A Study of Parallels between Modern Physics and Concept of Spanda Shastra

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ABSTRACT
Spanda-Karikas is one of the important works of Kashmir Saivism. Modern scientists have discovered that the world was created from the vibration of the first explosion and that the universe is still expanding. This paper points out the parallels between modern physics and *spanda* principles. They will particularly look at the parallels between *spanda* principles to particle physics, quantum mechanics, theory of relativity and string theory. It is there opinion that present-day science and engineering students should be able to work quantitatively with the concepts of modern physics and *Spanda Shastra*.

Keywords
Spanda-Karika, modern physics, particle physics, quantum mechanics, string theory Shiv shakti, shakti-cakra mantras.

1. INTRODUCTION
Spanda-Karikas in one of the important works of Kashmir Saivism. The doctrine of *spanda* is scientific. Modern scientists have discovered that the world was created from the vibration of the first explosion and the universe is still expanding. *Spanda* is a Sanskrit term derived from the root '*spadi*', which means to move a little for the creative pulse of the universe as it manifests into dynamism. The term is a key concept of Kashmir Saivism according to which the entire universe is nothing but conscious energy where everything in the universe is that I consciousness expressed in different forms. *Spanda* as the supreme reflects different meanings including vibration, an explosi-n, an arising of a throb source of spontaneous expression or a reflection oriented through thought and intention to organize into authentic action. It is dynamic consciousness. *Spanda* also connotes *svatantrya* (absolute freedom) of the divine. *Spanda* means both tension, excitement, and, in scientific terms, voltage or potential difference. *Spanda* may be described as a desire to lie according to the innermost urging of soul and rhythm of the nature of the body as they harmonize within the great scale of natural life. *Spanda* is not only sound but unity of sound and light, not only tone but a unity of tone and colour, a unity implied by the term 'colour tones'. The authorship of *Spanda-Karikas* is divided. Amongst Bhaskara Utpala Vaisnava and Bhatta Utpala, both of whom flourished in the 10th century CE.

The author of this *Karikars* was Kallata who was the chief disciple of Vasugupta. Vasagupta divided the *Karikas* into three sections: totalling 53 verses as follows:

1. Svarupaspanda or Spanda as essential Nature of Siva [25 verses]
2. Sahajavidyodaya[7 verses],
3. Vibhutispanda[19 verses].
4. two verses.

2. MODERN PHYSICS
In the 18th century Newtonian universe is Euclidian Geometry. Newton's equations and fundamental laws of motion are the basis of Classical Mechanics. French mathematician Laplace explained irregularities in the motion of the planets. So Laplace succeeded in explaining the planetary motions, tides and other phenomenon related to gravity. In 19th century discovery of electric and magnetic field along with the works of Faraday and Maxwell replaced the concept of force by the force field. Maxwell tried to explain in mechanical terms, interpreting the fields as states of mechanical stress in space filling medium called 'ether' and the electromagnetic waves as elastic waves of this ether. Einstein pronounced that no ether existed and that the electromagnetic fields were physical entities which could travel through empty space and could not be explained mechanically.

In 1905 Einstein initiated the revolutionary trends of thought 1) special theory of relativity and 2) theory of atomic phenomenon. According to relativity theory space is not three dimensional and time is not a separate entity. Both are intimately connected and form a four dimension space-time. In relativity They can never talk about space without talking about time and vice versa. Einstein invented the equation $E = mc^2$ where 'c' is the speed of light. Einstein's general theory of relativity abolishes the concepts of absolute space and time. The whole structure of space and time depends on the distribution of matter in the universe and the concept of empty space loses its meaning. The discovery of X- rays led to the conception that the atom had some structure. Ernest Rutherford realized that α-particles emanating from radioactive substances were high speed. This was by supplemented by discoveries of Niel Bohr, de Broglie, Schrödinger, Pauli, Heisenberg and Dirac. Every time they asked nature a question in an atomic experiment, nature answered with a paradox. After a long time they accepted the fact that these paradoxes belong to the intrinsic structure of atomic physics. In the words of Heisenberg they got into spirit of quantum theory and finally they formed the concept of quanta.

