# The Most Ancient Theory of Everything

Sai Venkatesh Balasubramanian

A single unified “Theory of Everything” or ToE has been the elusive Holy Grail of Science, from the days of Einstein to the present day. Such a model would bring into its fold, all the four fundamental forces - gravity, electromagnetic, nuclear strong and weak, the fundamental states of matter - solid, liquid, gas, plasma, the fundamental particles of the Standard Model, and also have an explanation for Dark Matter and Dark Energy.

In the mainstream, the most viable contender for such a theory in recent times has been String Theory, which has also been subject to an equal amount of criticism. In terms of observable practicality, this is nothing more than a fancy mathematical construct expanding upon 25 and more dimensions, which will in all likeliness remain out of human validation and observation till the end of time. Other theories too have been proposed, such as Loop Quantum Gravity. Geometrical approaches too have been proposed such as the E8 by Garrett Lisi. The discovery of new particles predicted by the E8 will either validate beyond doubt, or completely disprove the theory. This article will outline very generic concepts of interpretation and mapping, and while it will refer to the E8. the concepts can easily extend to the other aforementioned models too. The general idea here is developing a signal based perspective to quantum physics, and taking it forward from there. The result is that we get a ToE unifying all above mentioned aspects of nature, and we find that such a Theory is not new - it simply follows the ancient Vedic model of three Shaktis - Iccha, Jnana and Kriya, and the five Bhutas or elements of nature,

Basis to the ToE is the Chaotic Interpretation of Quantum Mechanics, published as a separate paper in viXra:1510:0438. A brief overview of the article follows:

Quantum Mechanics is the discipline centering around describing the universe, particularly subatomic particles as wavefunctions and state vectors, containing all information necessary to completely describe a system, and centers on the uncertainty or probabilistic aspect of exactly determining basic properties such as position and momentum.

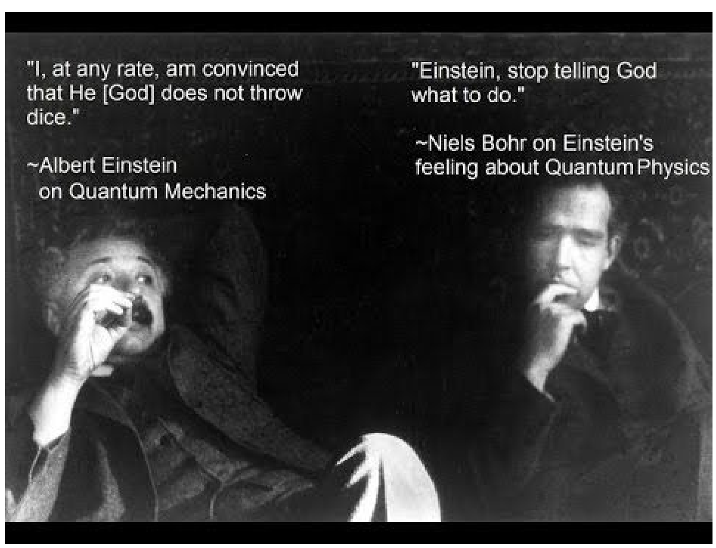
Arising from this concept is the concept of a Quantum Bit or Qubit, as the basic unit of information. While a classical bit is capable of holding the smallest unit of information in either of two states as a 1 or a 0, a quantum bit has the additional capability of holding information as a 'superposed' state, having both 1 and 0 as probabilities. This is best explained by the famous Schrodinger Cat Thought Experiment, where a veal of poison kept in a box with a cat is closed, and until it is opened at a later time, one does not know whether the cat has succumbed to the poison or not, and representing its dead and alive states as 0 and 1, one says that before observation, the cat is in a superposed state containing both 0 and 1. The act of observation, termed measurement causes this superposed state to 'collapse' to either 0 or 1, thus reducing a qubit to a classical bit.


In a system with more than 1 qubits, it is possible that these qubits are simultaneously in superposed states, and that the state of any qubit is completely impossible to describe independent of other qubits – this phenomenon is called Quantum Entanglement.

For example, in a 2 qubit system AB, if both qubits are in superposition state with equal probabilities of collapsing to 00 and 01, then one knows that whatever be the outcome, A will collapse to 0, independent of B, whereas B might collapse to either 0 or 1.

