

Nature of the Universe regarding Space, Time and Reality in Modern Science and in Jain Philosophy

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Abstract

Here in this paper, concepts of space, time and reality in the Universe are discussed according to modern science. A new order of space, time and reality in five-dimensional Universe with mass as the fifth dimension is discovered. It is found that these concepts are consistent with those propounded by Jain Philosophy in conformation with principle of Anekantwad of Lord Mahavira and the principle of conservation of energy. It is suggested that to get more light on the subject, Jain Philosophy should be studied in detail.

Keywords

Space, time, reality, modern science, Jain Philosophy

I. Introduction

A point cannot determine space. It can determine only a black hole. When a second point comes into being, we can measure the distance between two points and we can define space. It was sage Baudhayan who gave the formula for distance between two points, 200 years before Pythagoras. Baudhayan-Pythagoras Theorem $r^2 = x^2 + y^2$ is at the base of measurements in the Universe.

It gives infinite-linear dimension in space. A creature which has sense of only one direction cannot see a point near its path.

Then came to be known two dimensions x and y . They determine an area. It also expands the vision of that creature doubly infinitely. However creature can see the impression of the feet of a person standing nearby, but cannot see the person as a whole, as it has sense only of two dimensions. When third dimension Z comes into being, the creature could see the whole Universe, and the concept of volume came into being, and our vision of the Universe became triply infinite.

Baudhayana-Pythagoras Theorem then becomes: $r^2 = x^2 + y^2 + z^2$

In the Universe, as such, there is no object which has only one or two dimensions, all objects are of three dimensions. But there is time associated with every event. Newton used three dimensional, Euclidean space to describe his dynamics of the Universe with time 't' as an external parameter.

Though, Newton succeeded in describing the dynamics of the Universe for small velocities and weak gravity, nevertheless there were a few very genuine problems with his dynamics. It failed to describe motions of particles with high velocities and in the region of strong gravitational field. Moreover, it does not comply with Maxwell's beautiful electro-dynamics. To overcome these difficulties with Newtonian dynamics, Einstein set to generalize Newtonian dynamics. Einstein considered Universe to have four dimensions with time as fourth dimension. Obviously then, Pythagoras Theorem becomes $r^2 = x^2 + y^2 + z^2 - (ct)^2$

Note that time is measured in seconds and space, that is, lengths - x , y , z are measured in meters. How to convert time into length? This

can be done if we multiply 't' by a Universal Constant having dimensions of velocity and that, is C – the velocity of light. That is, 'ct' can serve our purpose. Negative sign is put in before $(ct)^2$, not to make space distance imaginary when four dimensional distance is zero.

If we take $x=y=z=1$ meter and $t=1$ sec, then $ct = 3 \times 10^8$ meter = 300 million meters. This shows that with respect to time space-dimensions are very much suppressed. When $x=y=z=300$ million meters then only, they become comparable to time-dimension, that is, when $x=y=z=1$ light year, space-dimension become appreciable compared to time-dimension. This is, indeed, interesting.

One should note that a physical quantity becomes a dimension, if it is independent physical quantity and is present throughout the Universe. x, y, z and t are such quantities.

To think that Universe may have five dimensions, what should be that physical quantity which could qualify for that, that is, a dimension? Velocity or acceleration certainly cannot.

Mass could qualify for that, as it is present throughout the Universe and is independent physical quantity. Here mass means mass and energy ($E=mc^2$).

But a question is: How to convert mass into length?

One can find a universal constant $G/c^2 = 7.42 \times 10^{-28}$ meter/kg which gets multiplied with mass gives dimension of length. Hence, we can write Baudhayan-Pythagoras distance in five-dimensional universe with mass as its fifth dimension.

$$r^2 = x^2 + y^2 + z^2 - (ct)^2 - (G/c^2 M)^2 \quad (1)$$

where M is the mass in kg and $m = (G/c^2 M)$ is mass in terms of length. But one can see that even with space dimensions, mass dimension is suppressed very much to the extent 7.42×10^{-28} . Mass dimension would be seen if $M = 10^{+27}$ kg, until then, it is suppressed.

