

Swami Vivekananda – as the Scientist

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Abstract: Journey of science from the 19th century concept of atom to the creation of universe (big bang theory), inclusive of dark energy dark matter enigma of 21st century, is briefed along with the corresponding concepts of Vedanta as propounded by Swami Vivekananda (Swamiji). Swamiji (1863-1902) envisioned in 1890, that the micro-world & macro-world are built on the same plan. He spoke of interdependence of every species in nature, popularised as ecology in 21st century.

He propounded from Vedanta that:

- Matter & Energy are the same, proved later by Einstein.
- Indeterminacy to be the innate characteristic of nature, viewed through the prism of time, space & causation; akin to Heisenberg's uncertainty principle proved decades later.
- Creation of universe started from infinitesimally small with infinite energy primordial stage, termed singularity-- corresponding to Vedantic terminology of Anidavatam (no vibration) -from which sprang forth time space, energy, matter. But while the Vedantic concept speaks of alternate big bang and big crunch- continuing since eternity, science is silent on state before singularity, which science says started 13.8 billion years ago.

Like a scientist, Swamiji explained abstruse philosophical thoughts making them as factual scientific truths, than using abstract philosophical jargons of a mystic.

Keywords: Atom, energy, Vedanta, uncertainty principle, ecology, big bang, singularity, Anidavatam, creation of the universe, dark energy and dark matter.

1. PREAMBLE

It all started in 1897. The long and challenging journey to the micro-world; and with simultaneous exploration of macro-world as well. Till then, atom was considered not only to be the smallest entity of matter, but indivisible as well. This myth was broken by J.J. Thomson after his discovery of electron in experiments with the Cathode ray tube. He offered a plum cake model, to explain the structure of the atom suggesting negatively charged electrons to be interspersed like raisins in the pudding with the dough containing the positive charge.

But, this scheme of atomic structure proved to be wrong, when nearly 15 years later Thomson's student- Rutherford (from his Alpha ray scattering experiments) showed the positive charge to be confined as a small dense nucleus in the centre of the atom, with negatively charged electrons surrounding it. Two years later in 1913, a student of Rutherford- Niels Bohr developed a model of atomic structure which was patterned on the solar system, and his model is termed planetary model of atomic structure. In this model, electrons are orbiting around a positively charged central nucleus like the planets orbiting around the sun.

Strangely, a wandering monk of India (passed away in 1902) said of his vision, that the scheme of the universe in material plane follows the same pattern for both micro-world and the macro-world. He pronounced in early 1890's, that whether it is of the Earth, Sun, or the minutest particle of matter- the scheme followed is alike¹. Awakening from a trance that followed his deep meditation below an old Peppul tree beside a stream near Almorah (India), he jotted down his vision in a note book and wrote, "the scheme of the universe of both micro-world and macro-world are built on the same plan.....the whole universe exists in the atom"¹. His vision was *anti-science* during that period, where the general belief was that atoms are the smallest particle of matter and they are indivisible. But quarter century later it proved to be the correct scientific truth.

In the Bohr's planetary model of the structure of atom, it is necessary to add that Bohr's model was remodelled by Somerfield on the question of the details, making rosette structure of the electronic path and termed Bohr-Somerfield model. This model was also taken up a step further by Schrodinger in 1926, introducing the quantum –mechanical model of atomic structure. He introduced the probability concept in the orbiting path of the electrons putting in the sub –energy levels of most probable electronic clouds. In 1932, with Chadwick's discovery of neutrons, the central nucleus became known containing both positively charged proton and neutral neutrons.

But the story of atom does not end here. Based on the recent discovery--- protons and neutrons are known to contain still smaller particles like quarks, which are considered to be the vibratory strings of energy particles. Now in 21st century this string based theory, termed as the theory of everything, is trying to visualise the entire scheme of the universe as a unified field.

Meanwhile Albert Einstein had propounded in 1905, that matter is nothing but the condensed form of energy, citing the quantitative relationship between the two. Thereafter for the next 40 years Albert Einstein tried to find out one single energy (unified field theory), under whose umbrella could be said to constitute all the energy systems, governing both the micro world and macro world.