Depending on how they look at them it appear sometimes as particles or sometimes as waves. After these developments Max Planck discovered that energy is in the form of energy packets. Einstein called these packets 'quanta'. Quantum theory reveals a basic oneness of the universe. Quantum theory has shown that all these properties of atoms arise from

the wave nature of their electrons. In 1930, after quantum theory had emerged, the main task was to understand the structure of nuclei and forces which hold them together. In the 1930s scientists discovered the basic building blocks of matter which were three basic elementary particles. Understanding the nuclear world is essential to both quantum theory and relativity theory. The new view of particles was put forth by Dirac. Dirac predicted the symmetry between matter and antimatter. After Dirac the dynamic realistic view was adopted. Did the paradox disappear? The particles were now seen as dynamic patterns, which may involve additional particles. High energy collision particles are used by physicists to study the properties of these particles and particle physics is therefore also called 'high energy physics. Both force and matter are now to have their common origin in the dynamic pattern, which we call 'particles'. The particle world cannot be decomposed into elementary components. In modern physics the universe is as a dynamic inseparable whole which always includes the observer in an essential way. The similarity of quantum physics to relativistic theory becomes apparent and even stronger in 'quantum–relativistic' models of physics. After this the concept of string theory started gaining ground.

Relativistic quantum field theory was effective in describing the observed behaviours and properties of elementary particles. But the theory itself only works well when gravity is so weak that it can be neglected. Particle theory only works when we pretend that gravity does not exist. General relativity has a wealthy look into the universe, the orbits of planets, the evolution of stars and galaxies, the big bang and recently observed black holes and gravitational lenses. However, the theory itself only works when we consider the universe as purely classical and quantum mechanics as not needed in our description of nature. String theory is believed to bridge this gap.

Originally string theory was proposed as an explanation for the observed relationship between mass and spin for the certain particles called 'hadrons' including protons and neutrons. It has also been known for a long time that there is a particle with zero mass and two units of spin. This has been known by the theoretical physicist for a long time. This particle is called 'graviton'. This led to the belief that string theory be applied not as a theory of hadronic particles but as a theory of quantum gravity for zero distance between the interacting particles for the gravitons' mathematics behaves so badly at zero distance that the answers just do not makes sense. In string theory the strings collide over a small but finite distance and the answers do make sense. But the zero distance behavior is such that quantum mechanics combine with gravity and they can talk sensibly about a string excitation that carries the gravitational force. This was a great hurdle that was overcome in the late 20^{th} century physics, which is why young people are willing to learn the grueling complex abstract mechanics that is necessary to study quantum theory of an interacting string. What is string theory? Think of a guitar string that has been tuned by stretching the string under tension across the guitar. Depending on how the string is plucked and how much tension is in the string, different musical notes will be created by the string. These musical notes could be said to be excitation modes of that guitar string under tension. In similar manner, in string theory the elementary particles we observe and particle accelerators could be thought of as the 'musical notes' or excitation modes of the elementary strings. If string theory is to be a theory of quantum gravity then the average size of a string should be somewhere near the length scale of quantum gravity called the 'Planck length' which is about 10^{-33} centimeters. String theories are classical according to whether or not the strings are required to be closed loops, and whether or not particles spectrum includes fermions. In order to include fermions in string theory, there must be a special kind of symmetry called 'super symmetry', which means for every boson (particle that transmits a force) there is a corresponding fermion (particle that makes up matter), so super symmetry relates the particles that transmit forces to the particles that makes up matter. In the next decade evidence for super symmetry at high energy would be compelling evidence that string theory was a good mathematical model of nature at the smallest distance scale.