II. Space Time and Reality in the Universe

The background metric [1] is:

$$r^2 = x^2 + y^2 + z^2 - (ct)^2 - (G/C^2 M)^2 \text{ with usual meaning and} \quad (1)$$

$$G/c^2 = 7.42 \times 10^{-28} \text{ m/kg.}$$

The Lorentz transformation of coordinates along m -axis in the background of five-dimensional Universe with mass as the fifth dimension given by (1) is

$$x' = x, y' = y, z' = z \quad (2a)$$

$$m' = \beta(m - vt) \quad (2b)$$

$$t' = \beta(t - v/c^2 m) \quad (2c)$$

$$\text{where } \beta = \frac{1}{\left(1 - \frac{v^2}{c^2}\right)^{+\frac{1}{2}}} \quad (2d)$$

m, m' are in length dimensions, that is, $m = (G / c^2)M$ and $m' = (G/c^2)M'$ where M and M' have mass dimensions.

Evolution of Mass of the Universe with evolution of the Universe with time

$$m' = \beta(m - vt)$$

$$(G / c^2) M' = \beta \{(G / c^2) M - vt\}$$

$$M' = \beta (M - (c^2/G) vt)$$

When $t=0$, $v=0$, $\beta=1$ and hence $M'=M_0$, the rest mass of the Universe.

As 't' increases

$$M' = \beta (M - 1.35 \times 10^{27} vt)$$

We have

$$M \geq 1.35 \times 10^{27} vt$$

At large distance, let $v = c/2$ and $t = 14$ billion light years - the present epoch of the Universe, we have

$$M \geq 1.35 \times 10^{27} \times 1.5 \times 10^8 \times 4.2 \times 10^{17} \sim 10^{53} \text{ kg} \quad (3)$$

In the Universe, there are about 100 billion galaxies. On an average each one contains 500 billion stars of average mass of the Sun.

Therefore, total mass of the Universe can be approximated to be 10^{53} kg. This is consistent with Eq. (3).

Evolution of Age of evolving Universe with evolution of its mass

$$t' = \beta \left(t - \frac{v}{c^2} m \right)$$

$$= \beta \left(t - \frac{v}{c^2} \frac{G}{c^2} M \right)$$

$$\text{when } t = 0, v = 0, \beta = 1, t' = 0$$

As 't' increases...

$$t' = \beta \left(t - \frac{v}{c^2} 7.42 \times 10^{-28} M \right)$$

$$\text{taking } v = \frac{c}{2}$$

$$t' = \beta \left(t - \frac{1}{2c} 7.42 \times 10^{-28} M \right)$$

$$= \beta(t - 1.23 \times 10^{-36} M)$$

Taking mass of the Universe at present epoch to be $\sim 10^{53}$ kg

$$t' = \beta(t - 1.23 \times 10^{-36} \times 0.8410^{53})$$

$$= \beta(t - 0.9338 \times 10^{17})$$

we have, now

$$t \geq 0.9332 \times 10^{17}$$

$$t \sim 10^{17} \text{ sec} \quad (4)$$

which is consistent with the age of the Universe at present epoch.

This shows that a simple Lorentz transformation in five-dimensional Universe with mass as the fifth dimension can give the mass of the Universe, if we know its age, and can give us the age of the Universe, if we know its mass. Note that Planck mass ($\sim 10^{-8}$ kg), plank time ($\sim 10^{-44}$ sec) and Planck length ($\sim 10^{-34}$ m) cannot be seen or appreciated. They give the lowest limits for mass, time and length to be seen or appreciated.

III. Space, Time and Reality in the Universe and in the Jain Philosophy

Here, we consider mass as a space dimension, and time also as a space dimension. One should note that, as dimensions, mass and time are independent, and also independent of space dimensions, but implicitly they are dependent on space, and they are real, that is, it gives reality, in that, it gives mass of the Universe at an epoch, if one knows the time. If we take time as present age of the Universe, we get the total mass of the Universe at this epoch and vice-versa.

This is, in conformity with Jain philosophy that space and time are real in the Universe. This is reality in the Universe. Reality means,

there is a correct theory to explain a particular phenomenon or thing, or it may have real existence. Jain metaphysics described space as an astikaya, i.e., an extended substance, which has an independent objective existence.

