THOUGHTS REGARDING DERIVATION OF CLASSICAL MECHANICS FROM FOUR-SPHERE THEORY FOUNDATIONS

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The foundational law in four-sphere theory is one law, the only law governing all of Nature above $\delta = 10^{-15}$ cm. The cutoff is rough in the sense that we don't care about strong force and other high energy nuclear forces.

We are strongly compelled that it is a clear wave equation on spinor fields of a four-sphere that lies as the fundamental law, and all other phenomena are derived from this law.

It is from this perspective of rebuilding all of 'macroscopic' physics from the foundations that we examine how what has been called classical mechanics arises. Between 1696, the Johann Bernoulli's brachistrone challenge to 1762 and Joseph Louis Lagrange's δ-algorithm to 1830's and William Rowan Hamilton's partial differential equations we have the basis of what is has been called classical mechanics.

We are today in a new phase of physics where we have a fundamental law that is reliable, the Ahmed-d'Alembert Law or S4 Electromagnetic Law, and the geometry of the universe is finally extremely clear, and it is $S^4(R = 3075.69Mpc) \times \mathbf{R}$.

It is now time to understand to what extent classical mechanics of the Lagrangian and the Hamiltonian types can be derived from the fundamental law.

I have not done this exercise at all. I do know some basic ideas from folklore and do not have the clearest idea of how to prove them carefully. The main idea here is based on the idea that singularities propagate along geodesics.

It is extremely well known that geodesics of a four-sphere are the great circles. I have left this issue till my analytic abilities reach a better level. The basic intuition is quite clear: particles exist because of the geometry of the four-sphere, that for the integers $k = 1, 2, \ldots$ the spherical harmonics of the eigenvalue $k(k + 3)$ exist in families of dimension $d(k)$, the exact formula is known, and it has some polynomial growth in k. But in these eigenspaces only one eigenfunction, the zonal eigenfunction have particle localisation. These eigenfunctions are the basis of particles in Nature, and they are singularities. The fundamental law then pushes them to *move along geodesics on* $S^4(R)$.

Regardless of what are the other features of the four-sphere theory, it is extremely positive that particles that do not have any interactions do have to move along geodesics *just by the virtue of the classical wave equation's formal properties*. So we make a small step right here towards Nature's behaviour without any ad hoc assumptions. Particles *must move* along geodesics because the fundamental equation is a classical wave equation.

As the originator of four-sphere theory, I am most pleased indeed. I am pleased because I did not hypothesize that particles must even *exist* and did not mandate that once found to exist that they must move in any particular manner. It is a consequence of mathematical theory of wave equations that this will be so.

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1. Theoretical Task: Exact Dynamical Laws

The task of examining the behaviour of particles in four-sphere theory beyond moving in geodesics, which are great cirles, what they do in interactions and so on, is a great task that I will just conjecture will lead to equivalent Lagrangian and Hamiltonian mechanics. I do not know to what exactness this will be the case but it is a valuable project.

I believe we will be able to prove then with rigorous mathematical theory that *Eternal Recurrence* is true about Nature.

2. Path To Proving Eternal Recurrence In Four-Sphere Theory

I have promoted this argument for many years now but it is worth refining till it is absolutely rigorous.

2.1. Phase Space Finiteness.

For a single particle, based on speed of light constraint and assuming a maximum mass, we can set the momentum to a maximum M.

Then the phase space is the cotangent ball bundle $P_1 = B^*S^4$ where we just consider vectors smaller than M in the cotangent spaces.

The key is that this is a compact and finite volume object. Then let $N_{all} \sim 10^{80}$ be all particles in the universe.

Let $P = P_1^N$ and by Tychonoff theorem this is compact and the volume is finite. That means that the phase space of the entire universe is finite volume.

2.2. Assume Phase Space Volume Preservation By Hamiltonian Dynamics.

In classical mechanics this is true, and assume this true for four-sphere theory. It will be established eventually, as the classical Liouville Theorem is quite reasonable.

Then we take $T : P \to P$ to be the dynamics of one second. This is measure-preserving on a finite measure space.

3. Ergodic Theorem Applies

Ergodic theorem's hypotheses are met for

$$T : P \to P$$

So then we can prove that the same states repeat infinitely often in iterations of $T, T^2, T^3, \dots$. This is Eternal Recurrence.

3.1. Four-Sphere Theory Replaces Big Bang With Eternal Recurrence.

This is obvious. We deny expansionary Cosmology and we claim Eternal Recurrence is truth. Our path here is not by faith but by application of Ergodic Theorem based on the various features of four-sphere that are checked.

Although Ancient Indians and Ancient Egyptians both held this on faith, I claim to be the first modern man, Asian-American, to have shown this to be true displacing Big Bang Cosmology.