Exploration

Avyakta: The Fabric of Space

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Abstract

A new concept, the 'Fabric of Space' is introduced to complement the Standard Model and explain gravitation. It is attempted to be shown that the fabric of space provides substrate for all the fields including electromagnetic field, gravitational field and Higgs field, without conflicting with current thinking. Dark matter and virtual particles gain new meaning and cosmic inflation is seen in fresh light. Convincing explanation is provided for matter/antimatter asymmetry and generations of matter.

Keywords: Avyakta, fabric of space, Standard Model, gravitation, Higgs field, Dark Matter.

Assumptions

A). It is assumed that a fabric of special nature pervades the entire universe as a continuous web. A term is introduced for it here - 'Avyakta'.

B). It is assumed that Avyakta (the fabric of space, S for short) is pliable in its own way, so that at any time at any given point it is either Tough or Humble or Flat. When S is Tough, it spreads out if left free. When Humble its tendency is to shrink. When Flat, it does neither; it will remain idle. Toughness and humbleness indicate action-potential of mutually opposite nature. The word 'Vigour' is proposed to be used to indicate this potential.

C). It is assumed that Avyakta is tough at this stage of the universe, but it is declining in toughness. The decline started from the big bang, and the background fabric has consistently spread out but has not yet reached the Flat state.

D). A particle is considered as a small volume of S with an additional toughness (T), surrounded by S of normal background toughness (t). It is also assumed that at the quantum level, T is represented as a wave of the fabric.

1. Fundamental Particles, Forces and Fields

1.1 Matter-waves

According to the de Broglie hypothesis, every object in the universe is a wave[1]. Matter waves are a central part of the theory of quantum mechanics. The position of any particle is described by a wave function. A beam of electrons can be diffracted just like a beam of light. Wave behaviour of matter was first experimentally demonstrated in electrons, by the Davisson–Germer experiment[2]. Subsequently wave behaviour was also confirmed for other elementary particles

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and atoms. Experiments with Fresnel diffraction[3] and atomic mirror[4] on neutral atoms confirmed the existence of atomic waves which undergo diffraction and interference. The wave behaviour of matter is also crucial to the modern theory of atomic structure and particle physics.

The sun converts hydrogen to helium via proton-proton chain reaction, but the temperature of its core is a little low to overcome the repulsive Coulomb force for two protons to come together. It is through the phenomenon of tunneling that the protons overcome this barrier[5]. Quantum mechanics explains that the wave function of a particle summarizes everything that can be known about a physical system[6]. Quantum tunneling correlates with a dynamic wave model and explains a lot many properties of atomic particles.

1.2 Movement through Avyakta

In the background fabric, the particle is an integral part of its surroundings, as it is a wave-form of the fabric itself. When the particle moves, the matter wave develops an additional direction or vector component in its wave-form. The extra toughness or extra humbleness which is the physical content of the particle is transferred to adjacent S. If the particle shifts once, its extra toughness goes on shifting as the wave-form has picked up an additional vector. Movement is kept on till it is undone by encounter with an equal and opposite force.

1.3 Gravitational field

Assumption: It is widely accepted that the internal wave structure of subatomic particles is complicated such that it cannot be explained in terms of any simple physical model. However, here it is assumed that the wave form of the T of the quark is spherical and oscillatory in nature, having an outgoing spiral component andan incoming spiral component with a definite chirality. (A spiral oscillation with chirality is not difficult to visualize; for example the common sea shell has such a pattern.)

Inferences: The continuity of the particle with the surroundings is not broken any time because Avyakta is a continuous fabric and the particle is not separate from it. During the phases of wave motion, corresponding to the incoming spherical spiral oscillation phase, the decline in toughness just outside, or the jerking-in, spreads to the surroundings of the particle. Similarly during outgoing spiral oscillation, outside the particle, the gradient caused by the spreading out would be refilled. Both these oscillations establish themselves as minute concentric waves in the fabric around the particle.

Avyakta has been decreasing in toughness from the big bang onwards, but is still relatively tougher than that in the Flat state. As the surrounding fabric is tough, its readiness to spread is a lot more than its willingness to shrink. Therefore even though the oscillations in the particle are resonant, the surrounding Avyakta always favours 'filling in' or the incoming oscillation of the particle. This effect can be taken as negligible in the majority of oscillations pertaining to a small sub atomic particle such as the quark as its internal wave motion is well balanced within the baryon. But in a larger conglomeration the situation is different. The tendency of the surrounding

Avyakta to favour incoming oscillations reinforces through all the combined oscillations of its constituent particles as a set of concentric waves around the assembly.

Therefore around a large assembly of particles, there is an in-jerking wave in Avyakta due to decrease in toughness that spreads forcefully, followed by the reluctant and slower making up of it. When there is another particle in its vicinity, the sudden decline in toughness acts on it, tending to pull and deform the wave form of the guest particle in that direction. This amounts to an additional vector in the internal oscillation of the guest particle in the direction of the deformation. As a result the particle is attracted towards the host.

Gravity is transmitted across by the gravitational waves with a speed not more than what any wave can move through Avyakta. Therefore gravitation cannot act instantaneously at a distance.