This shows that the space no more remains a mere order of things, but takes the form of some reality or field which has curvature. This is an independent reality, that is, akāśa. We are measuring everything with respect to this space, which is real and independent and therefore could serve as absolute space for our purpose. The whole finite universe is nothing but bubble of energy (Pudgala). In the Universe, Maxwell's equations have solution even in vacuum, that is, Electro-magnetic waves exist even in vacuum. So, residual curvature exists even in vacuum. One can, therefore, take space and ether as one and the same, synonym to each other and hence ether is not needed separately. In this sense ether has been abolished but has appeared in the form of space itself. Ether is not kind of matter (fluid) having some rigidity etc. Symbols appearing in equations like $E=mc^2$, Einstein's Field Equations, tensors, etc., represent state of ether, while mathematical equations show the relationship among symbols, themselves, as its characteristics. Space itself is energy.

The Jain philosophy defines akāśa as an objective reality or real substance giving room to other substances. General theory of relativity unifies space with gravitational field or the material field which includes electromagnetic field as well.

As far as the curvature of the Universe is concerned, a problem before scientists, on account of the solutions of field equations of the Universe, is whether the curvature is +ve or -ve. If the curvature is +ve, the Universe would be finite and closed and if the curvature is -ve, the Universe would be infinite and open.

The space of the Einstein Universe is +ve and hence, the Universe is finite and closed. On the basis of solutions of the field equations, it is also possible that the curvature is –ve. In that case, the infinite and open Universe has also been conceived.

Thus, on the basis of +ve or –ve curvature, there are two concepts of Universe (1) finite and closed and (2) infinite and open.

Now, if we assume that the curvature of Lokakāśa is +ve and that of the Alokakāśa is –ve, the finiteness of the Lokakāśa and the infiniteness of the Alokakāśa are possible. Confined to the finite but unbounded boundary, at the edge $T=0$ (where T is absolute temperature), nothing can move, nothing can escape from the Universe, whatever dimensions their Universe have. No motion in super cosmic space. Pudgala cannot reach there – the boundary of the loka.

Thus, the Jain Theory of Lokakāśa and Alokakāśa can be taken as a combination of the two cosmological theories (Universe) which accepts +ve or –ve curvature of space.

Jain Philosophy

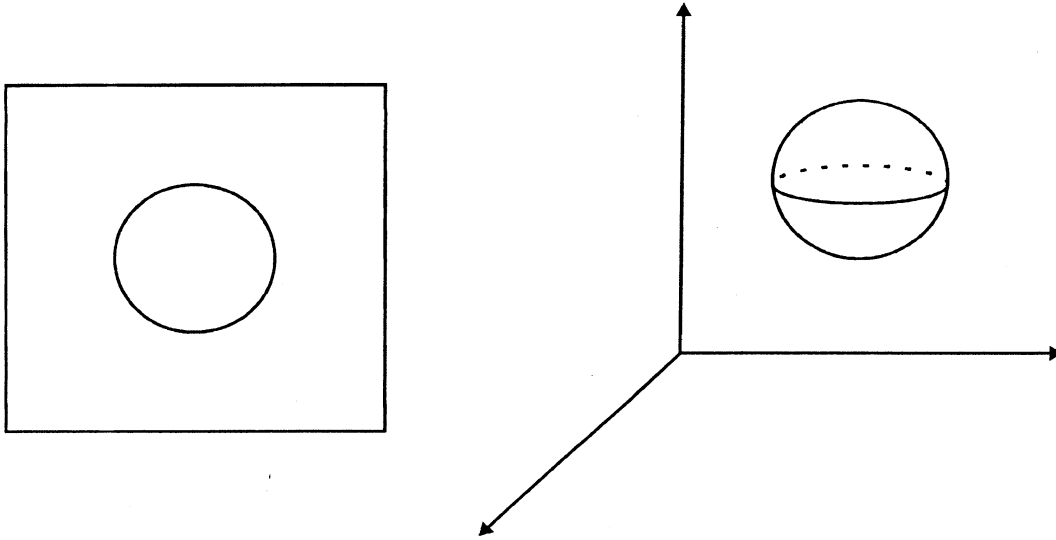
Einstein's Universe Loka-akāśa always occupied by Pudgala, finite and closed.

