

The Finiteness Theory – a Theory of Everything

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Abstract:

For the first time in the history of physics, a complete 'Theory of Everything' is proposed. This paper is the last in a series of papers based on reality, and gives a complete description of the theory, and refers to the earlier papers for details. Whether it is the right theory or not, I leave it to the community of physicists to decide.

Key words: Axioms, Laws, Theory of everything, Reality, Finiteness, Determinism

1. Introduction:

Laplace proposed mathematical determinism by stating that if we know the 'properties' and the 'valid mathematical equations' of the present in full, it would be possible to know the past and the future. We arrive at 'the properties' and 'the equations' through observations, experiments and logical reasoning. The properties are stated in the form of 'axioms', and the equations, in the form of 'laws'. A single theory based on these 'axioms' and 'laws', it is expected, will be able to describe everything from the past to the future.

The 'axioms', depend on our world-view. There is always an accepted mainstream-view, which changes with time and at times undergoes paradigm shifts. The 'laws', being mathematical, are somewhat rigid. These never become wrong, but are replaced by more accurate equations that cover more areas. Our efforts to understand the present, though still incomplete, have yielded a significant amount of information that we can say, time is ripe for a 'Theory of Everything'.

The two accepted theories of the present, General relativity and Quantum Mechanics are mutually incompatible, and require different axioms. Since these theories are valid in their respective domains, the present strategy is to find a coherent set of axioms applicable for both, and thus arrive at a Theory of Everything. However, nobody has so far come up with a complete theory. Maybe it is an impossible task.

An alternate strategy is proposed in this paper: Discard the above two theories, change the existing 'axioms', and make corrections in the existing 'equations'. This can lead, as shown in this paper, to a complete theory. Thus, for the first time in the history of physics, an actual 'Theory of Everything' is proposed.

2. The concept of reality - the philosophy behind the new theory:

We observe a *real physical world*¹, the reality of which is independent of our observation. The only entities we observe are space, time and matter. Reality implies that (i). Space, time and matter are measurable; and standard units will represent the same amount of the respective entity anywhere in the universe, and the measured value will never be negative. (ii). Bodies made up of matter cannot have negative or zero mass, cannot have negative or zero volume, and cannot remain simultaneously at two positions

or in two shapes. (iii). No process can happen in zero or negative time. Thus the concept of reality imposes some restrictions in the role of mathematics in the domain of physics.

Physics requires the existence of a real physical world to be explained. So the axioms in physics should be physically meaningful, or should be in conformity with the concept of reality. Mathematics does not need any physical world and is more fundamental. Physics has no role in the domain of mathematics, but mathematics has a definite role in the domain of physics: mathematics governs the changes in the physical world, and that is its only role. But Newtonian physics, General Relativity and Quantum Mechanics use mathematical axioms as the basis to explain the physical world. Newtonian physics, however, is in conformity with the concept of reality, but the other two are not, and this is the main reason why a Theory of Everything remains unattainable.

3. The proposed axioms:

- (i). Space and time are continuous; space is three-dimensional, time moves forward.
- (ii). Matter has a *basic unit*¹⁰ having finite mass, finite volume and finite speed.
- (iii). *Energy*⁴ is motion and *force*⁴ is reaction to motion.
- (iv). Forces can be attractive and repulsive, and energy acts as pseudo repulsive force.
- (v). Due to attractive forces, matter remains integrated as a system, the universe.

The above statements constitute a set of axioms based on logical reasoning, stated without any proof. The validity of the axioms depend on the final result; that is, these are valid, if and only if everything can be explained based on these. It can be seen that mathematics has no role in deciding these axioms.

4. The role of mathematics:

Though mathematics has no role in deciding the axioms, how such a world (a world that can be described by these axioms) behaves, depends on simple laws of mathematics, and we get the following primary results.

