

# BOSON, FERMION & SUPER SYMMETRIC STATISTICS

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## INTRODUCTION

Science has remotest antiquity. To prove this, we can show any number of evidence from the scriptures of ancient past like Veda. Further, it is a fact that the Eastern and Western parts of the world have different approaches, developments, realisation and understanding of Science. The ultimate objective of science is to realise the absolute truth, i.e. the oneness of the Universe. East had already reached its zenith, by realising this truth in the remote past, whereas the West is still struggling to realise it, though at present crawling in this direction. This article tries to elaborate these facts in an evidence based narration.

## DALTON'S ATOMIC THEORY

In 1802 C.E., John Dalton declared that all elements consist of extremely small units called Atoms and these atoms are indivisible. This is the first component of the famous Dalton's Atomic Theory. Hence, it is postulated that the smallest unit of physical matter is atom and the atom cannot be further divided into smaller parts. Thus, there was no scope for the apprehension of sub-atomic particles.

## ALBERT EINSTEIN'S EQUATION $E = MC^2$

$E = MC^2$  is the famous equation of Albert Einstein. It first made its debut in Einstein's Special Theory of Relativity of 1905. This equation equates Energy and Matter as inter convertible and one and the same. Thus, Matter is nothing but the condensation of Energy. This further paved way to the realisation and extraction of much higher end of energy of immense, mammoth and monstrous magnitude, i.e. Nuclear Energy. This intern led to the realisation that atoms can be split into much smaller sub-atomic particles of quantum world.

Before narrating further, let us view the history behind this equation. There was a fascinating narration prevalent in the scientific circles in 1900s. It was detailed in the article, "The Swami and the Savant" written by the American Journalist A.W.Hill. (Downloadable from Internet). In this article, A.W.Hill wrote that Einstein's equation made its debut as  $E = M$ , in the margin of an early draft of Einstein's Special Theory of Relativity, written in hand by Mileva Maric. She was Einstein's wife and was also a scientist. Both Mileva Maric and Nikola Tesla, the great scientist of U.S.A., are of Serbian origin. They had a friendship of many years since their studies at Budapest, Hungary. They both had scientific postal correspondence even after Nikola Tesla settled in U.S.A.

Then, A.W.Hill points out that it was actually Swami Vivekananda who conveyed Nikola Tesla the scientific fact that Energy and Matter is same and interconvertible, when Nikola Tesla

met Swami Vivekananda in U.S.A. (Refer: 1. Swami Vivekananda's letter to E.T.Sturdy, dated 13/02/1896, from New York, as found in "The Complete Works of Swami Vivekananda" 5<sup>th</sup> Volume, Pages 100 to 104, Advaita Ashrama, 2007, 2. "The Influence of Vedic Philosophy on Nikola Tesla's Understanding of Free Energy" by Toby Crotz, President, Wireless Engineering U.S.A., Pages 2 to 4, published by Tesla Memorial Society of New York 1996, & 3. "Swami Vivekananda, Sarah Bernhardt and Nikola Tesla" Marie Louise Burke, Prabhudda Bharata, Pages 110 to 120, 1972).

Swami Vivekananda further wrote in this letter, "Nikola Tesla thinks he can demonstrate mathematically that force and matter are reducible to potential energy. I am going to see him next week, to get this new mathematical demonstration. In that case, Vedic Cosmology will be placed on the surest foundations". Swami Vivekananda's explanation to Nikola Tesla on energy and matter is based on Kapila Rishi's Sankhya Philosophy. The 61<sup>st</sup> verse of 1<sup>st</sup> Chapter of Kapila Rishi's Sankhya Philosophy mentions as,

"Sattava Rajas Tamasaam Saamyavasthaa PrakRuti:"