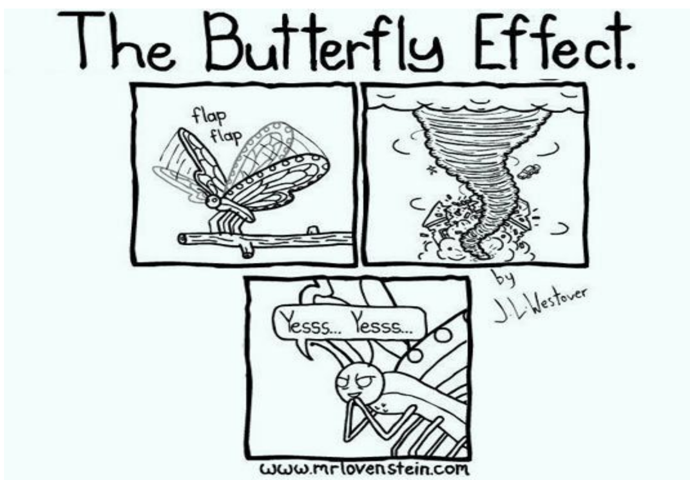
On the other hand, if A and B are in superposition with equal probabilities of collapsing to 01 and 10, it is impossible to surely tell whether any of the bits A or B will collapse to 0 or 1. But, what is known is that if A collapses to 0, B necessarily collapses to 1, and vice versa. Thus, the state of A or B cannot be determined independent of each other.

Also, the entangled relation holds instantaneously, no matter how far A and B are separated from each other, physically – a phenomenon Einstein had famously called 'spooky action at a distance'.

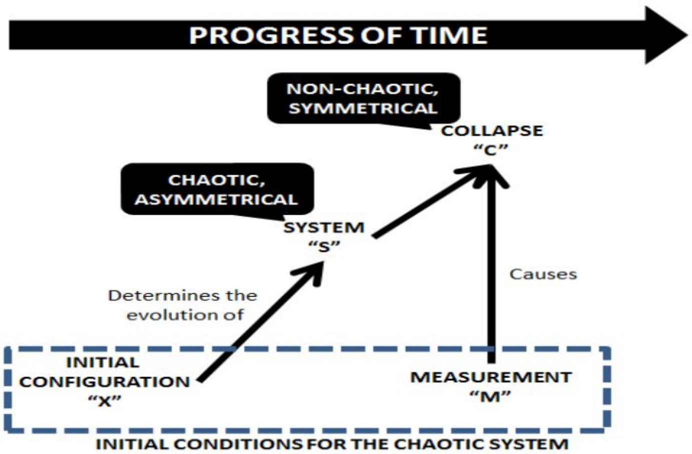


Extending this to a 3 Qubit system, one finds that there are 8 basic states possible – 000, 001, 010, 011, 100, 101, 110 and 111, with entanglements as combinations of these states in various proportions. Similarly in a 4 qubit system, as four, three, two or one qubits can be determined independent of the others, one observes classical case, superposition, minimal or maximal entanglement respectively. Mapping matter content or mass with information content, these states of entanglements have been seen in physics as equivalents representing high gravity systems and singularities such as black holes.

Chaos Theory is the discipline connected with nonlinearity in mathematics and physics, and the fundamental crux is the concept of sensitivity. Here, a certain system is seen to be chaotic when it is seen to be sensitive to the initial conditions that determine its evolution over time. In other words, even extremely small differences seen in the initial conditions quickly amplify into gross and massive differences in the course of time, due to the sensitivity of a chaotic system, with the consequence that it is extremely difficult to predict the value of a chaotic system at any given instant of time, unless the initial conditions are known perfectly well without any error at all. This is comically described as the Butterfly Effect, where a butterfly flapping its wings, in succession of events gives rise to a huge tornado, miles away in another part of the planet.




As such, the Chaotic interpretation of Quantum Mechanics dwells on positing the equivalence between the qubit and a chaotic signal, saying that superposition increases the degree of chaos in the signal, and this is reflected in entropy, a measure of uncertainty. Subsequently, entanglement between two or more qubits is seen as interaction between the chaotic signals, in such a way as to maximize the information content or entropy. As a verification of this equivalence, in 2016, UCal scientists have obtained experimental proof to this entanglement chaos equivalence: Nature Physics, 2016, Vol 12, Pages 10371041.