- (i). As space and time are continuous, both are *infinite*⁵.
- (ii). As the basic unit has *finite*⁵ properties, systems made up of matter are finite.
- (iii). As both energy and force depends on finite speed, both are *equal and finite*⁴.
- (iv). *Balance*⁴ between attractive and repulsive forces gives stability to systems.
- (v). If force/energy are fully used inside, the system cannot interact further.

The step by step integration of fundamental particles depends on mathematical feasibility, symmetry and balance being the criteria. In three-dimensional space, linear, planar and spatial integration are possible. As the structures are formed due to attractive forces, symmetry makes them as spherical as possible, and so the mathematical *constant π* ¹⁰ has a crucial role in integration. The properties of the fundamental unit give the fundamental constants representing mass, volume and speed (speed is a ratio of two constants, space-quantum and time-quantum). These dimensional constants together with π , the mathematical constant, decide the structures formed, and so the integration is completely deterministic, and we get a system that cannot interact further.

Changes in the system happen solely by way of motion, whatever may be the reason for that change. Motion is a space-time relation that obeys mathematical laws. So all changes in the system follow mathematical laws. So it becomes possible for us to explain the changes using mathematical models. The Finiteness Theory describes everything in the universe using physical axioms and mathematical laws.

5. The Finiteness Theory:

The theory can be stated as follows: *The universe is 'matter' in its real 'finite form'; where, matter is something made up of basic units having finite mass, finite volume and finite speed; and the finite form is an isolated 'pulsating system'.*

The statement implies that matter can exist only as a 'pulsating system' which is real, finite, and isolated, and not in any other form. The basic units, the fundamental particles, integrate step by step into a system we call, 'the universe'. The linear integration of particles gives [particle-pairs](#)⁶, planar integration gives [rings](#)⁶, and spatial integration gives [shells](#)⁶. These integrate further into larger structures as shown below. The mathematical models of these structures are given in previous papers.

- (i). *Particle pairs* → *electromagnetic radiations* → *a system of radiations*
- (ii). *Rings* → *neutrino radiations* → *electromagnetic radiations*
- (iii). *Shells* → *Electron-positron pairs* → *Neutrons* → *atoms* → *large 'masses' of atoms* → *Orbiting-systems of 'masses'* → *A pulsating system.*

Thus the end result of integration is a [pulsating system](#)¹⁴ of [orbiting-systems](#)¹³ (Galaxy-clusters) accompanied by a system of radiations, [Cosmic Background Radiation](#)¹⁰. Though integration can thus be explained, it does not mean that matter existed as particles in the beginning and integrated later into a system. Matter always existed as a system which remains in an [infinite-loop](#)⁵ of pulsations. There is no theoretical limit to the number of universes in the infinite space; it may be just one or even billions, but not infinite.

6. Theoretical problems resolved :

Though the existing theories provide a very excellent explanation of the physical world, there are some unresolved theoretical problems. Any new theory proposed should be able to resolve one or more of these problems, if it has to be of any relevance. Finiteness Theory resolves the following theoretical problems existing at present.

- (i). *Matter - antimatter:*

[Electron-positron pairs](#)⁹ are the building blocks of [neutrons](#)⁹; neutrons change into atoms, and all large scale-structures are made up of atoms. Positron is thus part of matter and not antimatter. There is no antimatter.

- (ii). [Inertial and gravitational mass](#)⁸:

Energy is motion, and force, reaction to motion. So both energy and force depend on the same mass; so there is no distinction between the two masses in the new theory. Electromagnetic force also depends on mass (charge is an arbitrary value used in place of mass, and the difference gets adjusted in the constant).

(iii). Unification of forces :⁸

At the level of electrons/positrons, force gets divided into electrostatic force and gravity. So in all larger structures, these remain as two distinct forces that are not inter-convertible. When an electron moves, magnetic force is created at the expense of electrostatic force. These three are the only 'forces of nature'.

(iv). Weak gravity¹² :

At the level of electrons, gravity is as strong as electrostatic force. During integration, 99.9 % of gravity is used inside nucleus. Out of the remaining, one-fifth is used for interaction between the nucleus and the electrons. So gravitational force between atoms is nearly thousand times weaker. When atoms integrate, gravitational force exists towards 'the centre of the body' formed. This force is extremely weak compared to the gravitational force between 'atoms', and this is observed as weak gravity.