"Sattava" is the abstract noun of "Sat" meaning Being, Existing and Reality, denoting Static Energy, which remains and exists as Static. "Ranj" means Kinesis and Motion. The word "Rajas" is derived from "Ranj" and thus it means motion and thus it denotes Kinetic Energy. "Tam" means Inclination, Transformation and Condensation and "Tamas" is derived from "Tam". Thus it denotes Potential Energy, i.e. Matter, the condensation of Energy. "Saamaya" is the abstract noun of "Sama" meaning equal and same. "Avasthaa" means the state of being and in what manner one exists. "PrakRuti:" is the Upaadaana KaaraNam, the material cause of the Universe, i.e. the total Energy. Thus, this verse states that the Static, Kinetic and Potential (Matter) Energy is one and the same and the total will be of same quantity. Modern Science mentions the same as conservation of energy, energy neither created nor destroyed and the matter is nothing but the condensation of energy. Thus, the scientific fact that Energy and Matter is same ( $E = M$ ), was revealed by Kapila Maharishi, thousands of years before present. Swami Vivekananda taught this Sankhya Philosophy to Ketri Maharaja Ajit Singh Bahadur and many others.

These narrations clearly reveal that Swami Vivekananda knew very well that Energy and Matter is same with inter convertibility and taught the same to Nikola Tesla. Nikola Tesla and Mileva Maric had letter correspondence and Mileva Maric wrote  $E = M$ , in the margin of an early draft of Einstein's Special Theory of Relativity. Thus, A.W. Hill postulated that the famous equation  $E = M$  made its way to Einstein from Swami Vivekananda, through Nikola Tesla and Mileva Maric. A.W. Hill wrote further, "Though I cannot affirm the variety, it has a ring of truth". Dr T.G.K. Murthy, former ISRO Scientist mentioned, "Einstein himself acknowledged the contribution of Swami Vivekananda, by stating that there is one KANANDA (as the western papers often referred Swami Vivekananda) who predicted that Energy and Matter are interchangeable. (Refer: Swami Vivekananda an Intuitive Scientist, Pages 40 & 41, Ramakrishna Mission Mylapore). Dr. Mylswamy Annadurai, former ISRO Scientist mentioned, "It was Swami

Vivekananda who had first come up with the theory  $E = MC^2$  and not Einstein. In fact Einstein himself acknowledged that a Swami had found something about quantum Energy”. (Refer: Deccan Chronicle, Chennai Edition, Special Issue, Page No.2 of 11/02/2013 Issue).

## UNCERTAINTY IS THE NATURE OF NATURE

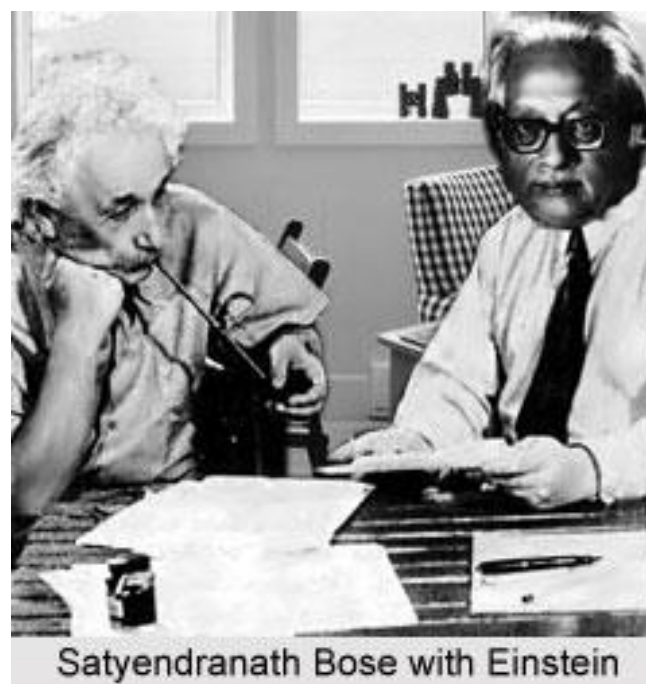
Thus, based on the equation  $E = MC^2$ , it was realised that atom can be split and when it was accomplished, the Physicists came to be aware and discovered a new quantum world of sub-atomic particles. They found out one after another of nearly 200 sub-atomic particles, of which electron, proton, neutron and photons are the prime entities. However, this new discovery puzzled them much, as the properties of these sub-atomic particles and the rules they obey, differed much from the physical and chemical properties and rules of the macro world. They found that Electrons behave as particles as well as energy. Light Photons travel as waves as well as particles. Thus, the sub-atomic particles behave in either way and thus, both extremities are possible in the sub-atomic world. This lead to Werner Heisenberg’s Uncertainty Principle of 1927. It states that it will not be possible to determine both position and velocity of sub-atomic particles simultaneously, at the same time. The more precise of our measurement in one quantum variable, then less accurate will be the other quantum variable.