The spiral during the time of the incoming component in the host particle also imparts a weak spiral component to the gravitational wave which tends to rotate the guest in the direction of the incoming spiral of the ripple. Hence there is a torque. Every part of the body subjected to the pull of the curvature of the fabric also experiences the tangential component of the spiral. Therefore, a free-falling body tends to circle the attracting body instead of coming straight to it. The weak spiral component also causes the host body to rotate on itself (if its mass is equally distributed / other things remaining the same).

When there is a large spherical assembly of particles, the gravitational waves around them reinforce each other most at the centre of the sphere. If the body is large enough, the particles so far fortified by it begin to get vulnerable. If the size of the conglomeration crosses a certain limit, the background Avyakta itself begins to go into contraction phase initiating gravitational collapse.

Gravitational field is not manifest for instrumentation or experiments as it is the sole property of the background fabric. Due to the weak nature of the force and the invisible background, physics has major difficulties in finding the representative boson for it (graviton).

In this article the fourth dimensional aspect for Avyakta is not considered though mathematically any number of dimensions are possible. Here the attempt has been to work out simple explanations based on the three dimensional framework itself.

1.4 Mass

Mass is a measure of an object's resistance to changing its state of motion when a force is applied. It is determined by the strength of its gravitational attraction to other bodies, its resistance to being accelerated by a force, and the energy content of a system. For subatomic particles, the energy content is an important contributor. Mass is proportional to the amount of energy contained within the body, using $E = mc^2$.

Here the extra toughness which is the content of the particle with its independent wave motion provides it a position in the fabric of space. Movement in any direction would mean addition of further vector component to the wave form and therefore require application of force. Its incoming oscillation makes it involved in gravitation. Those which have an additional, independent and stable content of tough or humble S involved in its wave-action will have mass. This applies to however tiny they are; e.g., neutrinos.

The dynamic involvement with the surrounding Avyakta would indicate problems related to fixing the exact mass of subatomic particles because some of the wave components are manifested only during certain instances of time during their oscillation, and some parts may remain always un-manifested. The wave gradually goes into the flat stages during its oscillation from humble to tough; for an observer, the wave would seem to 'fade' into and 'come back' from Avyakta. There is possibility of add ons as the essential content is the same in the particle and the surroundings. This is demonstrated in the phenomenon of neutrino oscillation – there are three types of neutrinos based on their mass and interaction - the tau, muon and electron neutrinos – yet they oscillate between the different types or inter-change themselves[7].

It can also be inferred that mass does not relate to the 'amount' of S in the particle. The mass of the tough particle is the same as that of the humble particle (antiparticle), because in both extremes of tough and humble S, the vigour or its tendency to react is the same. Therefore energy is the same in both extremes irrespective of the 'content' in the oscillation. Apparent mass would be the same in both particle and antiparticle. (Antiparticles are discussed in a later section.)

1.5 The fields in classical physics

Magnets have an area around them in 'empty' space where a force exists which is strong enough to either attract or repel another magnetic substance. Magnetic fields in 'space' even give power to other particles that come into contact with the field. Magnetic field lines show the direction of the force and its strength.

Magnetism was once thought to consist of currents of aether, the all pervading substance of space. Even after the Aether theory was proved wrong by the Michelson-Morley experiment, the vector algebra still described electromagnetic phenomena adequately so that the disappearance of the aether left the concept of magnetic flux much unchanged. It was forgotten that 'flux' meant flow.

In the modern framework of the quantum theory of fields, as a field contains energy it is assumed that its presence eliminates the vacuum. “A particle makes a field, and a field acts on another particle, and the field has such familiar properties as energy content and momentum, just as particles can have"[8]. And a field particle is assumed to represent the field, namely a boson. The question of the flux is got around by assuming that the electromagnetic field consists of 'virtual' photons. It had long ago been accepted that the electromagnetic wave need not have a medium for propagation. Therefore the background supporting all this phenomena could be forgotten. But there is one problem. What if that 'vacuum' behind the field itself proves that it is not empty?

1.6The 'vacuum' state – the 'zero' point energy of all fields in space

In quantum field theory, the vacuum state is the quantum state with the lowest possible energy where the fields are quantized. So this vacuum state is absolutely empty and should have zero energy; but the actual situation is found to be different. Even in the vacuum state there is energy which has measurable effects – quantum vacuum zero-point energy, the lowest possible energy that a quantum mechanical physical system can have; the energy of its ground state. It is the zero-point energy of all the fields in space, which in the Standard Model includes the electromagnetic field and the Higgs field. In fact, this energy of a cubic centimetre of 'empty' space has been calculated figuratively to be one trillionth of an erg.

And there is even more to it. In quantum field theory, the 'empty' fabric of space is visualized as consisting of fields, with the field at every point in space and time being a quantum harmonic oscillator, and not only that; the neighbouring oscillators are also always in a constant state of interaction. Therefore from every point in 'empty' space, there is a contribution of energy.

It gets even more interesting with fluctuation of this energy in vacuum. A quantum vacuum fluctuation is the temporary change in the amount of energy in a point in space. That means that in Quantum ElectroDynamics, conservation of energy can appear to be violated. These fluctuations are taken by QED to allow for the creation of 'virtual particles', in an effort to explain vacuum polarization. The term 'vacuum fluctuations' refers to the variance of the field strength in the minimal energy state[9], and is described picturesquely as evidence of "virtual particles"[10].