A Chaotic Interpretation of Quantum Mechanics, complete with discussing various features of this interpretation and where it stands on explaining many observed features, properties and phenomena of the quantum system forms the basis for extending this interpretation to the E8 ToE proposed by Garrett Lisi. The article is in viXra:1510.0437.

The E8 ToE is one of many candidate theories that promise to unite all known particles and forces into a single framework, and while simpler than other theories such as string theory and loop quantum gravity, the E8 ToE essentially postulated that the universe is a 4 Dimensional Space Time framework, where at each point in this fabric, one sees the E8 Polytope, which has 248 roots seen as its vertices.

As an over-simplified model, consider the spacetime as a 2D fabric, with the only force acting as the electromagnetic force. The electric and magnetic parts of this force are interconnected. Mathematically, this connection is seen as a circle U(1). This implies that, at every point in this fabric is a circle, a vector (marking) on its topmost point.

As long as the mark stays on top, the value of electromagnetic force (EM) is zero. If the mark moves from the top, caused by rotation of the circle, the EM force acquires a value. The rotation represents a charge – the electric charge. Thus there are two representations of the EM force – a "geometric space‟ (circle on a fabric) and a charge space (the value of electric charge at every point).

Now, along the same lines, consider a 248 dimensional structure moving along a 4 dimensional spacetime fabric. This is the E8 structure. This structure has not one, but 8 useful "markings". Thus the geometric space of this is a 248 dimensional E8 on our 4 dimensional space time, whereas the charge space has 8 charges.

This means that the 248 roots are represented by an Charge Space, which contains 8 elements representing various types of charges such as spin and color, giving rise to properties such as mass.

| $E8$ | | $\frac{1}{2i}\omega_T^3$ | $\frac{1}{2}\omega_S^3$ | $U^3$ | $V^3$ | $w$ | $x$ | $y$ | $z$ | $F4$ | $G2$ | # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\omega_L^{\wedge/\vee}\ \ \omega_R^{\wedge/\vee}$ | $\pm1$ | $\pm1$ | 0 | | 0 | 0 | | | $D2_G$ | 1 | 4 |
| | $W^{\pm}\ \ B_1^{\pm}$ | 0 | | $\pm1$ | $\pm1$ | 0 | 0 | | | $D2_{ew}$ | 1 | 4 |
| | $e\phi_+\ \ e\phi_-\ \ e\phi_1\ \ e\phi_0$ | $\pm1$ | | $\pm1$ | | 0 | 0 | | | $4\times4$ | 1 | 16 |
| | $\nu_{eL}\ \ e_L\ \ \nu_{eR}\ \ e_R$ | $\pm1/2$ ... even#>0 | | | | $-1/2$ | $-1/2$ | $-1/2$ | $-1/2$ | $8_{S+}$ | $l$ | 8 |
| | $\bar{\nu}_{eL}\ \ \bar{e}_L\ \ \bar{\nu}_{eR}\ \ \bar{e}_R$ | $\pm1/2$ ... even#>0 | | | | $1/2$ | $1/2$ | $1/2$ | $1/2$ | $8_{S+}$ | $\bar{l}$ | 8 |
| | $u_L\ \ d_L\ \ u_R\ \ d_R$ | $\pm1/2$ ... even#>0 | | | | $-1/2$ | $\pm1/2$ ... two>0 | | | $8_{S+}$ | $q_I$ | 24 |
| | $\bar{u}_L\ \ \bar{d}_L\ \ \bar{u}_R\ \ \bar{d}_R$ | $\pm1/2$ ... even#>0 | | | | $1/2$ | $\pm1/2$ ... one>0 | | | $8_{S+}$ | $\bar{q}_I$ | 24 |
| | $\nu_{\mu L}\ \ \mu_L\ \ \nu_{\mu R}\ \ \mu_R$ | $\pm1/2$ ... odd#>0 | | | | $-1/2$ | $1/2$ | $1/2$ | $1/2$ | $8_{S-}$ | $l$ | 8 |
| | $\bar{\nu}_{\mu L}\ \ \bar{\mu}_L\ \ \bar{\nu}_{\mu R}\ \ \bar{\mu}_R$ | $\pm1/2$ ... odd#>0 | | | | $1/2$ | $-1/2$ | $-1/2$ | $-1/2$ | $8_{S-}$ | $\bar{l}$ | 8 |
| | $c_L\ \ s_L\ \ c_R\ \ s_R$ | $\pm1/2$ ... odd#>0 | | | | $1/2$ | $\pm1/2$ ... two>0 | | | $8_{S-}$ | $q_I$ | 24 |
| | $\bar{c}_L\ \ \bar{s}_L\ \ \bar{c}_R\ \ \bar{s}_R$ | $\pm1/2$ ... odd#>0 | | | | $-1/2$ | $\pm1/2$ ... one>0 | | | $8_{S-}$ | $\bar{q}_I$ | 24 |
| | $\nu_{\tau L}\ \ \tau_L\ \ \nu_{\tau R}\ \ \tau_R$ | $\pm1$ | | | | 1 | 0 | | | $8_V$ | 1 | 8 |
| | $\bar{\nu}_{\tau L}\ \ \bar{\tau}_L\ \ \bar{\nu}_{\tau R}\ \ \bar{\tau}_R$ | $\pm1$ | | | | $-1$ | 0 | | | $8_V$ | 1 | 8 |
| | $t_L\ \ b_L\ \ t_R\ \ b_R$ | $\pm1$ | | | | 0 | $-1$ | | | $8_V$ | $q_{II}$ | 24 |
| | $\bar{t}_L\ \ \bar{b}_L\ \ \bar{t}_R\ \ \bar{b}_R$ | $\pm1$ | | | | 0 | 1 | | | $8_V$ | $\bar{q}_{II}$ | 24 |
| | $g$ | 0 | | | | 0 | 1 $-1$ | | | 1 | $A2$ | 6 |
| | $x_1\Phi$ | 0 | | | | $-1$ | $\pm1$ | | | 1 | $q_{II}$ | 6 |
| | $x_2\Phi$ | 0 | | | | 1 | $\pm1$ | | | 1 | $q_{II}$ | 6 |
| | $x_3\Phi$ | 0 | | | | 0 | $\pm(1\ \ 1)$ | | | 1 | $q_{III}$ | 6 |