Further, there exists the phenomenon of observer, observation and observed. It states that the mere act of observation itself causes alteration and changes in the observer, observation and the observed. Say, the scientific analysis and laboratory measurement of the chemical and physical properties will alter the properties of the observed chemical. Thus, one cannot precisely determine the exact and absolute nature of anything that is observed and analysed. Thus, uncertainty is the nature of Nature. Then, Physicists realised the Quantum Entanglement and further perceived every particle is contained in every other particle. Thus, nothing is separate and independent of the other, in the sub-atomic world. Thus, there exists an inseparable quantum interconnectedness between all particles of this Universe. Thus, Physicists cannot define the sub-atomic quantum world with certainty.

## MAJOR BREAKTHROUGH

In the year 1924, Dr. Satyendra Nath Bose, the great scientist of our Nation, wrote a four page article, “Plank’s Law and Light Quantum Hypothesis”. (Downloadable through internet). He sent his article to Albert Einstein requesting him to translate into German and to publish in German Science Journals. On those days, all scientific article were published mainly in German or to certain extent French Journals and not in English. Einstein rendered it in German and Bose’s article was published in the prestigious German Journal, “Zeitschrift fur Physik” (Journal for Physics). In that article, Satyendra Nath Bose emphasized the **probability** of finding the particles in phase space of  $h^3$  volume, **discarding the distinct position and momentum** of the particles. This derivation of Bose was enthusiastically endorsed by Einstein, who saw that Bose at once had removed the major objection in understanding the light quanta particles. Thus, it is a great

breakthrough in understanding the quantum physics. Bose's derivation gave accurate results. This is due to the fact that two photons with equal energy cannot behave as two distinctly identifiable photons. Any number of identical photons can occupy the same quantum state. By analogy, if the coins behave like photons and other bosons, on flipping two coins, **the probability** of producing two heads is one-third of the time and not one fourth (tail-head is same as head-tail). Later on, the photons and the sub-atomic particles obeying the same identical statistics were named as Boson particles, after Satyendra Nath Bose, as a mark of recognition, respect and honour to the pioneering turning point and breakthrough accomplished by Bose. Bosons have integral spin quantum number. The statistics which Bosons obey is named as Bose Einstein Statistics, just to include the translator of Bose's article, Einstein's name. Later on the Bose Einstein Condensation was also realised.