According to present-day understanding of what is called the vacuum state or the quantum vacuum, it is “by no means a simple empty space[11]”, and again: “it is a mistake to think of any physical vacuum as some absolutely empty void[12].” “According to quantum mechanics, the vacuum state is not truly empty but instead contains fleeting electromagnetic waves and particles that pop into and out of existence [13].”

According to the explanation in QED, these "virtual" particle–antiparticle pairs (leptons, quarks or gluons) created out of a 'vacuum' conveniently annihilate each other after the required time. They can carry various kinds of charges, such as colour charge. Charged virtual pairs such as electron–positron pairs[14] can act as electric dipoles, and in the presence of the electromagnetic field around an electron they reposition themselves, thus partially counteracting the field. The field therefore will be weaker than would be expected if the vacuum were completely empty. This reorientation of the short-lived particle-antiparticle pairs is the cause for vacuum polarization.

Explanations: Without realizing the dynamic involvement of Avyakta in these effects, the only feasible explanation is by attributing everything to virtual particles, appearing by pure magic out of nowhere and excusing themselves on account of Heisenberg's uncertainty principle.

Avyakta is tough at this stage of the universe, therefore its tendency is to spread out and fill oscillations supporting the wave forms already existing in it. The dynamic background contains all the virtual particles as a sea of background waves constantly interacting with already formed ones. Therefore the same has the tendency to alleviate inadequacies and dampen the field.

The magnetic field is magnetic resonance in the surrounding S, produced as the unpaired electron precesses in the atom. Energy, or flux, or virtual photons in QED, flows from one pole to the other through the fabric in the form of resonance waves. A cross section of the electron along with the field is represented by the flux in the field arranged in concentric rings with alternating areas of increasing and reducing strength. The ring is resonance due to unpaired precession of the electron and the alternating waves are due to its unpaired oscillation phases.

The electric and magnetic fields are similar to the gravitational field. The oscillating toughness of the baryon correlates with gravitational waves; similarly the structure of the electron correlates with the magnetic field.

As the magnetic and electric fields are supported by and formed from the background Avyakta, this would indicate problems to assigning values to the particles because of their continuous interaction with the background; at the subatomic level everything would cater to 'laws' only within limits. The g-factor would never show a normal result if only the original model of the electron particle is considered.

The anomalous magnetic moment of the electron, and also all composite particles, are attributed in QED to the effect of vacuum energy. The differences in energy between the 'equal' energy levels of the hydrogen atom (the Lamb Shift) is also because of fluctuation in the position of the electron due to interaction with the vacuum energy fluctuation. There exist small zero-point oscillations that cause the electron to execute rapid oscillatory motions; again pointing out to the nature of the background. The electron is ‘smeared out’ and the radius is changed.

1.7 Virtual particles

The present established concept of ignoring the background has compelled physics to explain a lot of phenomena based on 'virtual particles' so that their list now seems endless. The things the virtual particles can do also appears to be 'super-particulate' in many respects because, without the concept of the dynamic interactions with the fabric of space, any particle that is actually observed never precisely satisfies the conditions theoretically imposed on regular particles.

Virtual particles can be presented in convenient combinations that mutually more or less nearly cancel so that no actual violation of the laws of physics occurs in completed processes. They are also visualized as 'conceptual devices' that do not even need the same mass as the corresponding real particle. If the mathematical terms that are interpreted due to the presence virtual particles are omitted from the calculations, an accurate result is not obtained in many situations[15]. This is because there is presently no concept of the dynamic background. There are 'virtual particles' for explanatory visualizations in almost everything in quantum mechanics.

Examples of explanations with virtual particle help include the Coulomb force due the exchange of virtual photons, the magnetic field caused by the exchange of virtual photons, electromagnetic induction, Casimir effect (where the background field causes attraction between a pair of electrically neutral metal plates, and the Van der Waals force, which is partly due to the Casimir effect between two atoms), vacuum polarization and Lamb shift, the spontaneous emission of a photon from an excited atom or excited nucleus in which the background of QED 'vacuum' mix with the excited state of the atom to release the photon (Spontaneous emission in free space depends upon vacuum fluctuations to get started[16].), Hawking radiation from black holes etc.

The weak nuclear force mediated by virtual W and Z bosons is another example. In the movement of β decay, the background oscillation which is formed is complex in itself to permit the conversion of the free quantum from a quark within the nucleus in a way that makes it possible to adjust to the area around the baryon. The background slot is only for the briefest period of time as the force carrier for the ejection, conversion and stabilization of the electron. This is the W boson (W-) and the characteristics of the slot have already been derived by the Standard Model. This boson which converts the tiny quantum from the quark to an electron is a hundred times larger than the proton, why, even heavier than atoms of iron! It is irrational physics unless the concept of the dynamic background is accepted. The W boson is from the background Avyakta; it is a virtual particle in that it is never 'independent' from the background, it has no ‘existence’ before and after the event and the whole 'set' converts as soon as it is formed. Experimentally the existence of the W boson is proved but it is never manifest.