Strangely, that same wandering monk in his discourses in London sometimes in 1896, boldly asserts "... what we call matter does not exist at all; it is only a certain state of **force**..."². He also added on another occasion , " When you look at the universe, remember that you can reduce it to matter or to force (meaning energy). If we increase the velocity the mass decreases ^{2a}.

Such bold assertion had to wait for another 9 years proving the inter convertibility of matter and energy, from Einstein's equation in 1905. The same monk delivering a discourse on 'The Absolute & manifestations' declared non-chalantly, as if a spokesperson of the scientific community, that "Science today is telling us that all things are but manifestation of **one energy** which is the sum total of everything which exists"². Such one energy assertion that he said in 1896, is the topic of research in the 21st century. Scientists globally are yet working out even today, a century and half afterwards, to reach that goal- identification of one energy under whose ambit all other forms can be included .

An out and out spiritual person, this monk boldly declares in his Chicago address on 19th September, 1893, like an authority of science, that "...Vedanta philosophy, of which latest discoveries of science seem like echoes..."³.

This wandering monk is Swami Vivekananda and I would try to elucidate to what extent, modern discoveries of 21st century would seem to be echoes of Vedanta, as boldly declared by Swami Vivekananda. Swami Vivekananda is known as a spiritual leader with a dazzling personality, but his scientific bent of mind has largely been unexplored and this article will make an objective analysis of Swami Vivekananda (to be referred as Swamiji) as the scientist leaving aside all the emotive frills.

2. INTRODUCTION

As per the Oxford Dictionary science means: "knowledge about the structure and behaviour of the natural and physical world, based on facts that you can prove, for example by experiments". The word **scientist means**: "a person who studies one or more of the natural science (=for example physics, chemistry, biology) ...working in his laboratory"⁴. Certainly, as per the above definition, Swamiji was not a scientist and perhaps nor was Albert Einstein. Einstein's theory of gravitation proposed in 1911 was deduced from the thought process of an extraordinary mind, based on theoretical principles only. The onus of its proof lay to Sir Arthur Eddington nearly a decade later than Einstein's proposed theory. Eddington observed during solar eclipse in 1919, that the light from the stars indeed bent as it grazed the Sun, by the exact amount of Einstein's predictions, making Einstein a celebrity.

In analogy to it, 'the similarity of the guiding principle in both micro-world and macro-world... the solar system & the atomic structure', that Swamiji envisioned sometimes in 1890, had to wait for nearly two and half decades for its confirmation from Bohr's atomic structure propounded in 1913.

It is also worth mentioning that the wave-particle duality of electron (in analogy to light) propounded by De Brogli in 1923, was just a hypothesis based on theoretical thought process from quantum mechanical approach. It had to wait 4 years for its experimental proof made by C.J. Davisson & L.H. Germer, showing diffraction of the electron similar to wave's diffractions against crystals.

Thus, it is contended to redefine a scientist, "who from experimental studies or, simply from *extraordinary thought process*, can lift the great veil of nature, at least a part of it". Of course, it has

to wait for its universal acceptance either, from verification by experiments/ observations or, making postulates defining the principles using the language of science. We are to follow this definition of scientist, when we try to assess Swamiji as a scientist.

The pertinent question that arises is the necessity of such identity assignment of Swamiji with science, who in his own right has been acclaimed as a spiritual messiah, the prophet of the nuclear age. Particularly when Swamiji himself said over his search of the Absolute (God-concept of Swamiji), “Art, science & religionare the three different ways of expressing a single truth.” In this context it may not be out of place to quote from Albert Einstein, who also said, “The most beautiful and deepest experience a man can have is the sense of the mysterious. It is the underlying principle of religion as well as the serious endeavour in art and **science**. He who never had this experience seems to me, if not dead but blind.”⁵.

It could be noted from the study of Swamiji’s works, that he preferred to use the language of science to explain the abstruse philosophical thoughts on Vedanta, or his religious discourses. In order to distinguish between the immortal soul in a body and of the omnipresent God infinite (distinguishing between *Jibatma* & *Pramatma*), the common simile given by philosophers is that of a water-filled pitcher immersed in the ocean, making the pitcher water distinguishable from the ocean, though both are the same. The container pitcher (the shroud of *Maya*) demarcates the pitcher water from the ocean; till the container is broken with the instrument of Jnan/Bhakti etc. But such simile identifying ocean with God etc, lacks the infinity component of soul/God, since the ocean though vast, is bound.