Satyendranath Bose with Einstein

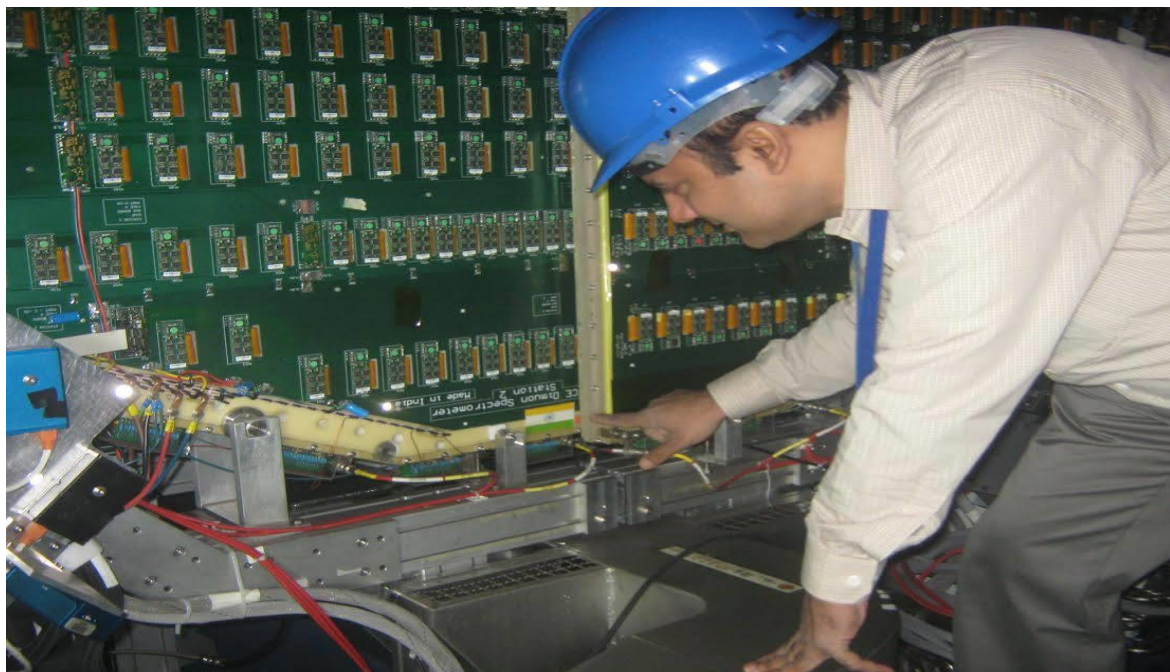
Soon, Enrico Fermi and Paul Dirac, the two Physicists derived the Fermi Dirac Statistics. The particles that obey these Fermi Dirac Statistics were named after Enrico Fermi as Fermions. These sub-atomic particles are with half integral spin quantum number. No two identical Fermions with equal energy can occupy the same quantum state. Fermion are the basic building blocks of the sub-atomic world. Six Leptons and Six Quarks are Fermions. (Electron, Proton, and Neutron). Bosons are the particles that mediate the interaction between Fermions. Bosons are  $W^+$ ,  $W^-$ ,  $Z$  particles (Photons etc.).

## CERN & MANAS PROCESSORS

CERN (European Organisation for Nuclear Research) is located in Switzerland France Border in Europe with its headquarters at Geneva in Switzerland. CERN conducts a scientific experiment to find out mainly, 1. The Interaction between quantum mechanics and General Relativity and 2. The super symmetric counterparts of Boson and Fermion sub-atomic particles.

Thus, its objective is to understand the Unification of four fundamental forces and Super Symmetric Status. This is accomplished by bombarding protons in clockwise and anticlockwise opposite direction, at light speed (2,99,792.458 Kilometres/second), in Vacuum, at a temperature of 0 Kelvin ( $-273.15^{\circ}$  Centigrade), in a large Hadron Collider of 27 Kilometres in Circumference, buried at a depth of 50 to 175 metres below ground level. Hadrons include Baryons such as Protons and Neutrons and also Mesons, Pions and Kaons. By the collision of these bombarded protons, the Higgs Boson Particles may be created and based on the analysis of this generation, the objectives of the CERN can be accomplished. Higgs Bosons are the conjectured Boson Particles that give mass to other particles and hence also called as God Particles.

In the ALICE (A Large Ion Collider Experiment) of CERN, Dimuons may be created and to detect these Dimuons, other Sub-atomic particles and the quantum events occurring in ALICE, signal processing chips are required. They are the most important components of the whole experiment of CERN. For CERN, these processors are like brain cells of human beings. There will be high temperature and high radiation. Hence, these processors should be of high radiation and temperature tolerant along with other standards like 16 channel read out capacity, accepting signals with minimum distortion, recording the signal data at astronomical speed (high speed recording), with high volume of storage (Heavy recording), preserving maximum sign to noise ratio (low noise level), small gain fluctuation and large dynamic range, yet the size should be very small. All the developed countries in the world had competed for the order. However, our Nation India's processors alone have met out all the requirements and standard. India has supplied 1,10,000 Processor chips to CERN.