The same is the case with Z boson. It is another heavyweight but takes part only in elastic scattering of tiny neutrinos. It is never manifest any time else and has no independent existence. Both the manifestation of Z boson and neutrino oscillation are direct evidences to interaction with the background Avyakta. The W and Z bosons are temporary condensations of the background fabric in the pattern conductive to their interactions.

The strong nuclear force: The gluons are assumed to be ‘mass-less’ particles which hold the quarks together. The strong nuclear force between quarks is brought about by interaction of virtual gluons. It describes their nature from previous discussions – they are virtual waves without a core and they are obviously formed by background Avyakta. Individual quarks contribute only about 1% of the total mass of the nucleus[17], the rest is contributed by the 'mass-less' gluons when they are manifest, i.e., they have combined with the quarks. It is a proof of how much the background Avyakta is directly involved in the formation and working of the world.

Experimentally, if the gluon could be stripped off the quark, it would show the corresponding antisymmetry of the quark that it was tied on to. Bombard the nucleus with extremely high energy particles; but to break two quarks held by a gluon would require so much force that it would amount to 'pulling out' a fresh antiquark through the gluon from the background Avyakta. The pulling out of one quark leaves a corresponding volume of humble S plus or minus background toughness, and the defect is filled up by surrounding S in the reverse spiral as the quark is taken away, producing the anti-quark.

Level two of the strong force acts indirectly by transmitting the binding force of gluons through more ‘virtual’ particles such as pi and rho mesons.

Higgs field and Higgs boson: From the discussions about quantum vacuum, zero-point energy and virtual particles (the W boson), a rational idea about the Higgs field is also obtained. Avyakta provides a credible background for the Higgs field and also provides insight to how it works. The Higgs field is everywhere, and under the circumstances in which there is conductive background toughness, oscillations of Avyakta impart toughness or humbleness which help manifest independent waves from the background or contribute to stabilizing their waveforms. The Higgs field represents one of the properties of the fabric of space, with the Higgs boson its scalar representation. But the 'power' of the field is usually attributed only to the boson[18].

1.8 Antiparticle

This subsection follows logical inferences about antiparticles based on the discussions so far.

Assumption: In correlation with the symmetry as outlined in the Standard Model of particle physics, the fabric of space can host a set of both tough quantum and humble quantum, for a given range of background toughness.

Inferences: In a background of tough expanding fabric which is the phase of the present universe, a particle could be either a tough-in-tough one, a flat-in-tough one, or a humble-in-tough one. It can be inferred that the tough-in-tough particles are the neutron, proton and quarks; and the humble-in-tough particles are the antiproton, antineutron and antiquarks.

The anti-particle is not naturally created in our S, because Avyakta is tough in this stage of the universe. Because of the same reason, even in situations when S has a ‘choice’ to favour either the particle or the anti-particle, the particle is always preferred. In the present S, the antiparticle is formed only as decay products or in certain select situations.

The tough-in-tough particle is formed when the fabric with extreme toughness spreads explosively as during that of the big bang. In the same way, it is assumed that the humble-in-humble particle forms when the fabric contracts after extreme humbleness (during the reverse phase of the universe). Thus its chirality is opposite to that of the particle. The structure of particles and antiparticles can be compared to exploding and imploding whirlpools, as they have positive and negative content of the 'stuff' respectively within them, and opposite chirality. When they collide, both of them are ‘annihilated’ with the release of energy that went into the making of these oscillations.

In the sun, the p-p chain involves formation of a diproton and its conversion to deuterium in the first two steps. Two protons combine, and one of them changes to a neutron. This would imply electron capture by the proton to convert itself to a neutron, which is the simultaneous process of all nuclei susceptible to $\beta+$ decay, especially proton rich nuclides. However, when there is more energy as in the sun, the electron quantum can be assumed to be 'pulled in' from the surrounding Avyakta to form the neutron, with reverse filling and the production of a positron. Such positron emission occurs in various $\beta+$ decays but can take place only if the newly formed nucleus has sufficiently more energy that the original one. The neutrino emitted in either path is the same, because essentially it is the same process in both – electron capture and conversion of one up quark to a down quark.

Since negative charge correlates with attraction for a defect of the tougher oscillation part, the humble antiproton has a negative charge; and since positive charge correlates with attraction for a lacking humble oscillation part, the flat-in-tough positron has a positive charge. Therefore the charges are reverse in the anti-particle.

2. The Universe

2.1 Big bang and creation

From the four assumptions at the beginning of this presentation, particle creation can be looked afresh. Just before the big bang, Avyakta at the core is too tough to harbour any particle within it. When the expansion of Avyakta sets in, the toughness begins to spread, and the natural outcome of the explosive expansion will be the creation of numerous waves in the fabric from the very small to the very big in the wake of the spiral unwinding. From this numerous units of spiral oscillations develop, and it is randomly possible for some of them to become independent with stable resonance specifics – the earliest bosons, and later the pre-particles. This natural mode of creation is also evidenced by the fact that the same background Avyakta can and does provide numerous virtual particle characteristics to support manifested matter waves in the present phase.

When a particle with an oscillating toughness comes into existence, gravitation would also manifest from the tough background. Thus the concept has easy and natural explanations for creation of matter and also the appearance of the gravitational force.