3. HISTROY OF STRING THEORY:

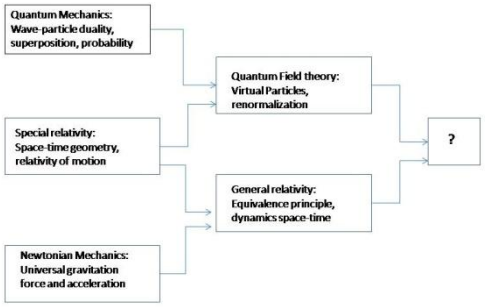

Figure 1: Components of Strings

In 1970 string theory emerged to describe the particle spectrum and it also described the quantum mechanics of oscillating strings. In 1991–1995 the duality revolution's interesting work on string black holes in higher dimensions leads to a revolution in understanding how different versions of string theory are related through duality transformations. Then what is string theory–what is the world made up of? Ordinary matter is composed of atoms, which are in turn made up of three basic components: (1) The electron whirling round the nucleus. The electron is a truly fundamental particle and one of a family of particles known as leptons. (2) The nucleus composed of neutrons and protons. Neutrons and protons are made of smaller particles known as quarks. Quarks as far as they known as elementary. The knowledge of subatomic composition of the universe is summarized by the Standard Model of particle physics. It describes (1) the fundamental building blocks out of which the world is made, and (2) the forces through which the blocks interact.

There are 12 building blocks:

Table 1: Building Blocks of particles

Six Quarks	Six Leptons
UP,	Electrons and heavier siblings
DOWN	Neon
CHARM,	Tauon
STRANGE,	Three neutrinos
BOTTOM,TOP	

For example, proton is made up of two up quarks and one down quark. There are four fundamental forces in the universe:

1. Gravity
2. Electromagnetism
3. Weak nuclear force
4. Strong nuclear force.

Each of these forces is produced by fundamental particles that act as carriers of the force. The most familiar is photon, a particle of light, which is the mediator of electromagnetic forces [e.g. a magnet attracts a nail because both the objects exchange photons]. Graviton is a particle associated with gravity. Strong force is carried by eight particles known as 'gluons'. Weak force is transmitted by three particles, the ω^+,$\omega^-$and z . The behaviour of all these particles and forces is described precisely by the Standard Model. The essential idea behind string theory is that all of the different 'fundamental' particles of the standard model are really just different manifestations of one basic object, a string. How can that be? Electron is ordinarily pictured as a point with no internal structure. A point cannot do anything but move. But if string theory is correct then under extremely powerful microscope electron is not really a point but a tiny loop of string. A string can do something aside from moving—it can oscillate in different ways. If it oscillates a certain way, then from a distance they are unable to tell whether it is really a string, and they say an electron. But if it oscillates in some other way than gravity then we call it a 'photon' or a quark or a you get the idea. So if string theory is correct then the entire world is made of strings.