In the E8 Theory, the eight charges in the charge space are represented by wT, wS, U, V, w, x, y and z. Among these, x, y and z and derived from three quantities namely g3, g8 and B2. Among these, the first two pertain to the color or flavor of a certain particle, characterized by red, green and blue gluons and their anticolored counterparts, all of which mediate the strong nuclear force, which is responsible among other things, for maintaining protons and neutrons compact within the nucleus. Also characterized by x, y and z are quarks and leptons, characterized by positive and negative 1/2 values, unlike integral values of +1 and 1 characterizing the gluons.

B2, termed the Baryon minus Lepton number is related to the hypercharge, and characterizes colored and anti-colored quarks by positive and negative 1/6 values, whereas matter particles leptons, such as electrons are seen with + and – 0.5 values.

Denoting left and right chirality as eL and eR, spatial and temporal coefficients wS and wT are formulated such that wL = wSiwT and wR=wS+iwT, i denoting imaginary number. Thus, with inphase or out of phase relationship established between spatial and temporal rotations, one formulates wT/2i and wS/2 as the charge spaces.

wS and wT represent spatial rotation and temporal movement respectively. Right and left handed particles are represented by unlike or like signs of these two. Spin up and down are given by positive and negative values of wS. All this forms the spin field.

One then understands that the electroweak gauge field, denoted by W, (combining the aspects of the electromagnetic force mediated by photons and responsible for electricity and magnetism determined respectively by electric charge and spin orientation, as well as the radioactivity inducing weak nuclear force), acts on left-chiral pairs of quarks and other particles. By introducing a partner B1 acting on right chiral doublets of fermions, which are matter particles such as electrons, one observes part of B1 acting along with B2 to give electroweak B.

W and B1 acts on the Higgs doublet, which is responsible for the mass property, and in essence, just as wL and wR yielded wT/i and wS, one obtains charge spaces U and V from W and B1, since V=W-B and U=W+B. Subsequently, electrical charge is given as Q = U + (X+Y+Z)/3. From B1 and B2, one obtains the weak force hypercharge Y, and the positive combination of the quantum numbers B1 and B2 yield a new quantum number partner to the hypercharge X.

In another direction, one bundles together the connections pertaining to spin, electroweak, the frame of coordinates (the acceleration and curvature in which denote gravitational force), and the Higgs into a single group, represented by charge space of wL, wR, W and B1.