Swamiji is more exact and defines using the language of science, “...soul is a circle whose circumference is nowhere but the centre is in some body....God is a circle whose circumference is nowhere, and whose centre is everywhere, and when we get out of the narrow centre of the body, we shall realize God- our true self.”⁶.

Mention may be made of another religious discourse of Swamiji where he explained that non-violence can be called a virtue only for the strong and not for the weak and lazy; with whom it is certainly not a virtue, but only cowardice & sin. He explains citing a phenomenon of natural science, saying: “In all matters two extremes are alike. The extreme positive and extreme negatives are always similar. When the vibration of light is too slow, we do not see them, nor when they are too rapid. So with sound; when very low pitch we do not hear it; when very high, we do not hear it either”⁷.

Swamiji’s approach in application of scientific truth to explain religious enigma may be understood from his approach in dissuading certain doubts of his disciple Haripada Mitra. Mr Mitra had confusion on contradictory attributes of God, of delivering justice and at the same time be kind as well; which seemed to be a paradox. Instead of giving a philosophical discourse explaining God to be the meeting point of contradiction logic etc., Swamiji cited the simultaneous existence of two opposing forces of centripetal (drawn towards the centre) and centrifugal (force drawn away from the centre) in material plane itself. So how can it be considered to be a paradox as the opposing qualities simultaneously existing over the all mighty God⁸.

Swamiji’s religious talk used to be in the language of science, illumined with the clarity of a practical scientist, than following the ambiguous jargons of a mystic. It has been reported on one of his religious discourses at Detroit in 1894, “...for nearly two hours Vivekananda wove a metaphysical texture on affairs human and divine, so logical that he made science appear like common sense”⁹.

Thus, based on the above back-drop, it may be quite pertinent to introspect the attainment of **Swamiji as a scientist**, and of course not ascribe designating **Swamiji** to be **the scientist**.

This makes us to bring to light the following aspects from the life and works of Swamiji, such as:

- His depth of knowledge & grasp over the contemporary material science.
- Any scientific experiments, if undertaken by Swamiji to get an insight into the material science or, beyond.
- To what extent he was ahead of his time in understanding nature, which might have got confirmation from future studies, including the points where he proved right and where he erred.
- His approach in explaining the spirituality, nature & society with exactitude of an ardent seeker of the Truth, using scientific language and its influence over the scientific community, if at all.

A brief analysis on the above four points are discussed below.

3. SWAMIJI'S GRASP OVER CONTEMPORARY MATERIAL SCIENCE

Swamiji is said to have been a voracious reader studying different subjects making an in depth study on philosophy, history and literature. But his interest did not remain confined to these topics on humanities only. Mathematics (popularly said to be the gateway of science), was one of the subjects which he had to study as his curriculum course till the graduation level¹⁰; with particular interest in applied mathematics & astronomy. In this period he made a thorough study on Godfray's astronomy book¹¹. Naturally, even for making elementary study on astronomy one has to be thorough in optics to explain aberration in positioning of the heavenly bodies and has to study basics in physics with laws of motion etc..

No wonder Swamiji did not falter when confronted with a question at a dinner party in Detroit sometimes in 1894, as regards the authentic books to be studied on Chemistry as well as on Astronomy. It has been reported that "this Hindu monk (Swamiji) obligingly responded with a long list of English works on Chemistry as well as on books on Astronomy over which the Americans should have known better"¹².

Swamiji's scientific bent of mind and his acumen to grasp and accept scientific truth can be understood from his worry for his spiritual master Sree Ramakrishna's onset of throat pain sometimes in August 1885. It was Swamiji (then a youngman of 23, fresh from college), who first apprehended his mentor & Guru Sree Ramakrishna's sore throat symptoms to be an attack of the incurable Cancer, from studies of medical books in the medical college library; though the doctor examining him then, disposed it off to be clergy man's sore throat (Singer's nodule), caused from too much of lecturing¹³. Later Swamiji's apprehension proved right by subsequent specialist doctors. Swamiji, who loved his Guru Sree Ramakrishna more than his own self, felt extremely sad realising the hard reality that this is incurable and fatal whilst other senior disciples of Sree Ramakrishna, out of their emotive exuberance, considered it to be just a passing phase and some miracle will cure this.