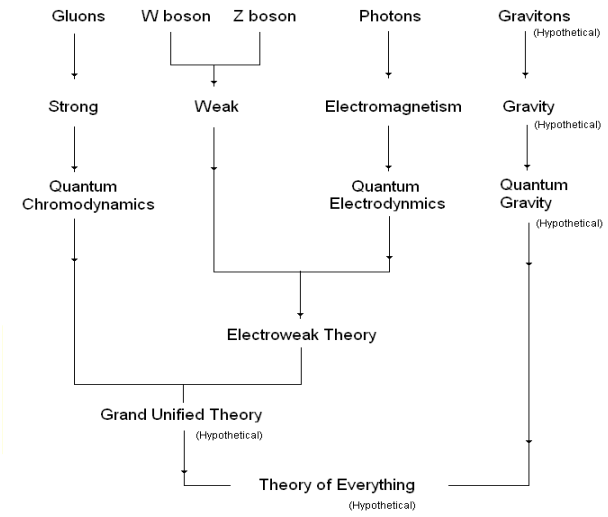

Figure 2: Force Carriers

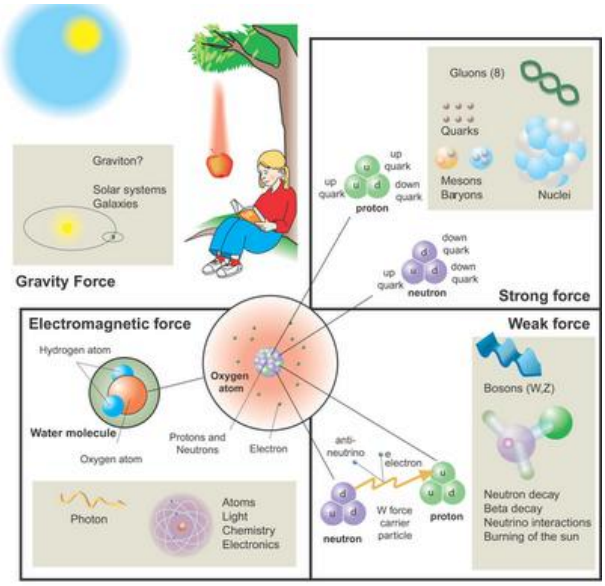

Figure 3: Newton's Concept of Force

Source: The Daily Blaa Blog Spott http://www.thedailyblaa.com

4. PARALLELS BETWEEN SPANDA PRINCIPLES AND MODERN PHYSICS.

In what follows, we provide the verses from the *Spanda Shastra* and attempt to draw out a parallel of it to modern physics. The numbers correspond to the numbers of verses.

1. In *Spands Sastra*: *Svatantryasakti* (The power of absolute freedom) of lord is called *Spanda*.

Parallels in physics: Energy is parallel to *svatantryasakti*. Is energy fundamental?

2. In *Spanda Shastra*: This power though non-distinct from the lord goes on presenting the cycles of manifestation and withdrawal on its own background like the reflection of a city in mirror.

Parallels in physics: This *fundamental* property of nature (matter and non-matter) which occur in different forms with respect to time and is unique and also it cannot be differentiated from its origin $(x_iy_iz_it_i) – (x_ny_nz_nt_n)$

3. In *Spanda Shastra*: The great teacher has written this *sastra* in order to explain the fact that our nature is identical with that of Sankara who is full of *spandasakti* the essence of which consists in quivering light, thus this *shastra* has been appropriately named *Spanda*.

Parallels in physics: The universe is made up of different particles. The existence of these particles is realized due to their vibrating property in nature

4. In *Spanda Shastra*: The root meaning of the word *Spanda* is 'having slight movement' the lord is *acala*, means non-moving. Therefore, movement cannot be ascribed to him. The word '*Spanda*' in case of the lord, i.e. Shiva, has to be taken in a figurative sense of creative pulsation, divine activity throbbing with life dynamism.

Parallels in physics: Macroscopically atom is the smallest part of an element. Each element is composed of different elements. Therefore we can say that the atom is the representation of the universe which is basically a stable state. However, when this universe is studied through its particle structure microscopically, it is observed that the notion of the

universe being stationery is negated. In fact the universe is constantly in a moving state (vibration state) which is attributed to the elementary components of atoms of the universe which are by nature always in motion in this aspect. They can claim that the universe is dynamic and not static. This phenomena assigns the dynamic to the universe which defines life.

5. In *Spanda Shastra*: *Spanda shakti* consists of the compact bliss of consciousness which holds in its bosom (chest) endless cycles of creation and dissolution which is of the nature of the entire world of the pure and the impure; which, in turn, is of the nature exhibiting limitation and expansion of subjects and object

Parallels in physics: The world is made up of building blocks which are fundamental elements. These blocks constantly interact with each other due to forces existing between them. That means core of building blocks possesses certain quantum of energy which is intrinsic of the blocks and forms the source of energy for interactive forces mentioned above. This quantum of energy is variable in nature for every block and hence the amount of energy inhaled or exhaled during the interaction occur intermittently and is responsible for the expansion and contraction behaviour of the matter—pure or impure—of which the universe is made up of. The details of the quantum energy, interactive forces and related blocks is elaborated in the Standard Model.

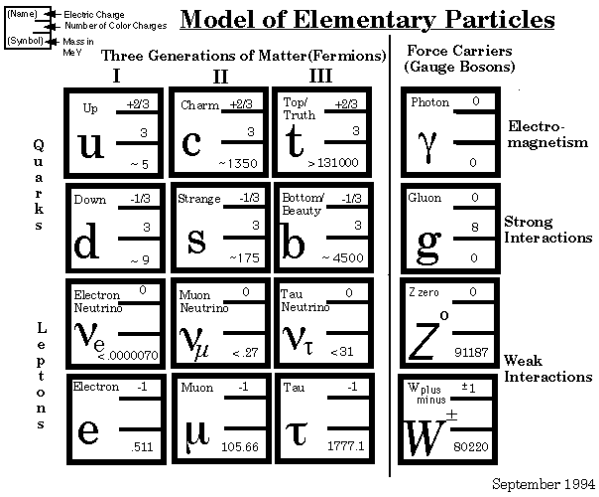

Figure 4: Standard Model of Elementary Particles

(Source: https://www.withfriendship.com/images/g/30710/Elementary-particle-pic.png)