De Sitter Universe Aloka-akāśa empty space, infinite and open.

Lokaloka-akāśa Akasastikaya combination of both Einstein's Universe and De Sitter Universe.

In a way, Einstein's Universe and De Sitter Universe are sub-universes of the universe of Jain Cosmology.

Circle is curved in 2-dimensional space and also finite but unbounded. Sphere is curved in three-dimensional space. Three dimensional space is curved in 4-dimensional space. Four dimensional space is curved in 5-dimensional space. Five dimensional space is curved in 6-dimensional space and so on.



This implies that the Einstein Universe and the De Sitter Universe are sub-universes of the Universe propounded in Jain Philosophy.

Pudgala is that which possesses the attributes of touch, taste, smell and colour. In modern language, Pudgala is matter or energy. The smallest indivisible part of a Pudgala is a parmanu. Pudgalas are many in number. Pudgala is not devoid of consciousness. Substance in Jainism has the same meaning as substance in modern science.

Two points, are reality and therefore, distance between two points is also reality, as two points define space, so space is also a reality. Space is support to everything. Jain metaphysics described space as an astikaya, i.e. an extended substance which has an independent objective existence.

सर्वं यस्यवसादगात् स्मृतिपदम् ।
कालाय तस्मै नमः ॥

(Bhartruhari)

I bow down to that eternal time which transforms reality into memory.

In Jain Philosophy of Mahavira, Kala (Time) is accepted as a substance, reality (physical quantity).

In Jain Philosophy, there is concept of Planck-time ($\sim 10^{-44}$ sec) time-atom (kalanus).

Relativity theory now also indicates that there exist quanta of space, time and mass hence one can treat General Theory of Relativity under Thermodynamics.

Jain Acharyas have thought about space and time very deeply. It should, therefore, be paid attention to (Muni Mahendra Kumarji, [2]) Concepts like empirical time, transcendental time and kalanus in Jain Darshan are marvelous. In Shvetambara tradition transcendental time (kāla), is believed to be in the form of modes of jīva and ajīva, whereas, in Digamabara tradition, the transcendental time is considered to be independent objective reality. Time is real enigma of the Universe. It is taken to flow straight, but is measured in terms of cyclic phenomena. We can make sense of timeless existence. Measure of space and time is objective. Effect of motion on the dimensions of length, time, even on mass can be sensed.

Anekantvad of Lord Mahavira – Solution of all disputes (in-fighting)

Anekantvad of Lord Mahavira is, indeed, a great principle. It states that different views of scholars and scientists old and new, should be

respected and understood, and we should remove defects, if any, in our own concepts by knowing good and bad of concepts in theories of others, thereby, strengthening our own views. Do not reject views of others outright. Do not keep prejudice against any theory but understand it very well, as if it is correct, then and then only, you will find good and shortcomings of theories of others. This can improve the concepts of our own theory.

Principle of Conservation of Energy and Jain Philosophy

The Principle of Conservation of Mass and Energy in modern physics and the theory of persistence through modes in the Jain philosophy are propounding the same truth that the reality is ultimately eternal, although the scientific principle is related with physical reality, the Jain philosophy applies to all fundamental substances and, in that sense, much more general.

Modern science can explain the Universe from all four points of view which are consistent with those given by Lord Mahavira. These four points of view of Lord Mahavira are:

1. Universe from substance point of view
2. Universe from space point of view
3. Universe from time point of view
4. Universe from modes point of view

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References:

- [1] Bijan N. & Rawal J. J., "Mass as the Fifth Dimension of the Universe", International Journal of Astronomy and Astrophysics, 2013, Vol. 3, **257-259**
 - [2] Muni Mahendra Kumarji – The Engima of the Universe, Jain Vishva Bharati University Ladnun 341306 (Rajasthan, India). Shri Vardhaman Press, Naveen Sharma, Delhi 32, (2012).
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