Corresponding anti-particles are not naturally created in this phase of the universe, except as break-down products. This is because the big bang is taking place in tough S, and it is far from humble to create vacuolization. Thus matter-antimatter asymmetry also has an easy explanation.

2.2 Generations of matter

Assumption: The symmetry of the particles and the corresponding slots as derived by the Standard Model depends on background toughness, and it is assumed that in certain background toughness, the quarks with corresponding toughness (mass) are supported. As and when the background toughness gets reduced, quarks with lesser toughness (lesser mass or energy content) are favoured.

Inferences: The heavyweight quarks were the first to be formed after the big bang. These quarks that the Standard Model has derived can be experimentally produced but are unstable, and physics does not know their significance as of the present. They are unstable now because background Avyakta of higher toughness is impossible to duplicate in the present time.

There are more arguments in favour: A). Three rungs of the quark ladder are known to physics. In the present S, there are the up and down quarks which are constituents of the nucleus, plus the electron. In the next heavy level there are the charm and strange quarks, and a heavier electron, the muon. In the top most level there are top and bottom quarks, and a very heavyweight tau or tauon. b). The products of decay of the heaviest quarks are the intermediate ones; and the products of decay of the intermediate ones are the present quarks. C). The neutrino has three faces – corresponding to the electron, muon and tau.

It is possible that the heaviest quarks decayed to the second generation ones without even forming a neutron; there must have been 'cascade particles'[19] (that term can be understood in a broader sense now) too. But there is evidence that at least one heavyweight combination formed and ruled the universe in its earliest stage; otherwise the neutrino would not have a 'tau' face on it. It is possible that the second generation ‘heavyweight' neutrons and protons would have lasted even longer (and even now as dark matter candidates in a background space of higher toughness). It is not possible to specify which of the quarks held hands to form the first super heavy proton. However in the next step (the second generation), a reasonable guess would be one strange, one down and one charm quark forming a heavy neutron, which, by one strange quark decay, would produce a 'proton' made of one up, one down and one charm quark (the lambda baryons). The corresponding three quark and proton-neutron combination ratios (with the corresponding lepton) could have created a parallel world too. The second generation quarks have actually been observed in hypernuclei. (They are candidates for dark matter as discussed later.).

The decay of proton is as such unknown now, because the proton is so stable now that such a question does not arise for a lot more billion years, till the toughness of S falls further to such level. Proton decay can never be experimentally carried out in our part of the universe because, even if it is possible to induce particles similar to that in a tougher fabric by high energy collisions, there is no way to induce a situation akin to lower toughness of Avyakta (humbler S) now.

It is a possible that all the quarks in the universe developed from a single type of great-grandfather quark, considering the isospin and symmetry. The expanding Avyakta spreads and reduces in toughness gradually, which makes the first heavyweight quarks go out of resonance and develop a half-life. For the next range of toughness the next set of quarks are then favoured.

Decay with resultant spectrum of quarks would bring up the ripe circumstances for the first nucleus which can be stable in that toughness. The virtual gluons manifest from the background field to combine with the quarks, and with the formation of electrons and protons, the charges become well established.

Thus a tough fabric of space in gradual expansion phase provides rational explanation for the generations of matter.

2.3 Formation of galaxy groups

As particles aggregate by gravitation to form larger bodies, those remaining for a time in the areas of high toughness at the arms of expanding wave due to the high gravitation and vigour may undergo gravitational collapse to form large black holes and structures like the quasars. The structures that form, with whichever association it has meanwhile developed, drifts with whatever velocity it has imbibed at birth or by association later, and they are either gradually brought together by gravitation and background oscillations of the fabric, or separated by the expanding fabric as its toughness falls.

Along with particles, the expanding wave also creates large scale oscillations. These perturbations are responsible for the subtle physics that result in the cosmic microwave background anisotropy. The reduction in toughness is also not perfectly identical owing to the nature of the expansion and the inherent oscillatory nature of Avyakta, and some regions may remain tougher and others may become comparatively humbler, as is observed in the distribution of later galaxies. Oscillations and gravitation bring matter together, and it condenses in intricate web-like structures based on the background fabric, forming galaxy groups and clusters.

The present concept in Physics lacks the description of the fabric of space; therefore the reason for the entire phenomena pertaining to these oscillations and structural condensations are not explained at present.

2.4 The explanation of dark matter

The high vigour and toughness of Avyakta explains faster accretion and formation of structures in observed patterns; however this cannot be explained if space is assumed 'empty' and only known particles (present stage of quarks) are considered in the universe. Therefore dark matter of unknown nature was postulated to add more mass, to account for higher gravitation and observed phenomena. It is now believed that dark energy plus dark matter constitute 95.1% of total mass-energy content in the universe[20]. The proposed dark matter has similar characteristics of the tougher background Avyakta such as – it does not react with light or any other particle directly, it is hidden and only interacts through gravitation.

Puzzle 1: Mass of galaxies were calculated from the distribution of stars in spirals and mass-to-light ratios, and it was found that the stars, and indeed whole galaxies rotate with more speed than warranted by their total mass[21]. They should go a lot slower if they adhere to the law of gravity – otherwise they should have more mass due to dark matter presence.