6. In *Spanda Shastra*: The goddess (i.e. creative power) is always engaged in exercising her energy in manifestation and yet always appears as replete she is the wave of ocean of consciousness, the volitional power of LORD.

Parallels in physics: The atomic power is constantly used up in the creation of the new universe and this power is exhibited in different forms and capacity. The quantum of energy which is intrinsic of every individual component forms a part of the vast energy existing in the universe. This represents the vibration behaviour of the matter.

7. In *Spanda Shastra*: Whose sakti (divine power) predominant in displaying creations instinct with the concealment (*nimesa*) of his *(sivas*) essential nature is the cause of the manifestation of the universe, i.e. manifestation form Siva, down to earth consisting of diversity.

Parallels in physics: This energy is prominent in the phenomena of the process of variation in the form of universe thereby hiding the fact that energy is the root cause for the change in the universe.

8. In *Spanda Shastra*: In reality however nothing arises and nothing subsides They show that it is only the divine *Spanda sakti* (the divine creative *pulsatia*) which though free of succession appears in different aspects as if flashing in view and if subsiding *sthiti* (maintenance of the world process *vilaya* (concealment of the essential nature) and *anugraha* (grace) are not anything other than particular forms of absorption and manifestation.

Parallels in physics: A quantity of liquid when cooled changes with absorption of energy as the same. When heated it changes again, and, with the form of energy exhaled, the quantum of energy in both the cases is the same. This shows that energy is neither created nor destroyed but what changes is the form (state) only. The law of conservation of energy is verified.

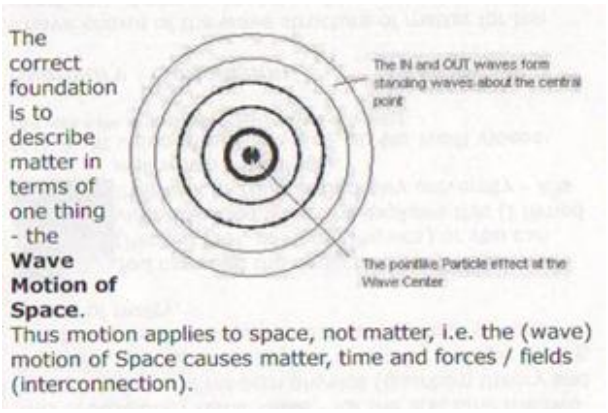

Figure 5: Wave Motion of Space

(Source: http://www.spaceandmotion.com/Most-Simple-Scientific-Theory-Reality.htm)

9. In *Spanda Shastra*: By *sakti-cakra* is meant the aggregate of twelve divinities such as *sristi rakta*, etc. By its *vaibhava* is meant the play of that aggregate in the form of creative activity (*udyoga*), maintenance (*avabhasana*), and absorption (*carvana*). So the whole phrase *sakti–cakra vaibhava- prabhavam* means the cause of creative creativity, etc., of the twelve divinities.

Parallels in physics: Energy spectrum of the atomic structure is an aggregate of 12diferent elementary particles structure spread over three generations of matter in the form of quarks (q1,q2,q3) and leptons (L1,L2,L3), The beauty of the resultant of these three generations of material particles is responsible for the creation, maintenance and absorption activities of the universe

10. In *Spanda Shastra*: *Sakti-cakra* is described of the aggregate of powers because it exists as identical with the internal digit of the supreme.

Parallels in physics: The atomic structure (*shakti chakra*) is the sum of the powers responsible for the three basic activities, that is creation, maintanance and destruction. This happens due to the behavior of the originator atom. So they say that the two powers (structure and originator) are identical

11. In *Spanda Shastra*: *Sakti* means 'the eternal mantras'.

The empirical individuals experiment their psychic apparatus, their organs of sense and action and the objective world are the expressions of these *saktis.* Eternal mantra is the mantra of *purnahanta* the ever-Present perfect I-Consciousness of the divine.