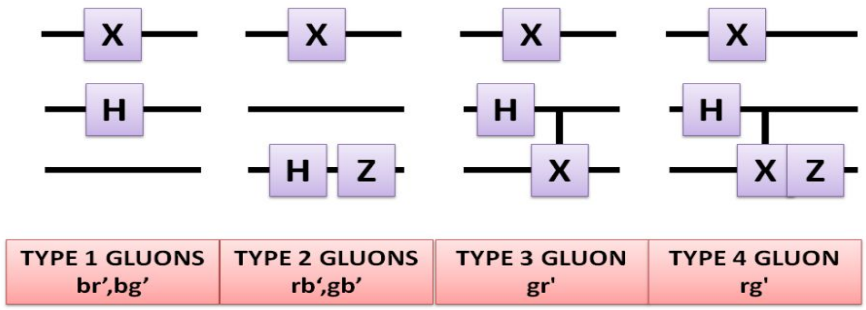
One observes here a triality relation, where rotating the system by 2/3 of pi leave it invariant. In other words, denoting the triality operator as T, one sees TTTwR = TTB1 = TwL = wR. Thus, three generations of fermions are obtained by appropriate use of the triality.

Putting these charge values together as an 8 tuple creates the E8 charge space as mentioned earlier, along with a new quantum number w, related to generations. One presumes that X and w have large masses, causing impediments to their measurement.

Using these quantum numbers forming the 8 valued charge space, one is able to identify the 222 known particles and their weights, out of a total set of 240. The remaining 18 particles pertain to a new field, that carries weak hypercharge and color, has three generations, and couples leptons to quarks. Thus, there also arises a new Higgs scalar for every color and anticolor. The interactions between the w and new Higgs fields are analogous to those between the gravitational spin connection and the frame-Higgs product. Thus, using the eight valued charge space, one is able to understand the mappings between various particle properties and fundamental forces of nature to the eight charges.

For any given particle, the 8 charges, which form a generic 8 Tuple set of values are then seen as proportions or weights of the 8 fundamental states of a 3 Qubit system. These 8 fundamental states form the representation of how the 3 Qubits entangle to manifest as the particle in question.

Specifically, the 8 tuple (wT/2i,wS/2,U,V,w,x,y,z) is seen as the equivalent of the eight states (000,001,010,011,100,101,110,111) of |ABC>, and by weighted combinations of the 8 states, any of the 240 particles can be constructed. For instance, six gluons can be prepared from the |000> vacuum state as shown below. The fundamental operations required to construct the various elementary particles and their interactions from a vacuum state are the quantum gates such as Pauli X Gate or "Bit-Flip", Pauli Z Gate or "Phase-Flip", Hadamard Gate converting pure states into superposed states and vice versa, and the Controlled NOT or CNOT Gate.




While these discussions revolved around the E8 Theory, one must note that this concept holds good for other theories, including String Theory. The essence here is simply representing a charge space of finite number of charges by entangled states of qubits, and by extension chaotic signals. This will work for other models too, albeit with a different number of charges, qubits and hence signals.

A unifying theory similar to the E8, uses the Spin (11,3) Lie Group. This Lie group allows for blocks of 64 fermions and, amazingly, predicts their spin, electroweak and strong charges perfectly. It also automatically includes a set of Higgs bosons and the gravitational frame. The curvature of the Spin(11,3) fiber bundle correctly describes the dynamics of gravity, the other forces and the Higgs. It even includes a cosmological constant that explains cosmic dark energy. Everything falls into place.

But skeptics object that such a theory should be impossible. It appears to violate a theorem in particle physics, the Coleman-Mandula theorem, which forbids combining gravity with the other forces in a single Lie group. But the theorem has an important loophole: it applies only when spacetime exists. In the Spin(11,3) theory (and in E8 theory), gravity is unified with the other forces only before the full Lie group symmetry is broken, and when that is true, spacetime does not yet exist.

Our universe begins when the symmetry breaks: the frame-Higgs field becomes nonzero, singling out a specific direction in the unifying Lie group. At this instant, gravity becomes an independent force, and spacetime comes into existence with a bang. Thus, the theorem is always satisfied. The dawn of time was the breaking of perfect symmetry. (http://li.si/SciAm.pdf).

Thus, one understands that the E8 model, as qubits or chaotic signals, exists prior to the Big Bang.