Swamiji talked about Hinduism and Vedanta at the World Parliaments of Religions in Chicago in 1893 and the American audience was enraptured with his talk. He gave an equally impressive talk on a totally non religious topic at the invitation of American Social Science Association. The topic delivered on Sept 6, 1893 (prior to his address at the Parliament of religion), at the Townhall was, 'The Uses of Silver in India' (the silver standard was a burning question at that time in American Politics)¹⁴.

Swamiji, stressed upon the need of science institutions & research in India and Jamshedji Tata, the great industrialist, was so much impressed speaking with him that he later on established a research institute, then known as the Tata Institute (which later emerged as Tata Institute of fundamental research in Mumbai & Indian Institute of Science, in Bangaluru); and he wrote asking him to take charge of it. He wrote: " I am of opinion that if such a crusade in favour of an asceticism of this kind were undertaken by a competent leader, it would greatly help asceticism, science, and the good name of our common country; and I know not who would make a more fitting general of such a campaign than Vivekananda."¹⁵.

Of course Swamiji, who renounced the world for a greater cause, declined the offer, in the same way as he declined the offer for the Harvard Chair of Eastern Philosophy in March, 1896¹⁶.

It has been reported that Swamiji spoke at least 4 times at the erudite scientific sessions in Chicago Parliament of religion ... the contents of which are however not available¹⁷.

It may not be out of place to point out here that Swamiji used to be quite at home in the company of the then acclaimed scientists. The scientific luminaries of nineteenth century, like Lord Kelvin, Prof. Von. Helmholtz, Nicholas Tesla, all attended the scientific sessions of Chicago Parliament of religion in 1893 and heard Swamiji's deliberations intently. They were so highly impressed from his astounding knowledge on the grasp of science, that they met later to hear him in dinner parties, as cited from the memoirs of Miss Cornelia Conger¹⁸.

Swamiji wrote to E. T. Sturdy on 13th Feb, 1896, from New York about his interaction with the great electrician Nicholas Tesla " ...Mr Tesla was charmed to hear about the Vedantic *Prana*, *Akasha* & the *Kalpas*, which according to him are the only theories modern science can entertain.Mr Tesla thinks he can demonstrate mathematically that force and matter are reducible to potential energy. I am to go and see him next week to get his new mathematical demonstration"¹⁹.

*[**Prana** is a term used in the scriptures & in Vedanta; simplified version of which can be ‘explained as the generalised manifestation of force’]²⁰.

Swamiji visited Tesla’s laboratory to see his experimentations, though the onus of determining quantitative relationship between matter and energy lay to Albert Einstein the great, 9 years later in 1905.

In this context it may not be out of place to find out whether Swamiji himself undertook some experimentation over material science, or beyond.

4. SCIENTIFIC EXPERIMENTS UNDERTAKEN

Swamiji, known as Narendranath in his premonastic days got impressed at the utility of gas, like, alighting the street lights in Calcutta in late eighteen sixties. Narendranath, then a child tried his innovative ideas of its generation by igniting straw at the compound of his house along with his playmates, and tried to channelize it collecting some earthen pots and lead pipes etc. This is the only evidence that we can cite of Swamiji making some scientific experiment, though this was during his early childhood days²¹.

In later life Swamiji made experiments in mental plane with *Raj-Yoga*, which can be termed to be the ‘science of human possibilities’ or the science of attaining perfection. Swamiji declares, “the science of *Raj-Yoga* proposes to put before humanity a practical and scientifically worked out method of reaching the truth.”²² The truth with assurance that we are the **children of immortal bliss**. The truth that declares “each man is only a conduit for the infinite ocean of knowledge and power that lies behind mankind”²³. Swamiji not only himself earned such power from practise of *Raj-Yoga*, but kept on cross checking with experimental verification of its marvels, to be convinced of²⁴.