Explanation: Earliest galaxies were mostly composed of gas and had only a few stars. They gain mass when small galaxies join together, but when the total mass becomes high enough and covers a large area, gravitational accretion begins to curve the background fabric. The basic mode of oscillation of Avyakta is spiral; and the fabric owing to high toughness spirals inside. The high gravitation at the centre along with the incoming spiral of toughness leads to gravitational collapse and a black hole at the centre, around which a spiral precession is formed. The spiral of a stable galaxy has many similarities to an oscillation within a particle, though here the spiral is not looped. The precession of the incoming spiral and thus the major part of its energy is due to the high toughness of the backgroundAvyakta. But this background vigour of the fabric of space is not considered at present; only the mass of the particles within the galaxy is taken into account. Also not considered is the presence of other dark matter candidates in areas of higher or lower toughness. (Since space is considered uniformly empty, it is assumed now that heavy matter such as quarks of the previous generation will be as unstable everywhere in the universe as they are here.). Hence the extra mass of unknown dark matter is needed to explain the phenomenon.

Puzzle 2: The orbital velocity of planets in solar systems decline with distance. But the orbital speed of stars within the galaxies does not follow this pattern; stars revolve around their galaxy's centre at equal or increasing speed over a large range of distances[22], i.e., they more or less maintain the spiral pattern.

Explanation: Present solution to this puzzle is to assume the existence of dark matter and that too distributed in an exact way, extending from the galaxy's centre to its halo, in a roughly spherically symmetric pattern. The 'density wave theory[23]' proposed by C.C. Lin and Frank Shu introduces the idea of long-lived quasistatic density waves– that the arms of the spiral are made of greater 'density' in the form of 'waves' which actually maintain the spiral pattern. It confirms to the view in this article about the spiral oscillation of Avyakta, where the spiral wave itself cannot be observed but is followed by the stars in that background. The pattern of the spiral is maintained by Avyakta but in present physics only the particle world is taken into consideration, therefore dark matter in the specific pattern was required for explanation.

Puzzle 3: In galaxy clusters, gravitational lensing observations confirm the presence of considerably more mass than is indicated by the clusters' light. So dark matter is considered to account for it.

Explanation: There is considerably more background toughness involved in the galaxy than its surroundings, due to gravitational collapse at the center plus the incoming spiral, but only mass from the particle world is taken into account at present, and that too corresponding to particles in background toughness in our part of the universe. Lensing depends on incoming gradient of toughness and this corresponds to curvature of the background fabric due to higher toughness in the galaxy.

All the reasons for dark matter and even the presence of dark matter candidates are easily explained by considering the changes in consistency of the background Avyakta interacting dynamically with the manifest particle world. For example, the high toughness within the neutron stars would 'reverse-produce' the strange and charm quarks from the present neutrons, which leads to magnetic field breakdown and production of ultra-high energy cosmic rays. These are named 'strangelets', and they are also suspected dark matter candidates – they confirm to the model of Avyakta. Present physics also does not know how these ultra-high energy cosmic rays are produced.

A similar picture can be seen when galaxies grow old, their stars becoming few and redder with all the gas being used up. There is considerable amount of dust and more black holes. The spiral implodes more and goes out of pattern resulting in more toughness concentrated within it, forming 'darker' galaxies. There are galaxies in space having much toughness contained within it but too few stars to account for the mass by themselves, for example the dwarf spheroidal galaxies. Their dark matter is made of high toughness of Avyakta plus heavier matter in it; matter which cannot exist in our part of space (and which cannot be explained by present physics owing to lack of the concept of a background fabric which can undergo such change in its consistency.)

The large scale structure of the universe has many 'void' spaces, 'nodes', 'filaments' and even 'walls'. Immense voids create spaces, sometimes called 'cosmic web'. Structure that cannot 'normally' form and 'cold space' have no explanation under the present cosmological model. All these can be explained only by Avyakta and its pliability which provides variable tough and humble features thereby making different conditions possible in different parts of the universe.

There is feedback influence from the particle world to the surrounding Avyakta. Increase in density of particulate matter by gravitational accretion in heavenly bodies in turn increases toughness of Avyakta involved in that body. The effect is pronounced in large stars, galaxies and in the formation of black holes.

Gravitational collapse means formation of a super tough node of the fabric of space going to contraction phase. In the black hole, waves of contraction of Avyakta pull everything in its vicinity to inside, dragging them around the node of ongoing contraction. The effect of the black hole becomes pronounced as a photon gets closer to it. If the path of the 'ray' is close enough and/or the conglomeration it passes adequately large, the ray takes a smooth and inward bend corresponding to curvature of the background, the reason for gravitational 'lensing'.

In future most of the matter which provides the toughness inside the black hole is converted to Hawking radiation. Infinite toughness or infinite humbleness are the phases in which matter is dissolved back to the Avyakta. This indicates that there is loss of information, but there is also every possibility that all information will be recreated; maybe in a different pattern, as universe renews with each expansion phase (big bang), assuming it to be cyclical.

Without matter in high gravitation which was the cause of the black hole, the contraction point in the background Avyakta is no longer sustainable and this phase ends. The point of super tough fabric slowly dissolves as a background wave which cannot be observed by any instrument, gradually evaporating the node. Black holes and galaxies are random events; not a stabilized oscillation like the particle.