(v). *Large number of arbitrary constants*:

Finiteness theory visualizes only four fundamental constants:¹⁰ the mass and radius of the fundamental particle, and the space and time quanta associated with it. These were derived using Planks constant, mass of electron, mass of neutron, and speed of light, and so the reverse deduction is possible. As the structures of electron, proton and neutron are like packing of spheres into larger spheres, their approximate radii alone can be theoretically deduced. Using these approximate radii, electrostatic constant, magnetic constant, Bohr radius and the so-called universal constant G can be deduced to give approximate values. (However, the mathematical relations for the 'mass difference between electron and positron', and the 'mass defect of proton' are yet to be arrived at.)

(vi). *Dark matter and Dark energy*:

These mysterious entities are part of the Λ CDM model, and so are model dependent. The accelerating expansion of the universe can be explained based on actual motion of galaxy-clusters¹⁴, and this does not require dark matter or dark energy.

(viii). Infinites ⁵ and singularities:

The fundamental particle has finite properties and so everything associated with matter is finite – even fields ⁴ are finite. Finiteness theory is thus devoid of infinities and singularities.

(ix). Increasing entropy ²:

A system and all its subsystems have entropy. An increase in the entropy of the system causes a reduction in the entropy of the subsystems, and vice-versa. The total entropy of an independent system thus remains constant.

7. Agreement with observations:

The Finiteness Theory modifies our world-view. But the world described is the same and so the theory should be in agreement with observed facts available, including the so-called exotic properties at the particle level. It can be seen from the following that the theory is in perfect agreement with the observable world.

(i). *Physical structures*:

The theory predicts the existence of all observable physical structures from *electromagnetic radiations*¹⁰ at the lowest level to *filament/voids*¹⁴ at the largest level.

(ii). *Accelerating expansion*¹⁴:

The theory predicts a pulsating universe, and now it is the expanding phase. The expansion is due to actual motion of clusters, and up to halfway, it is accelerating¹⁴.

(iii). *Cosmic Background Radiation*¹⁰:

The theory predicts a system of electromagnetic radiations to exist in the universe as background. This system also cools along with the universe that at any given time, it gives the average temperature of the universe.

(iv). *Amount of hydrogen*¹⁴:

During expansion, light elements change into dense elements and during contraction, the process reverses (the process does not lead to disintegration of atoms). Thus there is large amounts of light elements at the beginning of expansion.

(v). *Emergence of life*¹⁴:

The theory predicts that life emerges and exists in the middle region clusters during the middle period of expansion, and evolution reaches the zenith close to halfway of expansion. It requires only 8 million years more to reach exact half-way.

(vi). *Observable part of universe*¹⁴:

We belong to the middle region clusters where star formation is common, where life is possible and where fusion reactions end up with iron, the middle element. The observable universe, which extends only up to 9 billion light years from us, remain in this region, and naturally we observe these.

(vii). *Cooper pairs*¹³:

Cooper pairs are formed due to attractive magnetic interaction between moving electrons having opposite spins. The magnetic force created is completely used for the interaction, and so the moving pair has no magnetic field.

(viii). *Superconductivity*¹³:

Electrostatic force is finite, and is used for attraction and repulsion in a suitable ratio. If in a material the ratio is 50:50, it will provide a resistance-less path for electrons. Cooper pairs and suitable material together creates superconductivity.

(ix). *Plasma state*¹³:

Due to planar structure, hydrogen atoms can be packed very closely into a mass. At a certain position, the electrostatic force is used equally for attraction and repulsion, and the oscillatory and vibratory energy of the atoms is balanced by gravity. This represents plasma state, which exhibits superconductivity.

(x). *Hydrogen fusion*¹³:

In the above case, a slight decrease in internal energy disrupts the equilibrium, and the atoms collapse to form helium. Thus hydrogen fusion is a consequence of decrease in internal energy of a 'body made up of hydrogen atoms'.