Swamiji, like a scientist who cross checks and rigorously verifies facts for his experiments over material objects, cross-checked and verified subtle psychic power appearing in physical plane for his mentor and Guru Sree Ramakrishna before accepting them to be true.

Yogic powers and experiences are disposed of by commoners as beyond the scope of human understanding. But Swamiji, with a scientific bent of mind gave explanation of such apparent marvels. He explained, “think of the universeconsisting of varying degrees of vibrations under the action of *Prana**; vibrations are less if they are away from the centre, but nearer to it they become quicker and quicker. those of a certain state of vibration will have the power of recognising one another, but will not recognise those above them (their plane). Yet, just as by the telescope and the microscope we can increase the scope of our vision, similarly we can by Yoga bring ourselves to the state of vibration of another plane, and thus enable ourselves to see what is going on there”²⁵. Thus with his scientific explanations the mysticism of Yogic marvels no longer remains incomprehensible mysticism, but a verifiable scientific truth.

Now the question arises as to any other vision that Swamiji might have had in lifting the veil of nature, which later on might have the confirmation from rigid scientific experimentations. Some the important ones thus proclaimed by Swamiji are discussed below.

5. SWAMIJI’S PROCLAMATIONS IN LIFTING THE VEIL OF NATURE

It is to be appreciated when Swamiji spoke of his vision as early as in 1890, saying the scheme of the universe of micro-world and macro-world to be similar, atomic structure to be identical with the solar system; he certainly did not mention anything on whether it was orbit or orbital structure or, electron cloud etc. They were left for the scientists to probe, proving the details over the broad visions & principle that Swamiji had.

Speaking about *Prana* –Swamiji quotes from Vedanta and says “....what we call matter does not exist at all; it is only a certain state of force”²⁶; this signifies energy in modern terminology. He did not say anything on the quantitative relationship between the two, which was left to the scientists (Albert Einstein to prove mathematically with the velocity of light). However, such talks motivated & inspired the famous scientist like Nicholas Tesla to such an extent the he wanted to prove it mathematically, and learnt Sanskrit to know more details about the *Prana* that he heard from Swamiji²⁷.

The pertinent question arises, on whether besides matter-energy convertible relationship, Swamiji made any more prophecy on the scientific truths, may be on overall broad principles.

Swamiji's world centred around God and humanity and his discourses were by and large confined to these topics. However with his scientific bent of mind and rationality we find glimpses of scientific truths told in the course of such discourses, which had to wait for scientific confirmation for a number of years and there are yet some aspects which needs further exploration. Some of them may be cited as below:

1. Ecological balance.
2. Indeterminacy of the physical world.
3. Creation of the Universe.

A brief resume of the above three topics as per Swamiji's talk & subsequent scientific probe on their validity, are discussed below.

5.1. Ecological Balance

Ecology has become a much talked of subject since mid-twentieth century. From this time on the importance of conservation of all species have been realised and humans have understood that due to the interdependence of species, in order to survive we must all survive together or we all perish. This has led to the much talked of topics like sustainable development, environmental impact assessment (EIA), maintaining eco-balance, restricting species extinction etc. These topics, considered extremely pertinent and of global concern today in the 21st century, were unknown in the late 19th century or, during Swamiji's time.

But surprisingly we find Swamiji talking about this interdependence of nature during a talk delivered in London in 1896. He says "...every particle in the universe ...is in relation to every other particle.Interdependence is the law of the whole universe."'²⁸. He said more specifically at Los Angeles, in his talk 'Hints on practical spirituality', the exact mention of such topics relevant to modern ecology. He said, "The whole universe is one of perfect balance. I do not know that some day we may wake up to find that the mere worm has something which balances our manhood..... Balance everywhere"'²⁹. In fact, environmentalist today are concerned on unbalanced growth of our industry /commerce with indiscriminate use of resources, not keeping in tune with Nature's balance (of resources availability), over which Swamiji's caution was nearly a century ahead.