The Scientist of India's Saha Institute of Nuclear Physics, at CERN within Hadron Collider, showing Indian Flag and the MANAS Processors of India.

Our Nation's processor has surpassed all other, by its highest quality and its remarkable and exceptional first-rate efficacy. The name of the processor is MANAS (Multiplexd ANALog Signal Processor). Its size is so small i.e. 2.6 X 4.6 Millimetres. It is definitely a feather in the cap of all Indians. It is manufactured by Saha Institute of Nuclear Physics, Kolkata and a few other Indian Institutes helped in this process. Meghnad Saha, the Astrophysicist was instrumental in establishing this Saha Institute of Nuclear Physics. Dr.Rolf Dieter Heuer, former Director of CERN admired Dr. Satyendra Nath Bose's work and naming of Boson after Bose. Paolo Giubellino, Experimental Particle Physicist working on High-Energy Nuclear Collisions and the former spokesperson of ALICE, mentioned that India is like a historic father of CERN, because BOSON and MANAS are the most important, essential and crucial elements of CERN, in understanding the Unified Force and Super Symmetric Statistics.

## UNIFIED FORCE AND SUPER SYMMETRIC STATISTICS

Physicists are researching to understand the basic interaction of the Nature and Universe in a Unified way. For example, Maxwell's equation unified Magnetism, Electricity and Optics, the different manifestations of same set of Laws. In 1970s, Electromagnetic Interaction and Weak Nuclear Interaction of beta decay have been unified. Further, Electromagnetic Force and Weak Nuclear Force are found out to be the manifestation of Electroweak Force. Now, Physicists wants to know whether this Electroweak Force and the Strong Nuclear Force are the manifestations of one Unified Force, as predicted by many Grand Unification Theories. In this Unification process, Bosons have a crucial role. The conjectured Higgs Boson is yet to be discovered. Thus, Physicists are very keen on to unify the four fundamental forces of the Universe, i.e. Strong Nuclear Force, Weak Nuclear Force, Electromagnetic Force and Gravitational Force, as the manifestations of one basic Unified Single Force, which might have been existed, on the origin of the Universe. In this process, Physicists are presuming a Super Symmetric Statistics, which incorporates both Bose and Fermi Statistics.

As per this conjecture, for every Boson particle, there has to be a Fermion counterpart. For example, for Photons there should be a Super Symmetric Fermion partner, Photino. In the same way, for every Fermion, there has to be a Super Symmetric Boson counterpart. For example for Electron, there should be a Boson partner Selectron. Thus, Physicists are researching tirelessly to derive the Super Symmetric Status of the sub-atomic particles (Bosons and Fermions) and to find out Higgs Boson. Thus, modern science is progressing and researching steadily to realise and understand the conjectured Super Symmetric Statistics and Unified Force.

However, the Eastern world had reached this zenith and realised it in the remote past itself. For example, this Super Symmetric Status, expressing the two extremities like Boson and Fermion, in a single entity, has been symbolically represented in the form of Idols, worshiped in India. For example, the Idols of Sankara Naarayana, Ardhanaaree Esvara and Lakshmee Naarayana are the symbolic expressions of this Super Symmetric Status. By analogy, Sankara (Esvara) and Naarayana or Esvari can be considered as the two different obverse manifestations of Supreme Energy or

Force, i.e. the Omnipotent, Omnipresent Almighty. Esvari is often mentioned as the Maaya force of Naaraayana and also as Naaraayana's sister. Thus, the Idols worshiped as Sankara Naarayana, Ardhanaaree Esvara and Lakshmee Naarayana are nothing but the symbolic expression of the Super Symmetric Statistics and Unified Force. Thus, Esvara represents one manifestation and the counterpart manifestation is Naaraayana or Esvari. If both these manifestations are unified, then it is Sankara Naaraayana or Ardha Naaree Esvara (Unified Force). We can take one as Boson, the other as Fermion and the combined as Super Symmetric Statistics.