In summary, the discussion thus far demonstrates how all the fundamental particles in nature can be brought together in a unifying model, and in this model, they are represented as three chaotic signals which represent three qubits in various states of entanglement. In other words, it visualizes how fundamental forces representing matter and energy, and the spacetime can possibly be viewed as information. This has been proposed elsewhere too, such as the Computational Universe model, presented by Lloyd. In the era of Quantum Physics, it is necessary to view Information as a kind of energy, as much as Kinetic or Potential Energy. And just like matter to energy conversions have been famously postulated in Einstein's E=mc^2 equations, one must also understand conversions between information and energy and by extension matter.

A significant amount of research effort into understanding the early stages of the universe is directed at investigating dark matter and dark energy, with dark matter viewed as matter that reflects minimal to no light, yet having a gravitational influence, and Dark Energy being referred to the unseen influence causing the universal expansion to accelerate.

From the perspective of the Computational Universe paradigm, the following is the explanation of Dark Matter and Dark Energy. In an approximately homogenous, isotropic universe, the Einstein Regge equations take on a Friedmann-Robertson-Walker (FRW) form.

$$\rho' = -\frac{3(\rho + p)a'}{a};\ \frac{4\pi G(\rho + 3p)}{3} = -\frac{a''}{a};\ \frac{8\pi G\rho}{3} = \frac{a'^2}{a^2} - \frac{k}{a^2} \qquad (3)$$

where $\rho$ is energy density, p is pressure, k=-1,0,1 for positive, zero and negative curvatures respectively. Also, in terms of Kinetic energy K and potential energy U, $\rho$=K+U and p=K/3-U.

Defining the Hubble parameter H = a'/a, and for $\theta$ as net phase acquired within volume $\Delta V$, $U=\hbar\theta/\Delta V$. Rewriting Eq. 3 in terms of H and solving the first part yields K according to second part. Thus, the FRW equations can be rewritten as follows [38]:

$$-\frac{16\pi GK}{3} = H';\quad \frac{8\pi G(K + U)}{3} = H^2 - \frac{k}{a^2} \qquad (4)$$

In the case of k=0, H'=0, H and U are constants, Universe undergoes inflation at a constant rate.

If U>>K, universe expands exponentially, but if K>0, from Eq. 4, rate of expansion decreases with time. But $a''/a=8\pi G(U-K)/3$, when K>U, $a''<0$, and universe ceases to inflate.

If U>>K, universe expands exponentially, but if K>0, from Eq. 4, rate of expansion decreases with time. But a"/a=8G(U-K)/3, when K>U, a"<0, and universe ceases to inflate. K>>U corresponds to a radiation dominated universe and K=3U corresponds to matter dominated universe (p=0).

These scenarios are possible at different stages of the same computation. For instance, at t=0, let a=1 and K=0. This corresponds to inflation at the Planck rate with Gaussian curvature fluctuations also subsequently inflated. However, such an inflation is unstable, since for non-zero K, inflation decreases. In regions where $K>U$, $a''$ becomes 0 and inflation stops. K itself is seen as the breaking of homogeneity by quantum fluctuations in the various charge values. This slowing down in inflation creates energetic matter giving rise to a radiation dominated universe.

As K is proportional to $a^{-4}$ or $t^{-2}$ and U proportional to $a^{-3}$ or $t^{-1.5}$, K lowers to the level $K=3U$ and the universe becomes matter dominated. At this stage, the universe exhibits significant clumping and is no longer homogenous. In addition to matter dominated regions, in certain regions, $U<K<3U$. Here, pressure p is negative as $p=K/3-U$, but $a''>0$ and thus p is not sufficient for inflation. In some regions, $K<U$, and these regions start inflating again, though at a much lower rate.

In this scenario, the computational universe contains regions dominated by three different kinds of energy as follows:

1. Ordinary matter and radiation, $K>3U$.
2. Dark Matter, with non-inflating negative pressure at $U<K<3U$, typically in halos of galaxies.
3. Dark Energy, undergoing inflation, $K<U$.

Thus, while the E8 defines a unifying platform based on information as three chaotic signals, the computational universe builds upon it in physical expansion, following the big bang. The most important factor in the process is mass, which is defined by the frame, Higgs, and spin charges. As spacetime comes to existence, the signals expand in all dimensions, and the values of the 8 charges vary in different points. This destruction of homogoneity gives rise to varying rates of inflation, and thus dark energy, dark matter, and ordinary matter respectively.