5.2. Indeterminacy of Nature

In his talk on the topic of "Absolute and Manifestation" delivered at London in 1896 Swamiji speaks of the indeterminacy of the Absolute when viewed through the prism of time, space & causation, which is the 'WHY' factor. Using his exact words, "How has the Infinite, the Absolute, become the finite?This Absolute (a), has become the universe (b), coming through time, space and causation..... what we call causation begins afterthe degeneration of the Absolute to phenomenal, and not before; in the Absolute there is neither time, space, nor causation. It is all one.it is only something that has become limited by our mind,, if the Absolute becomes limited by our mind it is no more Absolute. It has become finite. Everything limited by our mind becomes finite. Therefore to know the Absolute is again a contradiction in terms"'³⁰. He further said, "Absolute is manifesting itself as many through the veil of time, space and causation. ...Time is entirely a dependent existence; it changes with every change of our mind. ..So with space. ...it cannot exist separate from anything else. So with causation .'"³¹.

Three decades later Swamiji's indeterminacy clause in understanding of the Absolute, opened up a new horizon of Physics, initiating debates amongst the greatest scientists over this indeterminacy or, fuzziness in Nature, when considered in the smaller scales of nature³². It all started with Werner Heisenberg, in 1927 termed indeterminacy principle or, the more popular term uncertainty principle; stating that "the position and the velocity of an object cannot both be measured exactly, at the same time, even in theory. The very concepts of exact position and exact velocity together, have no meaning in nature. The more accurately we know one of these values, the less accurately we know the other".'³³.

But the debate continued for quite a long time with Einstein not convinced of such uncertainties. Albert Einstein refused to accept quantum indeterminism and sought to demonstrate that the principle of indeterminacy could be violated, suggesting ingenious thought experiments, and known as Einstein

box, countering such ingrained uncertainties in nature. Neil Bohr could later on show the fallacies in this Box experiment (thought process) from Einstein's own gravitational theories, caused with respect to the measurement of **time**³⁴. Science has thus embarked from Newtonian mechanics with clear cut laws, to the probabilistic quantum mechanics with ingrained uncertainties viewed through the prism of time, space & causation.

5.3. Creation of the Universe

Lord Kelvin (1824-1907), the scientific luminary of Swamiji's time, and an admirer of Swamiji with mutual respect for each other, determined the age of the earth to be 100 million years, from Newton's laws of cooling³⁵ It was derived to be of much higher value, around 4.5 billion years from radioactive dating method, discovered much later³⁶. As regards the age of the Universe is concerned, NASA's study (2012), estimates it to be around 13.8 billion years³⁷.

Since late twentieth century, scientists around the globe are trying to determine the genesis of the Universe and came out with the fact that the universe in the primordial stage was infinitesimally small, infinitely hot, infinitely dense, something – termed in **singularity** state. There was no light, no space, no time and all these came out later³⁸. According to NASA when the universe from Singularity state, experienced an incredible burst of expansion, (termed Big Bang) it reached from subatomic size to golf-ball size in just 10^{-34} sec. One second after the **Big Bang**, the universe was filled with neutrons, protons, electrons, anti-electrons, photons and neutrinos. By 3 minutes the temperature came down to 1 billion Kelvin, and protons and neutrons collided to make deuterium, an isotope of hydrogen³⁸.

About 400 million years after the Big Bang, the universe began to emerge from the **cosmic dark ages** which lasted more than a half-billion years. Clumps of gas collapsed to form the stars and galaxies. Our solar system was born after 9 billion years. Although the expansion of the universe gradually slowed down as the matter in the universe pulled on itself from gravity, about 5 or 6 billion years after the Big Bang, a mysterious force (now called **dark energy**) started making accelerated expansion of the universe. This dark energy is one of the greatest mysteries in science³⁹. It turns out that atoms (matter) make up only 4.6 percent of the universe, 23 percent is made of one or more species of subatomic particles that interact very weakly with ordinary matter and is termed **dark matter**. 72 percent is made up of dark energy, which apparently is driving the accelerated expansion of the universe. In this expansion it is not that space is expanding, but the universe is expanding simultaneously with space along with it³⁹. According to NASA, the universe is not infinite but has no end, just as the area on the surface of a sphere is not infinite, but has neither beginning nor end to speak of⁴⁰. If the universe eventually stops expanding, it will start collapsing, termed the "Big Crunch."