This may seem to be farfetched for some of our readers and scholars. However, if we read the book, "The Tao of Physics" authored by Fritjof Capra, the Austrian born American Physicist (Theoretical Physicist and High Energy Physicist), we can get the much needed clarifications and understanding.

## COSMIC DANCE OF ENERGY

Fritjof Capra in his book, "The Tao of Physics" at Preface (Page 11), wrote, "I 'saw' cascades of energy coming down from outer space, in which particles are created and destroyed in rhythmic pulses; I 'saw' the atoms of the elements and those of my body participating in this **cosmic dance of energy**; I felt its rhythm and I 'heard' its sound, and at that moment I knew that this was the dance of Shiva, the lord of Dancers worshiped by the Hindus".

He thus explained that the creation and destruction sub-atomic particles in rhythmic pulses, was symbolically expressed in the Idol of God Nataraja. He detailed these explanations at pages 269 to 271 of this book as, "The upper right hand of the God holds a drum to symbolize the primal sound of creation, the upper left (hand) bears a tongue of flame, the element of destruction. The balance of the two hands represents the dynamic balance of creation and destruction in the world, accentuated further by the Dancer's calm and detached face in the centre of the two hands, in which the polity of creation and destruction is dissolved and transcended".

Bubble chamber photography proved that there exists a perfect balance of creation and destruction of virtual particles. How much particles are created, that much alone destroyed and vice versa. Thus there is perfect balance. Further, this creation and destruction of virtual particles are happening in perfect order, in rhythm, in cosmos and not in haphazard manner and not in chaos. Thus there is order and rhythm. Thus, there is 1. Creation and 2. Destruction of virtual sub-atomic particles, 3. In perfect balance and 4. In order with rhythm (**Cosmic Dance of Energy**). All these four are symbolically expressed in the Idol of Nataraja. The upper right hand with drum represents creation, the upper left hand with flame represents destruction. The perfect balance is represented by these two hands kept at equal height and the calm and detached face of God Nataraja. The order, rhythm and cosmos is represented by the dancing God Nataraja. Wherever there is dance, there will be rhythm and order. Thus, these four essential subatomic events and their basic components are represented in the Idol of God Nataraja, exactly, perfectly and scientifically. Thus, Ananda Coomaraswamy expressed his observation on the Idol of God Nataraja as, "It is poetry, but none the less science". We have to note that a six feet high Idol of



God Nataraja is kept at the Head Quarters of CERN at Geneva, with these narrations of Fritjof Capra.

However, the realisation of symbolic expression of the cosmic sub-atomic quantum events in the Idol of God Nataraja, has to wait for Fritjof Capra to realise and decipher it. In the same way, the realisation of the symbolic expression of Super Symmetric Statistics and Unified Force, in the Idols of Sankara Naarayana, Ardhanaaree Esvara and Lakshmee Naarayana, has to wait further more in time, to be expressed by any one of the future Physicist.

## CONCLUSION

These narrations clearly prove that the East had realised, understood and applied these scientific facts and thus, symbolically expressed these facts in the form of Idols, it worshiped. Thus, the East already reached the zenith by realising the Unified Force and Super Symmetric Statistics. East even went a step further, in realising the oneness of the Universe. This can be understood by reading the article of Swami Vivekananda in the prestigious Medical Journal of U.S.A. He wrote an article “Ether” in “New York Medical Times”. In that he explained that at the periphery of a circle, the radii are diverging and everything seems to be different. However on moving towards the centre, all are converging and everything is found to be interrelated and interconnected with other. At the centre of the circle, all are on the eve of finding a common centre. Thus, there is **oneness of the Universe**. In the same way, if we gain more and more knowledge, like moving towards the centre from periphery, we can perceive Unification (Unified Force) and Super Symmetric Statistics. This truth and reality had been realised, understood and applied with worship in the East in the remote past itself. However, the West is lagging behind much, though crawling in that direction.