(xi). Star formation ¹⁴:

Expansion is a process of internal energy changing into speed. As described above, this leads to hydrogen fusion and star formation. It is expansion that kindles and maintains the fusion reactions in stars.

(xii). Casimir effect ¹³ :

The gravitational attraction between 'atoms' is very strong compared to gravitational attraction between 'bodies made up of atoms'. If two parallel plates are kept in close proximity, the gravitational attraction between atoms manifest as Casimir force.

8. Theoretical proofs:

Finiteness theory can theoretically predict the following known values (the deductions are given in previous papers). These provide theoretical proof for the theory.

(i). The Classical radius of electron:⁸

Theory predicts that electromagnetic force of an electron is $mc^2/4$ (in energy units), and this force is completely used when two electrons touch. From this the classical radius of electron can be deduced.

(ii). Mass of Neutron .⁹

Based on whole number ratio of π , the theory predicts that neutron contains 919 electron-positron pairs. So the mass of neutron is approximately 1838 times of electron (positron being slightly heavier than electron).

(iii). The universal gravitational constant :¹²

The theory predicts that the so-called universal gravitational constant is actually the 'G of Earth' for its present speed, and can be theoretically deduced.

(iv). Earth- moon distance.¹⁴

The theory predicts that distance between the large-scale structures in the universe depends on the amount of matter in them, and this increases with expansion. Now expansion is at halfway, and so the present Earth- moon distance can be theoretically calculated.

9. Predictions at variance with the present view:

The theory predicts many things, as given below, which are not in conformity with the present views. These provide ways for testing the validity of the theory.

(i). Light follows circular path ¹⁰.

If the argument is correct, we will be observing the returning rays as well as the direct rays emitted by quasars. Thus the same quasar will appear at two different distances.

(ii). Expansion is due to actual motion of galaxy clusters ¹⁴.

If a reasonable number of object-image pairs of quasars are available, the direction of expansion, and centre of universe can be ascertained.

(iii). The age of the universe ¹⁴ is 15.46 billion years.

The oldest star so far observed is 14.46 ± 0.8 billion years old. There may be still older stars.

- (iv). *Universe cools at the rate¹⁴ 1K/2.99 million yrs.*
 The rate of cooling of radiations emitted by stars is such that at the end of expansion, (expansion lasts for 31.28 billion years and now it is at halfway) its temperature will be the same as that of the universe. It may be possible to ascertain this.
- (v). *Black holes have cold energy³.*
 There is symmetry between hot and cold states. The atoms in black holes oscillate in the same way as in hot bodies. This may be verifiable.
- (vi). *Light is streams of particles¹⁰.*
 Electromagnetic radiations are streams of particles moving along helical paths, and have gravitational fields. So these are dragged and bent by gravitational fields.
- (vi). *'A quantum of radiation' has a physical size.*
 The theory predicts that the length of a quantum¹⁰ and gap between quanta are equal to $1.0282 \times 10^{-2} \text{m}$. So absorption/emission of a quantum will take $3.4 \times 10^{-11} \text{s}$, and the time gap between two emissions in a stream of quanta¹⁰ will be double that.
- (vii). *The electromagnetic spectrum is finite.*
 The lower and upper limits¹⁰ of wave-length are $2.6392 \times 10^{-15} \text{m}$ and $4.4171 \times 10^5 \text{m}$. Due to delay in emission of quanta, radiations having apparent wavelengths greater than the limit are possible, but energy- wavelength relation will not be valid for these.
- (viii). *Radiations cool by disintegrating¹⁰.*
 In an expanding universe, the distance between particles inside the quantum increases, and the particles at the ends migrate to the gap between quanta, and gradually the gap gets filled and the ray splits into two, causing red shift¹⁰.
- (ix). *Mass of a neutrino¹⁰ is $4.296 \times 10^{-40} \text{kg}$.*
 Neutrino is a ring containing 42960400 fundamental particles, each having mass $1 \times 10^{-47} \text{kg}$. It has gravitational field but no electrostatic fields.
- (x). *Neutron has no fields⁹.*
 Neutron contains 919 electron-positron pairs. The force (both electrostatic and gravity) is completely used for the integration. So neutron has no fields.
- (xi). *Mass, not charge, takes part in electrostatic interaction.*
 Electrostatic and gravitational constants of an electron are the same, $2.7782 \times 10^{32} \text{m}^3/\text{kgs}^2$. Charge is a relative value⁸ for mass; the difference gets adjusted in the constant in the case of electron. But in the case of protons, using charge for calculating force gives wrong results.
- (xii). *Radius of proton⁹ is $4.04 \times 10^{-14} \text{m}$.*
 Proton contains 918 electron-positron pairs, and an unpaired positron. So its size should be proportionate to that of electron. This may be verifiable.
- (xiii). *G varies with speed⁴.*
 Measuring G in Moon or Mars will confirm whether G is speed dependent or not. If sufficient data regarding the measurement of G on Earth is available, it will reveal