Parallels in physics: The fundamental vibrations of the elementary particles are the frequencies of the ever existing atom of this universe and they are the intrinsic properties of the atom.

12. In *Spanda Shastra*: According to of the group of powers arising from the multitudes of the words '*sakti*' stands for the nature of the deities like Bramhi, etc. The presiding deities of the multitudes of the words are the following:

I. *Yogisvari* or *mahalakshmi* of a-*vergai*-e of the class of vowels.
II. *Bramhi* of *ka-verga*.
III. *Mahesvari* of *ca-verga*.
IV. *Kaumari* of *ta-verga*.
V. *Vaisnavi* of *ta-verga*.
VI. *Varahi* of *pa-verga*.
VII. *Andri* or *indrani* of *ya-verga*.
VIII. *Camunda* of *sa-verga*.

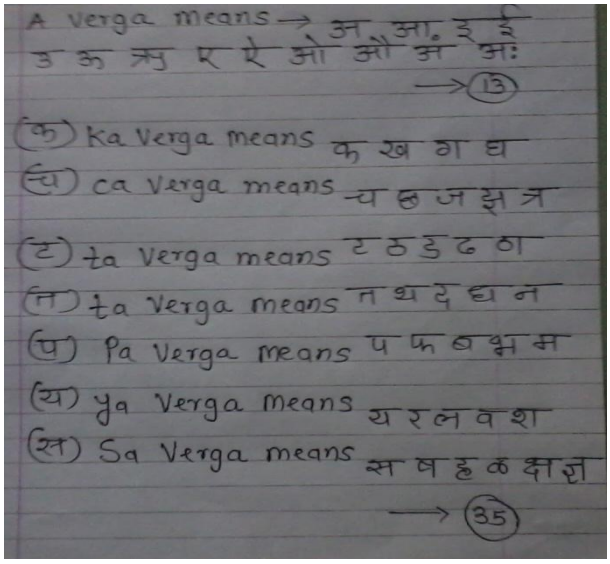

Figure 6: Consonents and Vowels

Table 2: Elementary Particles

Elementary Particles

	Types	Generations	Antiparticle	Colors	Total
Quarks	2	3	Pair	3	36
Leptons	2	3	Pair	None	12
Gluons	1	1	Own	8	8
W	1	1	Pair	None	2
Z	1	1	Own	None	1
Photon	1	1	Own	None	1
Higgs	1	1	Own	None	1
Total					61

(Source://en.wikipedia.org/wiki/Standard_Model)

Parallels in physics: Every element is recognized by its atomic structure which is made up of two basic components —1)the core and 2)its derivative. 1)The core is broadly derived into 12 different energy levels 2)The derivative may be considered as their siblings and are broadly 36 in nature based on their quantum energy. Hence they say that the entire phenomena in the universe is because of the kinetic energy of the core which has 12 quantum levels and their derivative 36 quantum levels resulting in a total of 12+36=48 quantum energy levels in general depending on energy spectrum of these 48 levels. These 48 are graded as *brahmi*,----------etc (8 *verga*)

13. In *Spanda Shastra*: In *Spanda Shastra* the particle '*ca*' should be interpreted in the sense of '*eva*' and should be put in different order so now the line would stand as '*yatrasthitameva*' (*yad*) *idam sarvamkaryam yasmad nirgatam* meaning only as existing in him is all this world come forth.

Parallels in physics: This collection of 48 energy levels are responsible for the universe which is existing in a given state.

5. CONCLUSION

In this paper they have tried to unfold the mystery of *Spanda Shastra*. In an attempt to do so,they found and observed that in modern physics the technology and the laboratory are dominant in arriving at the results, whereas in *Spanda Shastra* the human body was the technology and instruments both for arriving/understanding of the principles of nature. Hence they are prompted to conclude that the better understanding of nature and its laws/behaviour will be more fruitful if both the sciences work hand in hand.

6. ACKNOWLEDGMENTS

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