5 tetrahedra to fit together exactly by curving our flat space (and space-time).

My view is that the Dark Energy Graviphotons will have enough strength to do that because their strength will NOT be weakened by the (1 / M_Planck)^2 factor that makes ordinary gravity so weak.

It seems to me that a clearly designed experiment will either

1- not work and show my ideas to be wrong

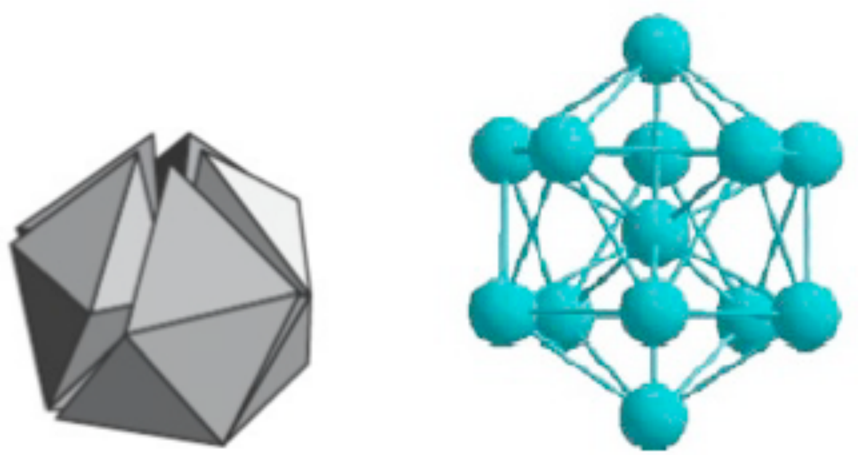
or

2 - work and be the Geometric Key to controlling Dark Energy
(as were Chain Reactions for Nuclear Fission and Ellipsoidal Focussing for H-Bombs)

More complicated configurations may be harder to fabricate in flat 3-dim space
but
they may prove to be more useful in the long run.

Here are a few examples:

42 edges (20 Tetrahedra) make an Icosahedron plus its center



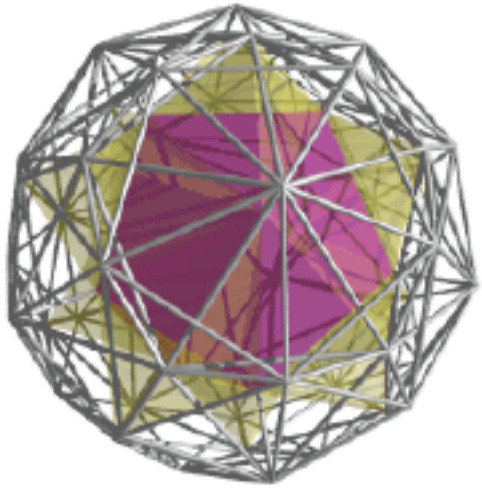
(images from Conway and Torquato PNAS 103 (2006) 10612-10617
and from Physical Review B 72 (2005) 115421 by Rogan et al)

with 30 exterior edges and 12 edges from center to vertices.

It has 20 Tetrahedra which in flat 3-space have gaps totalling 1.54 steradians
but
with Dark Energy Spacetime curvature they fit exactly in curved 3-space.

720 edges (600 Tetrahedra) make a 4-dimensional 600-cell

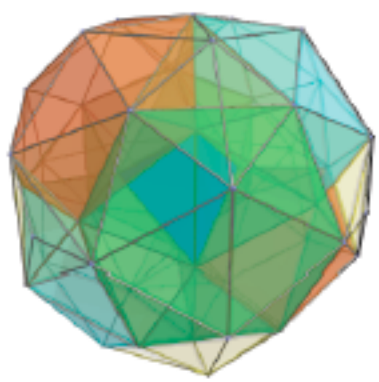
(image from Wikipedia)



480 of the 600 Tetrahedra of the 600-cell form 24 Icosahedra (each with 20 cells).

The remaining 600 - 480 = 120 Tetrahedral cells, with the 24 Icosahedra, form a Snub 24-cell