whether there is a pattern in the variation of its value depending on the time of the year it is measured.

10. Relative merits:

'Standard Model' and ' Λ CDM Model' represent the latest approved theories of particle physics and cosmology respectively. Comparing these with Finiteness Theory, a single unified theory for both domains, will reveal the relative merits.

(i). Particle theory

	<u>Finiteness Theory</u>	<u>Standard Model</u>
<i>Fundamental particles</i>	<i>1 only</i>	<i>18 (61 counting all)</i>
<i>Independent parameters</i>	<i>4 only</i>	<i>21</i>
<i>No. of basic forces</i>	<i>3 only</i>	<i>5 or even more</i>
<i>Structure of a 'photon'</i>	<i>Explained</i>	<i>unexplained</i>
<i>Structure of electron and neutron</i>	<i>Explained</i>	<i>Unclear</i>
<i>Physically meaningless concepts</i>	<i>nil</i>	<i>Duality, virtual particles, etc.</i>
<i>Infinities</i>	<i>nil</i>	<i>Require re-normalization</i>
<i>Agreement with cosmology</i>	<i>fully compatible</i>	<i>Incompatible</i>
<i>Whether complete</i>	<i>Complete</i>	<i>Still incomplete</i>

(ii). Cosmology

	<u>Finiteness theory</u>	<u>Λ-CDM Model</u>
<i>Cause of Expansion</i>	<i>Explained</i>	<i>Unexplained</i>
<i>Past and future</i>	<i>Clearly explained</i>	<i>Unclear</i>
<i>Structure of universe</i>	<i>Clearly explained</i>	<i>Unclear</i>
<i>Physically meaningless concepts</i>	<i>nil</i>	<i>Space time, expanding space, etc.</i>
<i>Unexplained concepts used</i>	<i>nil</i>	<i>Dark matter, Dark energy</i>
<i>Infinities and singularities</i>	<i>nil</i>	<i>Present</i>
<i>Agreement with particle physics</i>	<i>Fully compatible</i>	<i>Incompatible</i>
<i>Whether complete</i>	<i>Complete</i>	<i>Incomplete</i>

Thus, as a theory in physics, the Finiteness Theory is complete in all respects: it explains all observable physical structures, explains both the past and the future, and is a single unified theory for all domains. Considering other aspects, it can be seen that the theory has the minimum arbitrariness regarding fundamental particles and independent parameters, does not contain any physically meaningless concepts, does not use any unexplained concepts in the models, and is devoid of infinities and singularities. Thus, Finiteness Theory has more perfection than the existing theories.

11. Conclusion:

As at present, there is no Theory of Everything; there are only would-be candidates. So this is the first time in the history of physics that a complete Theory of Everything is proposed. Whether it is the right theory or not, I leave it to the community of physicists to decide. The present generation, however, is busy refining the Standard Model and the Λ CDM model; I hope they will have enough time to take up this case.

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