This is the concept that is mentioned in the Vedas, as the three Shaktis - Iccha, Jnana and Kriya. This characterizes the three realms of universe creation as seen so far.

The first realm is that of information, prior to the Big Bang, with the 3 signal E8. Jnana Shakti is literally this Information Energy, and is seen as Goddess Saraswathi. The three signals too are mentioned, as the three components A, U and M, of the primordial vibration called Pranava.

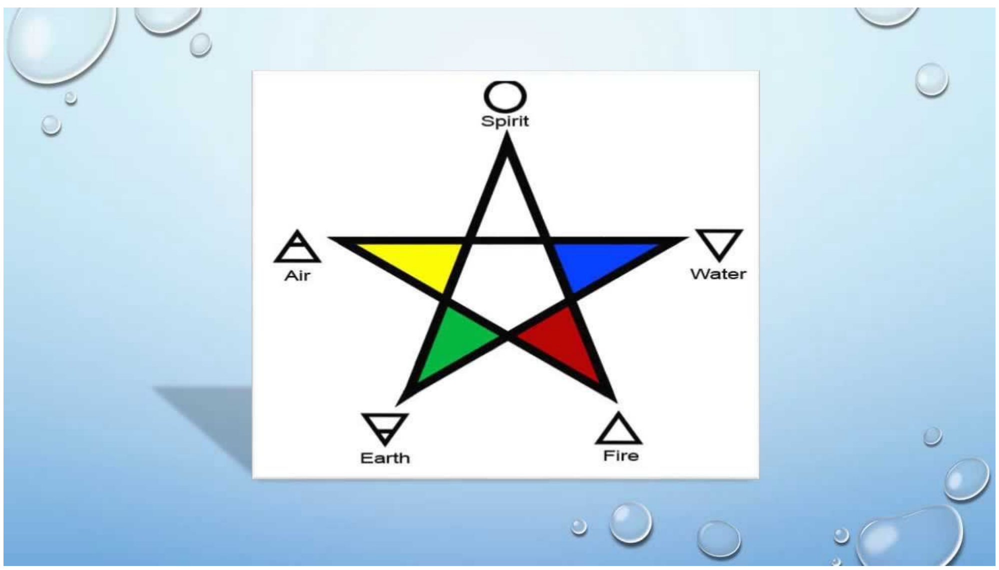
The second realm is that of potential energy, which characterises inflation. This is described in Vedic philosophy as Iccha Shakti or Will - the Divine Will to expand and create. In today’s universe, this is still seen as Dark Energy, constantly expanding from the Big Bang till this moment. This is the first consequence describing the Big Bang, and continues till significant clumping occurs due to breaking of homogeneity.

The third realm follows this breaking of homogeneity. This is the realm of Kinetic Energy, called Kriya Shakti, the power of Work. One can see that matter forms only when K is non-zero and positive, and when that happens, inflation stops. It is a see-saw between potential and kinetic energy.

The ordinary matter described here falls into four states depending on density and charges. These are the solid, liquid, gas and plasma. The last of these is characterized by ionized charges, and while similar to gases, it falls in density between gas and liquid. These states of matter, in this order of density is aptly described by four of the five Bhutas in Vedas - Prithvi, Jalam, Agni and Vayu describe solid, liquid, plasma and gas respectively. It is for purposes for easy understanding that these are named after familiar examples of these states in nature around us - land, water, fire and air respectively.

However, it is the fifth of the Bhutas, from which modern scientists could really benefit. Akasha is generally translated as space, but it is by nature impossible to observe, since it does not react with most forces, like the other four. Furthermore, Akasha is seen as a framework for the other states of matter to function.

This is precisely the description of Dark Matter, constituting 85% of all matter. It is inert to everything except gravity. This means that while not possible to observe using electromagnetic or nuclear methods, it still plays a significant role in setting up a gravitational framework, which determines the positions and hence interactions between other states of matter.




In summary, this article outlined a unifying Theory of Everything, and also explained such a Theory from Vedic perspective, all the way from a pre-matter informational realm through the Big Bang, to the Universe as seen today, including Dark Matter and Dark Energy. These are all beautifully described in the concepts  of the three Shaktis and the five Bhutas.