2.5 Red-shift

We observe that the galaxies are all getting further away. The speed of recession is calculated by red-shift, and the further they are, the greater the shift. But Avyakta was not considered before in explaining the red-shift. It has undergone expansion from the big bang onwards – therefore the galaxies are not running away; as the background expands the objects in it are getting gradually separated from each other. This is the reason for the red-shift.

2.6 Possibilities in the far future

As the wave of expansion of Avyakta crosses the expansion phase, universe would become ‘humble’, i.e., its toughness reaches unity and then goes below it. As it reaches the flat stage, gravitation ceases because the tendency of Avyakta to expand would be present no more. As it goes humble, S would develop the tendency to shrink. By all possibilities the gravitational wave would start to repel – formation of the anti-gravity wave.

At the end of expansion phase, Avyakta would have become infinitely humble; the particles would continue its stepwise decay (starting from proton decay) until it is dissolved in humbleness.

When the contraction stage starts, the resultant turbulence brings up the humble-in-humble particles. In a background of humble S, mirror images of both the present particles and antiparticles are likely to be formed. The humble-in-humble antiparticle is different from the humble-in-tough antiparticle in that its content is even 'less' than the present antiparticle. If time can be perceived as running back, then it can also be concluded that CPT symmetry is preserved.

Thus there is a possibility that the universe is cyclical, and renews its interior décor at every cycle of oscillation.

All the particles formed in tough S (our phase) have one thing in common: The direction of the spiral of toughness in them (chirality). It results from the super tough 'super-spiral’ of the big bang. In regions of tough S the spread of toughness within them and emanating from them always spirals in this direction. In the reverse phase of humble S these directions are of course mirror images. So is our universe left handed or right handed? The answer can be easily guessed by recollecting the decay modes – only left handed fermions take part in weak interactions; and only right handed antiparticle fermions take part in weak interaction – the present phase of the universe has a direct preference for left-handed chirality. And the mirror universe in the reverse phase is of opposite chirality to this phase.

2.7 History and philosophical implications

In earlier days when it was understood that electromagnetic waves needed a medium for propagation, a medium called 'aether' was accepted. Fields were visualized to be based on this medium. When it was proved that every particle of matter had wave characteristics, it indicated that the particle and medium were not two but one, and the particle moved through the medium by transferring (waving) its inherent energy through the fabric of the medium. But instead of reaching that obvious assumption, it was maintained that the medium was different from the particle. It was even believed that this medium, the aether, moved like a ‘wind’ around the heavenly bodies, separate from them. The famous Michelson-Morley experiment[24] gave conclusive evidence that such an aether could not exist. After some desperate measures to salvage aether, and again not seeing the obvious, the world of physics took the opposite view that there was nothing there whatsoever; space was ‘empty’ to the core, a ‘vacuum’.

Under that prevalent idea, Albert Einstein's solution was to discard the notion of a medium at absolute state of rest (aether). In relativity, any reference frame moving with uniform motion will observe the same laws of physics. In every reference frame, Einstein took the speed of light as a constant[25] (without the background, some base has to be there for all the other values to relate on), and brought about the concept of 'space-time', fixing any event to be happening at a time and a point of space. Two objects will have two different sets of reference frames and they can be described, by (t,x,y and z); and (t1,x1, y1 and z1) where t is time and the other three are the co-ordinates in space. Then the Lorentz transformation is applied to derive the relationship between time, length, and mass change for an object while that object is moving relative to the other, keeping speed of light a constant.

Since the speed of light is the speed of any wave in the model of Avyakta, and other values are all 'observed' and relative values, from the equation of the Lorentz factor[26] we can infer that such a comparison would explain the characteristics of the background fabric itself.

Ironically, Lorentz transformation was not fully Einstein's; it was derived from the Lorentz-Fitzgerald contraction hypothesis[27], which was put forward to help explain one of the properties of aether! Length contraction was postulated by George FitzGerald (1889) and Hendrix Anton Lorentz (1892) to explain away the negative outcome of the Michelson-Morley experiment and rescue the hypothesis of the stationary aether[28]. Hendrix Lorentz was one of the staunchest supporters of the aether theory.

Relativity is correlated with the concept of Avyakta easily. For example, what happens to the particle when it is accelerated to speeds very close to that of light? 1). The particle cannot move above the speed of light because that is the speed at which any wave can go in the fabric. Therefore as the speed of the particle approaches maximum limit, the energy required for accelerating it – its mass – tends to become infinite. 2). When the velocity reaches near to that of light, internal oscillation in the direction of motion will get shortened because it cannot move above that speed; in other words it will lose its third dimension – the phenomenon of length-contraction. 3). The total speed of a wave cannot exceed the speed of light. A particle can move near that velocity only by its wave components compensating the speed of its other oscillations. In other words, the speed of its internal beat will reduce proportional to the speed of its extra vector component. Therefore its internal clock slows down – the phenomenon of time dilation.

What Einstein did was to brilliantly work out a way to advance physics ignoring the concept of the 'background' after the failure of the 'aether theory'. Whether the background was empty or not did not matter anymore at that time. Therefore the aether theory was not needed and soon fell out of favour.

