Modern Physics and Kashmir Shaivism: The Higgs, Mass, Symmetry and Entropy

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ABSTRACT

After a brief review on the Higgs mechanism and the way it affects the perception of mass, the connection between mass and symmetry is visited. The computational universe model connecting quantum information theory with spacetime is then reviewed and the symmetry-mass connection is explored here as well. Based on these connections, a common thread linking entropy, symmetry, mass and information content is formulated. The key concepts of Kashmir Shaivism, mainly the Shuddha Vidyas are explored and the connection between these concepts and the common thread is elaborated upon. The remarkable similarity between the philosophical underpinnings between Kashmir Shaivism and Modern Physics reinforce the strong connections between the latter and Oriental Philosophy.

KEYWORDS:

Higgs Mechanism, Computational Universe, Black Holes, Entropy, Kashmir Shaivism.

INTRODUCTION

The discovery of the Higgs Boson has certainly taken the physics world by storm [CMS, 2012]. As the long sought after missing piece in the jigsaw puzzle of particle physics, the Higgs boson and the underlying Higgs mechanism provide a paradigm shift in our perception of mass and the understanding of why matter dominates over anti-matter [Baggott, 2012]. Such an understanding has far-reaching implications into answering pressing questions such as the nature of the early universe, characteristics of black holes and other singularities and so on [Papontonopouos, 2009]. It is noteworthy that a paradigm shift of this capacity begins with a small amount of clarity on the way we understand basic mathematical concepts such as symmetry and chirality [Hosaka and Toki, 2011].

On the other hand, the formulation of computational universe based theories proposed by physicists such as Lloyd have provided yet another route to the perception of reality and in particular, mass [Lloyd, 2002; Lloyd, 2006; Wolfram, 1994]. This route is through quantum information [Deutsch, 2004]. Building on these premises, similarities between black holes and quantum informational effects such as entanglement have been documented [Borsten et al, 2009; Borsten et al, 2011].

Building on the above mentioned core concepts of symmetry and information, the present paper takes a non-mathematical, metaphysical approach in connecting the common strands. After charting out the

relations between various concepts of the symmetry/Higgs mechanism and Entanglement/quantum information phenomena, the parallels between the philosophies of modern physics and the established Indian tradition of Kashmir Shaivism are explored [Mishra, 1999; Dycskowski, 1987; Shankarananda, 2003]. It is concluded that in the context of physical concepts such as symmetry, entropy and information, the analogues in Indian Spirituality is more than a happy coincidence.

THE HIGGS MECHANISM, MASS AND SYMMETRY

As a first step, the connection between mass, the Higgs mechanism and symmetry is explored. From existing literature on the interrelationships between these concepts, one can summarily observe the following:

1. The Higgs Boson is a scalar Boson, lacking spin, typically produced in a Gluon Fusion [CMS, 2014; Baggott, 2012].
2. The Higgs has a Vacuum Expectation Value, which on interaction with various particles gives them 'mass'. The Higgs field does not interact with massless particles such as the photon Baggott, 2012].
3. By contributing to the electroweak symmetry breaking phenomena, the Higgs Boson is responsible for the short range of the weak nuclear force and also the unification of the electromagnetic and weak nuclear forces [Baggott, 2012].
4. By equating the relation between the intrinsic angular momentum and spin of a particle to helicity ('handedness'), a massless particle can be viewed as an indicator of the 'intrinsicity' a particle's helicity. In short, if a particle has mass, different observers in different reference frames will measure different helicities [Hosaka and Toki, 2001].
5. As a parallel to the concept of helicity, chirality is defined by extending the polarity of direction of motion to complex plane, where the imaginary part, also seen as the shift in the quantum wavefunction, yields the chirality [Hosaka and Toki, 2001].
6. The effect of mass is to primarily 'mix up' particles. For instance, left chiral electron and the right chiral electron are viewed as a single entity – the mass-basis electron [Hosaka and Toki, 2001; Baggott, 2012].
7. The Electroweak group is mathematically defined by the Lie algebra of SU(2)xU(1). This results in three massless W bosons and a massive B boson. However, by 'absorbing' the charged Higgs Bosons, the W bosons develop charged versions of W+ and W-, whereas by the Goldstone Effect, the third W boson and the B boson combine to form the massive Z Boson. This phenomenon, combined with the non-zero Vacuum Expectation Value (VeV) of the Higgs Field results in a Mexican Hat Potential, ensuring that at the point of minimum potential energy, the VeV is non-zero. Also, this ensures that a rotation operation changes the physical configuration, thus destroying the symmetry [Baggott, 2012].

The take-home message from the above listed points is simple – Higgs breaks symmetry and gives particles mass.

COMPUTATIONAL UNIVERSE AND SYMMETRY

In order to form a platform agnostic metaphysical view of the concepts of symmetry and mass, it is imperative to review their connection with the concept of information. Such a connection forms the backbone of Computational Universe based theories, published by Lloyd and other scientists. The key points from these formulations are the following.