In this long journey of science unravelling the creation of the universe, starting from nineteenth century luminaries like, Lord Kelvin, to 20th century stalwarts like, Edwin Hubble, Steven Hawking, George Ellis, Roger Penrose, Arno Penzias, Robert Wilson, etc. and of the team of 21st century NASA scientists; where does Swamiji (1863-1902) of nineteenth century stand, with His story of creation of the universe ?

Citing 6000 years old verse of Rig-Veda, written in a poetic language in Sanskrit, Swamiji translated in English and said, "When there was neither aught nor naught, when darkness was rolling over darkness, what existed ?It then existed without vibration. The *Prana** existed then without vibration ... The *Prana* existed then but there was no motion in it. *Anidavatam* (*unvibrating*), means existed without vibration. ...Then when *Kalpa* (creation) begins, after an immense interval, *Anidavatam* commences to vibrate and blow after blow is given to *Prana* by *Akasha*. The atoms become condensed, and as they condensed different elements are formed"⁴¹. (*Apparently vatam means vayu or air; so Anitavatam means no air. But with the connotation of Sanskrit language it means a certain properties of air causing vibration, so Anidavatam means –no vibration, no movement, everything static*).

In modern terminology, ANIDAVATAM may be said to be equivalent to **Singularity** from which sprang forth time & space and energy and all of creation, which in Swamiji's language were all there but remained static which became dynamic, when blow after blow (*collision in modern terminology*) is given to *Prana* by *Akasha*. This Sanskrit terminology *Prana*, *Akasha* and *Kalpa* have their special

connotations, of which Swamiji himself explains saying, “ Every manifestation of power ...is the Prana...every material manifestation is Akasha. When this cycle will end all will melt back into original Akasha*.all will resolve into original Prana*. Then this cycle is said to sleep for a period to throw out ...all these forms. ..the whole period will subside again. Thus this process of creation is going down, coming up, oscillating backwards and forwards... it is becoming static during one period (Kalpa) and during another period, becoming dynamic ...this alteration goes on for eternity”⁴².

Explaining more explicitly the connotation of the term *Prana*, Swamiji said, “The sum total of all forces in the universe, mental or physical, when resolved back to their original state is called *Prana*”⁴³ The term ‘force’ as Swamiji used, would in modern terminology be said to be the same as ‘the Energy’. Meaning of the term *Akasha*, as per the Vedas means the vast space, where all thoughts remain in the condensed state, which the Rishis can only see as the shining Mantras; from which spring forth everything in the universe. Swamiji while stating on creation from *Akasha* says, “At the end of a cycle the energies in the universe quiet down and become potential. At the beginning of the next cycle they start up, strike the *Akasha* and out of the *Akasha* evolve these various forms”⁴³ (of creation). This **Akasha** thus in modern terminology could be considered to be the same, as **Quantum Vacuum*** & the cycles that Swamij referred to, are the ‘**Kalpas**’, which goes on for eternity; one following the other.

[*Quantum vacuum* = a mathematical concept, where it is considered the fundamental particles in space are created and destroyed. Naturally space cannot be considered to be just a void/ vacuum occupying the space - since nothing can be created or destroyed out of nothing. The term *Singularity of Big Bang* is also used as a mathematical concept only].

About the age of the universe Swamiji said, “the sum total of the energies in the universe is the same throughout.Energy toned down and calmed and next gets manifested. This evolving and involving goes on through eternity”⁴⁴ Modern science however is silent on what existed before singularity and fixes up the age of the universe to be of 13.8 billion years, and not of alternate big bang and big crunch, going on for eternity, as per Swamiji; which is one cycle or kalpa following the other.

Did Swamji say anything about the expansion of the universe when it got manifested? In some other context Swamiji said, “In the material physical world expansion is life, and contraction is death. Whatever ceases to expand ceases to live”⁴⁵. Everything in nature tends to expansion for life and contraction for death”⁴⁶.

Being himself a student of mathematics, Swamiji also said, “...the sum total of the energy that is displayed in the universe is the same throughout. You cannot take away one atom of matter or one foot pound of force”⁴⁷. So in *Anidavatam*, which may be said to be the same as modern terminology of Singularity, everything remained intact but not manifested.