Plotting events relative to each other in three co-ordinates would enable the geometry to be studied without needing the background. Making time the fourth co-ordinate only means that an event would occur at a point of time, it does not explain why or how. But adding the time co-ordinate would bring a pattern to the geometry as the Minkowski space-time, based on which models could be explained, mathematically advanced and even predicted. This model is different from the actual fourth-dimensional space.

The Standard Model of particle physics was also built up based on the same concept and principles, in which photons and other elementary particles are described as a 'necessary consequence' of physical laws having certain symmetry at every point in space-time. Thus it ignores the background but explains the symmetry in it. Three of the quarks combine in 1:2 ratios to produce either a neutron or a proton; both the products have similar masses. The free proton is stable, the free neutron is not; they combine in certain known ratio to produce elements. From observations like these, the conclusion was arrived that there is a pattern and a symmetry regarding the structure of these particles. Mathematical formulations of the symmetry of subatomic particles was similar to mathematical formulations given to spin, therefore it was named isospin. Later this was broadened to a large group, the set of 'flavor symmetry', and there was found to be a similarity about how these particles related to each other with the representation theory of SU(3) symmetry. The properties of the various particles can be related to representations of Lie algebras, corresponding to "approximate symmetries" in the universe, and the different quantum states of an elementary particle give rise to an irreducible representation of the Poincaré group. Thus even with the double-blindfold of obscured physical nature of the particles and the ignored background, the Standard Model of Particle Physics was successfully developed. Physical measurements, equations and predictions from them are all consistent and hold a very high level of confirmation.

Even after it was confirmed that gravitation 'travelled' with the speed of light (definitely indicating a medium through which it propagated), the notion of 'background emptiness' prevailed. But 'warping', folding or curving of space-time also did not fully erase reservations about 'empty' space transmitting wave packets. Moreover, how does 'nothing' warp, curve and fold on itself?

After undergoing a laborious 'renormalization', quantum electrodynamics became the most successful theory with experimental data confirming its predictions to such a high precision; so that the simplest and most basic questions were forgotten and they remained unanswered. As Feynman remarked about renormalization, "there is no theory that adequately explains these numbers. We use the numbers in all our theories, but we don't understand them – what they are, or where they come from. I believe that from a fundamental point of view, this is a very interesting and serious problem.[29]"

The phenomenon of neutrino oscillation and virtual particles give further evidence that matter is not separate from the background. Wave-matter duality and the fact that the all matter is represented as waves at the quantum level also points to direct evidence of a background Avyakta which is not separate from matter (A separate medium like aether cannot explain this fundamental property of matter.). But fields were perceived out of nothing and energy as stored in empty space. It was proposed the inflaton and the Higgs field and numerous virtual particles in empty space, and it was argued that mass-less particles would suddenly develop mass. While virtual particles were used to explain everything pertaining to the three fundamental forces and the interactions at the subatomic level, dark matter was depended on to explain the large-scale structure of the universe.

Many physicists became resigned to the foregone conclusion very early in their career that it didn't matter if you don't understand it; you just have to prove it mathematically. Mathematics is the language of the universe. ("Mathematics takes us into the region of absolute necessity, to which not only the actual word, but every possible word, must conform."- Bertrand Russell.) It is clear cut, irrefutable logic and absolute evidence; but of late it is forgotten that mathematics is the way and not the end. For example, is it the right thing to do by accurately calculating that there is a valley full of beautiful flowers exactly 658 meters ahead; arriving at the complete geometry of the flowers and comparing this valley to other valleys to see how they change with time; but all the while blindfolded that nobody can see anything? Why the foregone conclusion that the physical aspect of it is too complex to comprehend? Since when did physicists start giving up so easily?

If the size of individual atoms is compared to the size of a football field, the nucleus is only about the size of the football. Therefore most of matter is perceived as 'empty' in the present view. And it does not end there; the nucleus itself is also 99% virtual; only 1% of it is contributed by the quarks. If physics discovers some way in future which can provide a peek inside the quark, it would find most of the quark to be 'virtual' or 'empty' too because it is also nothing but a wave form. We can then even visualize ourselves as 'completely empty' men! As long as there is no concept of the background Avyakta, the whole picture would continue to be interpreted inaccurately. Actually none of these spaces are empty, they are all occupied by Avyakta, all matter manifesting as waveforms of it.

But to grasp the concept, physics has two practical problems to overcome: 1). Acceptance of the idea of the underlying fabric of space will involve re-structuring the edifices built so far. 2). It involves accommodating an entity –Avyakta– that cannot be weighed, dissected or transformed with any present device, as any equipment is necessarily its product and changes itself as and when the background changes. This is also the reason why direct experimental evidence for Avyakta is also lacking. Conclusions regarding physical phenomena are also derived from direct observations, but Avyakta is beyond the observational capacity of the sense organs. There are only indirect evidences such as the gravitational wave, but the number of such pointers is steadily increasing along with advancements in physics.

And that is precisely the basis of this endeavour – the attempt at a simple set of explanations from obvious evidences. All the entire enigmas in physics can be explained by the concept of the fabric of space instead of the round-about way resorted to till now. Every finding will hold good, all mathematical derivations and observations in relativity would remain the same; only the background concept needs to change.

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