Quantum Hyperspheres.

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Abstract.

This paper explores the hypothesis that fundamental particles (both fermions and bosons) consist of Hyperspheres (3-Spheres or 4-balls) and that the wave – particle duality of fundamental particles arises from their having a certain extremely small minimum size rather than a dimensionless point-like nature; but that this minimum size can appear to have the characteristics of a wavelength due to 'Spin' and the Uncertainty Principle.

This paper combines some extensions of Gödel's rotating universe idea and Einstein-Cartan theory, both of which derive from General Relativity to yield a result that may have some relevance to our understanding of Quantum Mechanics and thus provide a bridge to some form of Quantum Geometry.

Quantum Hyperspheres.

1) This paper considers the possibility that fundamental particles may consist of parts of the spacetime manifold which have a very high degree of curvature and spin. The Hypersphere Cosmology*[1] hypothesis suggests that spacetime cannot have the infinite curvature of a singularity because spacetime will undergo a phase change to a 3-sphere (4-ball) configuration when $r = \frac{Gm}{\pi c^2}$ or $L = \frac{Gm}{c^2}$ where L = hypersphere antipode length.

(Thus any macroscopic black hole will contain a hypersphere rather than a singularity.)

Now the Uncertainty Principle sets a maximum mass and a minimum 'size' for any quantum scale hypersphere:

$\frac{Gm}{c^2} \frac{h}{mc} = \frac{Gh}{c^2}$ Hypersphere length x Compton wavelength = Planck length squared.

Thus any fundamental particle with a mass exceeding the Planck mass would have a wavelength below the Planck length.

All fundamental particles have masses below the Planck mass yet their 'sizes' can appear to range from seemingly vanishingly small point like particles up to their Compton wavelengths which invariably exceed the Planck length. The theoretical hypersphere lengths of fundamental particles always lie below the Planck length but they do not have the zero extension of point singularities.

2) Einstein Cartan theory. See https://arxiv.org/pdf/gr-qc/0606062v1.pdf

"The Einstein–Cartan Theory (ECT) of gravity is a modification of General Relativity Theory (GRT), allowing space-time to have torsion, in addition to curvature, and relating torsion to the density of intrinsic angular momentum."

Einstein-Cartan theory leads to a minimum radius, the Cartan Radius, for fundamental particles, from which the Cartan Volume v_c arises.

$v_c = \frac{Gh^2}{mc^4} = \frac{Gh}{c^3}\frac{h}{mc}$ Cartan volume as Planck area times the Compton wavelength.

The Cartan Volume also decomposes as follows:

$v_c = \frac{Gh^2}{mc^4} = \frac{Gm}{c^2}\frac{h^2}{m^2c^2}$ Cartan volume as hypersphere antipode length times the square of the Compton wavelength.

The various lengths that can combine to form the Cartan Volume may well represent the wave (Compton wavelength and Compton cross-sectional area) and the point like particle (Hypersphere 'length' and Planck length) manifestations of fundamental quanta.

Now to consider the effects of rotation on a fundamental quantum of Cartan volume we should perhaps use a revised Cartan volume that uses hypersphere radius rather than antipode length.

$v_{c_1} = \frac{Gh^2}{\pi mc^4} = \frac{Gm}{\pi c^3}\frac{h^2}{m^2c^2}$ Cartan volume 1, as hypersphere radius length times the square of the Compton wavelength.

Alternatively we can use the reduced Compton wavelength when applying the volume to a rotation already corrected for 3-sphere rotation.

$v_{c_2} = \frac{Gh^2}{2\pi mc^4} = \frac{Gh}{c^3}\frac{h}{2\pi mc}$ Cartan volume 2, as Planck area times the reduced Compton wavelength.

3) Gödel's rotation hypothesis. See:
http://journals.aps.org/rmp/pdf/10.1103/RevModPhys.21.447

"(9) Matter everywhere rotates relative to the compass of inertia with the angular velocity: $2\sqrt{\pi G d}$, where d is the mean density of matter and G is Newton's gravitational constant"

Gödel derived from General Relativity a solution in which rotation stabilised a non-expanding and non-contracting universe. However he only derived this for a Spherical (2-ball) universe; and in the absence of an observable axis of rotation the solution became abandoned. However Hypersphere Cosmology provides a solution for a 3-ball rotation which does not have a readily observable simple rotation but rather a 'vorticitation' in which any point moves back and forth to its antipode position.

See http://vixra.org/pdf/1601.0026v1.pdf

Derivation 1.

$\omega = 2\sqrt{\pi G d}$ Gödel's formula for universal rotation.

$2\pi f = 2\sqrt{\pi G d}$ Substitute frequency for angular velocity.

$\pi f = \sqrt{\frac{\pi G m}{v}}$ Substitute mass over volume for density.

$$v_{c_1} = \frac{Gh^2}{\pi mc^4}$$

$$\pi^2 f^2 = \frac{\pi G m}{Gh^2/\pi mc^4}$$

$$\pi^2 f^2 = \frac{\pi^2 m^2 c^4}{h^2}$$

$E = hf$ Planck-Einstein relationship recovered.

Derivation 2.

$\omega = \sqrt{2\pi G d}$ Gödel's formula updated for a hypersphere (3-ball)

$$v_{c_2} = \frac{Gh^2}{2\pi mc^4}$$

$\pi^2 f^2 = \dfrac{2\pi Gm}{Gh^2/2\pi mc^4}$ Substitute mass over volume for density, and frequency for angular velocity.

$$4\pi^2 f^2 = \frac{4\pi^2 m^2 c^4}{h^2}$$

$E = hf$ Planck-Einstein relationship recovered.

In the first derivation the correction for Hypersphere (3-ball) 'rotation' rather than for simple Sphere (2-ball) rotation occurs with the insertion of hypersphere radius rather than hypersphere antipode length as a component of a revised Cartan volume.

In the second derivation we make the hypersphere correction to the rotation itself.

*[1]Both these corrections derive from Hypersphere Cosmology, see http://vixra.org/pdf/1601.0026v1.pdf

Both derivations lead to the fundamental quantum equation $E = hf$ which relates closely to one of the recensions of the Uncertainty Principle $\Delta E\ \Delta t = h$.

Conclusion.

It does seem that if we treat fundamental particles as Cartan volume 'Hyperspheres' ('enlarged' by the Uncertainty Principle), which spin in exactly the same way as the entire universe, then we can model some of their quantum behaviour precisely.

The torsion component of Einstein-Cartan theory may, if extended to include 3 dimensions of time, explain the apparent effects of electroweak and nuclear 'fields', analogously to the way in which spacetime curvature explains gravitational 'fields'.

Addendum.

If fundamental particles do have the same hyperspherical nature as the universe itself on the macro scale, then the Borsuk-Ulam theorem may have much to offer. If mapping from n to n-1 dimensions creates the apparent phenomenon of quantum entanglement and superposition then we can probably do a lot with the idea of fundamental particles as quantum hyperspheres.

See:

https://www.researchgate.net/publication/301197960_Quantum_Entanglement_on_a_Hypersphere

https://www.researchgate.net/publication/283349888_THE_BORSUK-ULAM_THEOREM_EXPLAINS_QUANTUM_ENTANGLEMENT

https://en.wikipedia.org/wiki/Borsuk%E2%80%93Ulam_theorem

'Whatever is below is similar to that which is above. Through this the marvels of the work of one thing are procured and perfected.'

As Hermes Trismegistus allegedly wrote upon the Emerald Tablet.

Peter J Carroll. 10/11/2016.