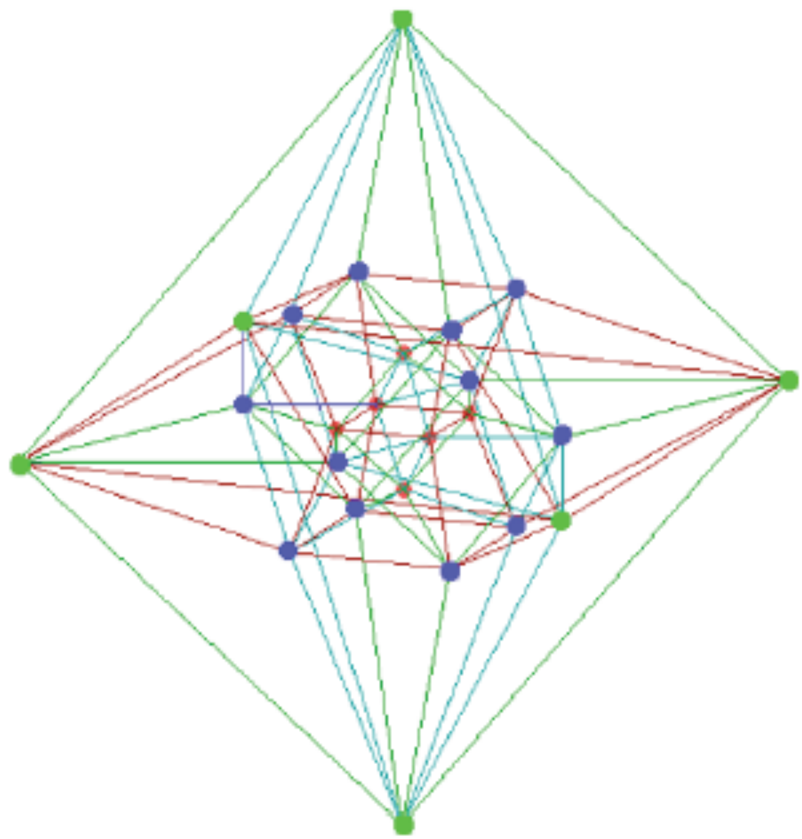
(image from eusebia.dyndns.org)



Each of the 24 icosahedra of the Snub 24-cell lives inside an Octahedron

Each of the 24 Icosahedra of the Snub 24-cell can be completed to an Octahedron by adding to it 120 / 24 = 5 of the Tetrahedra of the Snub 24-cell, forming a **24-cell with 24 Octahedral cells and 96 edges**

(image from members.home.nl/fg.marcelis/24-cell.htm#stereographic%20projection)



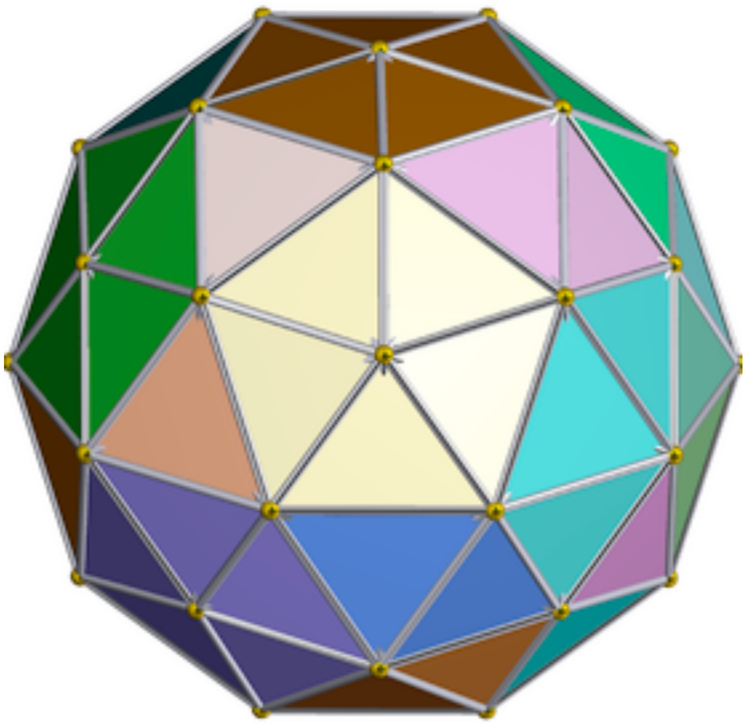
In this form, Euclidean 4-dim Spacetime
(related to Minkowski M4 Spacetime by Wick rotation)
can be tiled as in a D4 Lattice of Integral Quaternions
so
you can construct an Array of BSCCO Josephson Junctions to observe and control Dark Energy on a larger scale than a single isolated configuration.

By similar construction starting with a pair of 600-cells you can build a 120+120 = 240-vertex 8-dim Gossett polytope and construct Arrays related to Octonionic E8 Lattices.

The dual to the 600-cell (600 Tetrahedra and 720 edges and 120 vertices)
is
the 120-cell (120 Dodecahedra and 1200 edges and 600 vertices).

The dual to the Dodecahedron is the Icosahedron
so
the 600-cell is related by 2 dualities to
the Icosahedral 120-cell (120 Icosahedra and 720 edges and 120 vertices)

(image from Wikipedia)



This gives an alternative way use 720 BSCCO Josephson Junction edges
to construct configurations for observation and control of Dark Energy.