Thus we do find that Swamiji’s story of the ‘creation of the universe;’ tallies fairly well with the 21st century big bang theory, though it does differ in the question of details. Science does not accept eternity of cycles, it is silent over the state before singularity. It also admits that dark energy & dark matter, which taken together constitute nearly 96% of the universe, remains an unresolved mystery in the 21st century science.

6. LANGUAGE OF SCIENCE THAT SWAMIJI’S USED IN HIS DISCOURSES ON METAPHYSICS

In his talk in unifying the identity of God with His creation, Swamiji said, “Creation and creator are two lines without beginning and without end, running parallel to each other.God...from whose power systems after systems are evolved out of chaos, made to run for a time and again destroyed.the sun and moons, created like the sun and moons of previous cycles.....”⁴⁸ Also Swamji in his talk on ‘Real & Apparent Man’ starts asking question after some introduction as regards, “...whether the aggregate of the material we call the body is the cause of the manifestation of the force we call soul, thought etc, or whether it is the thought that manifests the body”⁴⁹ Based on this query Swamiji in his discourse proves like an *Euclidian Geometry theorem*, saying “the real man therefore is one and infinite, an omnipresent spirit. And the apparent man is only a limitation of the real man.”⁵⁰.

Swamji said of his conclusion elsewhere saying, “In its very essence it (the soul) is free, unbound, holy, pure, and perfect. But somehow it finds itself tied down to matter.Why should the free, perfect being be thus under the thralldom of matter....How can the perfect soul be deluded into the belief that it is imperfect?It is a fact that everybody’s consciousness that one thinks of oneself as the body.The answer that ‘it is the will of God’ is no explanation. This is nothing more than(saying), ‘I do not know’.”⁵¹ This language of frank admission “I do not Know” is not the

language of metaphysics, but the language of science, which only states facts and refuses to answer every “Why”; proudly and unabashedly declaring, “I do not know yet, but I will find out”.

Swamiji in enunciating the essence of Raj-Yoga, declares it to be sort of another science subject, practicing which in its prescribed methods, everybody can have *direct experience (of spirituality)*, like the experimental results obtained from the different branches of science following their respective methods and not to believe in anything unless the results are achieved. Swamiji categorically denies the common wrong perception of its non-universal application at the present day, which says it to be obsolete now and experienced previously only by few founders of religion. Swamiji says, ”This I entirely deny. it absolutely follows that that this experience has been possible million times before, and will be repeated eternally. Uniformity is the rigorous law of nature. What once happened can happen always. If there is a God, we must see Him, if there is a soul we must perceive It; otherwise it is better not to believe. It is better to be an outspoken atheist than a hypocrite”⁵².

Citing on the properly guided power of attention to the internal illuminating us, he says, “ “The powers of mind are like the rays of light dissipated; when they are concentrated they illumine”⁵³.

All these are some of the few illustrations as to how Swamiji’s talks and discourses in metaphysics directly illumined with rationality, and he spoke in the language more of a scientist than that of abstruse philosophical logic with jargons of a mystic.

7. CONCLUSIONS

What scientists are arriving at through experimentation and enquiry, Swamiji arrived at the same conclusions much earlier in time, and much more assuredly through intuitive meditation.

In making conclusion it may be relevant to make Swamiji’s famous quote, ‘In Buddha we had a great universal heart and infinite patience making religion practical and bringing it to everyone’s door. In Sankaracharya we saw tremendous intellectual power, throwing the illumined light upon everything. We want today that bright sun of intellectuality joined with the heart of a Buddha, the wonderful infinite heart of mercy. This union will give us the highest philosophy. Science and religion will meet and shake hands⁵⁴’.

In Swamiji’s discourses and talks we find both of Buddha’s infinite heart of mercy & Sankaracharya’s tremendous intellectual power throwing illumined light upon everything, being expressed in the language of science, today science and religion are shaking hands inspiring both the humanitarians and scientists of the globe alike.

Thus Swami Vivekananda, the prophet of the nuclear age, emerged as a Yogi and more like a scientist, who explained scientifically the deeper tenets of Vedanta, making them to be the factual scientific truths, rather than abstruse philosophical thoughts expressed with jargons of a mystic.

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