1. 'Computational Universe' models the 4D spacetime continuum as a network of quantum gates, the fundamental correspondence being that of 'matter' with 'information' [Lloyd, 2006].
2. Every quantum gate is seen to either transform ('scatter') a qubit state or leave it unchanged, and every such combination of operations in a network of quantum gates forms a 'computational history' [Lloyd, 2006; Lloyd, 2002].
3. By equating the information derived action equations with the spacetime based counterparts in the context of Delaunay and Voronoi based simplicial 'geodesic domes', the Einstein-Regge equations are written, relating spacetime geometry and computational 'matter' [Lloyd, 2002, Lloyd, 2005, Lloyd, 2006].
4. The STU supergravity model of a Reissner-Nordstrom Equation of a Black Hole, has in principle been shown to be equivalent to 3 qubit entanglement, with the point of equivalence being that of the 8 charges and the 8 components of a 3 qubit hypermatrix [Borsten et al, 2009; Borsten et al, 2011].
5. This implies that a genuine tripartite entangled state such as the GHZ entanglement has a direct correspondence to a black hole without a Bogomol'nyi Prasad Sommerfield (BPS) bound. It is observed that this case of entanglement has the least symmetry [Borsten et al, 2009; Borsten et al, 2011].

The key points here are that information is equated to matter, and the quantum operations of entanglement reduces the symmetry and is shown to increase the 'mass'.

CONNECTING THE DOTS

The common links of mass and symmetry between the Higgs effects and the Computational Universe based theories enable us to form a comprehensive view covering them both in a platform agnostic fashion. To this end, we uncover yet another common link – entropy.

Entropy, as a generic measure of uncertainty finds application in statistical physics and thermodynamics [Brooks, 1988]. While in statistical physics, entropy is viewed as an indicator of the information carrying capacity, thermodynamics defines entropy as the disorder, which is always on the increase in a natural process [Brooks, 1988].

We now have enough elements to frame a connection between the various concepts of mass, symmetry, entropy and information. This connection can be best viewed as a dichotomy – by considering two extreme cases, considering the Symmetry as the Base. This model is given as follows:

1. The perfectly Symmetric Case: Here, symmetry is not broken and hence this is a Massless case. Since mass is equated to information, this case has less amount of Information and hence a lower Entropy. In the particle level, this case would correspond to a massless particle such as photon.
2. The perfectly Asymmetric Case: The breaking of symmetry gives rise to Mass, and thus to Information, through a positive Action value. This consequently increases the Entropy. This case would directly correspond to a massive object such a black hole.

According to the Second Law of Thermodynamics, in a Natural Process, the entropy always increases [Brooks, 1988]. This can be re-stated as follows: In a natural process, nature tries all possible ways to break the symmetry and increase informational content.

SYMMETRY AND KASHMIR SHAIVISM

A lot of modern physicists such as Fritjof Capra have written and published on the equivalence between core concepts in modern physics and Oriental Philosophy [Capra, 2010]. In this context, we now try to find similarities between the Symmetry based connection outlined above and Indian Philosophy.

Of particular interest in this regard is the philosophical school of Kashmir Shaivism. Woven around the spontaneous recognition concept of "Pratyabhijna", it is typically viewed as a form of monistic idealism [Mishra, 1999; Dyczkowski, 1987; Shankarananda, 2003]. Among the various concepts elaborated in this school of philosophy, the most relevant to the present work is the concept of the 36 Tattva - 36 concepts describing the Absolute, its internal aspects and various aspects of creation [Mishra, 1999; Dyczkowski, 1987; Shankarananda, 2003].

The Tattvas are classified under three groups – Ashuddha ('impure' materialistic concepts), Shuddha-Ashuddha ('pure-impure' soul based concepts) and Shuddha ('pure' internal aspects of the Absolute). Of these, the Shuddha Tattvas consist of 5 concepts arising out of a form of Shakti (Energy) – Chit Shakti, Ananda Shakti, Iccha Shakti, Jnana Shakti and Kriya Shakti – each describing a stage in the creation of the universe and thus a projection of the Divine Energy of the Absolute [Mishra, 1999; Dyczkowski, 1987; Shankarananda, 2003].

The 5 Shuddha Tattvas and their relation with the above discussed Symmetry based concepts are as follows:

1. Chit Shakti – This represents Divine Consciousness, creating the Shiva Tattva.
2. Ananda Shakti – Creating Shakti Tattva, this represents Supreme Bliss. This and the previous Tattva represent the stage where Shiva and Shakti are completely identical to each other and are inseparable. This is thus the stage of pure symmetry – low entropy and 'massless'.
3. Iccha Shakti – The Divine Will, creating Sadashiva Tattva. In this stage the 'Aham' principle or 'Ego'ness dominates – the Shiva-Shakti attain self-realization.
4. Jnana Shakti – The Divine power of knowledge – creating Ishvara Tattva. In this stage the concept of 'Idam' or 'this'ness dominates. This stage is essentially when the 'scheme' for the creation of the universe is formulated. In this stage and the previous, Shiva and Shakti are

distinct, but not different. Thus, these stages represent a partial breaking of symmetry, increasing entropy and 'mass'.

5. Kriya Shakti – The power of manifestation creating Shuddha Vidya. Shuddha Vidya, as the instrumental function of the Sadashiva and Ishvara Tattvas balances the Aham and Idam and increases the 'distinctness' of the universe, consistent with the view of higher entropy and more information. In essence, Shuddha Vidya forms a state of Unity in Diversity.

From these five 'pure' concepts, the partially pure and impure concepts can be derived, each stage showing more asymmetry than the previous. The whole exercise of creation is thus consistent with the second law of thermodynamics.

CONCLUSION

The Higgs Mechanism and the way it affects our perception of mass and symmetry is briefly reviewed. Following this, the key postulates of the computational universe are reviewed and a link to symmetry, mass and information is formed. Based on the key concepts formed from the above mentioned reviews, a common thread connecting entropy, information capacity, mass and symmetry is explored. The connection between these concepts and the Shuddha Tattvas in Kashmir Saivisim is elaborated upon. The remarkable similarities found between the two reinforce the philosophical connection between Oriental Spirituality and Modern Physics.

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