

Key words: philosophy of holism, science, technology, quantum mechanics, transcendent reality

Ключевые слова: философия холизма, наука, технология, квантовая механика, трансцендентная реальность

The Science and Philosophy of Holism

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I am happy to be part of the International Philosophical conference of Belarus, to be held in Minsk on 20th May. Quite far away from the European Continent, how come I heard about this Philosopher of Science and social thinker, Dimitri Ivanovich Shirokanov, who have contributed heavily for the philosophical thinking in the second half of the twentieth century in Belarus is quite amazing. It is in through my friendship with Francois Pris whom I came into contact when he was doing research in Dortmund, Germany. As we both comes from the Physics and Philosophy background, we entered into interaction and collaborative work and even to publishing some articles together. So my interactions with Francois enabled me to know more about Belarus and its philosophical and scientific thinking. Philosopher and critique of science and the categories of thinking Academician Shirokanov became our latest connecting force and I found he was instrumental in giving foundations to Belarusian Philosophical school and how evolved new categories of thinking integrating the ancient and the contemporary. I think new ideas will evolve by fusing the ancient wisdom and the modern scientific thinking. One important aspect of this is the holistic thinking which I want to elaborate from the perspectives of the ancient wisdom which is known as natural philosophy and the contemporary scientific knowledge, especially quantum mechanics. I found no other person than Academician Shirokanov who has paved a new path in evolving this integration process and I pay tribute to this intellectual giant for his contributions and widening the horizon of our knowledge paths. I take this opportunity to thank my friend and collaborator Francois Pris for this wonderful opportunity of connecting with the august tradition of Belarusian thinking and culture with my own Indian and Eastern cultural heritage. In Bangalore, from where I hail from there is a Minsk Square as a symbol of the cultural exchange between our nations and I hope and pray that this connection will be further strengthened through bilateral exchanges. Thus, I am extremely happy

to be here in Minsk and greetings from Bangalore, a sister city of ancient wisdom and symbol of technological development. So thanking Priscilla and paying tributes to Shirokanov, let me elucidate the way of integrating the ancient wisdom and quantum mechanical conclusions of holism, in promoting holistic way of thinking in the twenty first century.

Usually reductionism was considered as the best means to comprehend the plurality of things and manifoldness of its expressions employed by humanity. Both in the East and the West, thinkers proposed certain building blocks like fire, air, water, earth and space as the constituents of this myriad manifoldness and thus derived a rational explanatory principle. The atomists both in the East and the West brought forth the explanatory theory of atoms to answer the multiplicity they experienced in this universe. Thus Democritus in the ancient Greece and Kanada in the ancient India proposed the atomic theory of indivisible atoms moving in the empty space colliding and structuring sustainable forms. While duality of Purusha and Prakriti of the Samkhya in ancient India and Heraclitus and Parmenides of ancient Greece emphasized the dual aspects of change and permanence as the ultimate principles of this universe. The abstract apeiron of Anaximander of ancient Greece paved a mathematical and abstract method of explaining the plurality experienced in this universe. In the Western tradition, Socrates gave a humanistic twist to this materialistic natural description of the universe by introducing knowledge and ethics and the importance of human life while in the Eastern tradition, Buddha, Jina and other spiritualists negated the materiality and upheld the spiritual transformation of the human person as the ultimate aim and purpose of life. In the West, Plato took the abstract, mathematical interpretation of the universe of his predecessors and refined it into the theory of the world of ideas that is eternal and perfect while the terrestrial life as a shadow of the life in the World of ideas where everything united with the One, the Good and the Beautiful, Unum, Verum and Bonum, which in Indian categories as Sathyam, Sivam, Sundaram. However, his disciple, Aristotle blended the three different streams of thought, namely the abstract - mathematical, the imaginative – tangible and metaphysical into a single whole, providing a holistic vision. Thus a fusion of physics and metaphysics is visible in his interpretation of the universe which became the foundation and bulwark of the western theology, philosophy and science.

Aristotelian Organism

Unlike Plato, Aristotle accepted the dual aspects of permanence and the flux of the reality as a fact even in this universe and in this life itself. He did not consider and explain the reality as existing somewhere outside the earth as pertinently described by Raphael's immortal painting where the two masters are debating with the raised forefinger of Plato pointing towards the heavens showing the reality as out there while Aristotle asserting by his palm that the reality as here, down to earth and now. Aristotle, the greatest intellectual of all times, compiled, fused and integrated all the knowledge of his times into a whole. Thus the Heraclitan flux, the

Parmenidean permanence, the Anaximanderian abstraction, the naturalists, five elements and the structural forces and the Eudoxian circles, the common experience of the motion of the sun and the day and night along with the fall of objects were unified into a system of thought known as Aristotelian physics. Thus the earth became the centre of the universe and sun, moon and other known planets rotating around it in concentric circles depicted as geocentric universe. Thus the earth got the unique position of the centre of the universe and all planets and even the sun revolving around the earth. Thus the universe was divided into terrestrial and celestial having different physical rules as well as constituent elements. The fire, air, water and earth were the constituent elements with the structural forces of the polar opposites, namely the wet and dry and the hot and the cold binding the things in the universe below the moon known as terrestrial bodies. The motion of the bodies is based upon its constituent elements. The fire and air have a tendency to go up while the earth and the water have a tendency to go down. If the fire and air elements are more, then the object has a tendency to go up. If a heavy and a light material are dropped simultaneously from the same height, the heavy one will hit the ground first. All the objects in the terrestrial universe have a tendency to come to rest. The celestial world that is above the moon is constituted of ether, a perfect element and hence the heavenly bodies move eternally in circles and they could never undergo change. Thus Aristotle reconciled the Platonic abstraction of the perfect world of ideas and the naturalistic empiricism of the Pre-Socratic philosophers through his division of the universe into the terrestrial and the celestial and designating different physical laws operating in these diverse levels.

Continuing his explanation of permanence and change in this universe, Aristotle developed four metaphysical principles. Essence- existence, form – matter, substance – accident and act and potency are the metaphysical principles he introduced in order to explain the permanent and changeable features of the universe. Aristotle accepted the reality of these two features and incorporated into the system of thought in explaining the phenomenon of the world. The permanent features are designated by the essence, form, substance and the dimension of time is introduced through the concept of act and potency. The future development of a system is envisaged through the potency and the actuality is defined as its present state. In explaining the polar opposite features of the universe, namely, change and permanence, Aristotle introduced the four causes, namely material, efficient, formal and final causes. Taking the example of a marble block, the material is the marble, the efficient cause is the instruments that are changing the material into a statue according to a plan or the model of the statue is the formal cause. The real instrument of this transformation is the sculptor who is undertaking the construction of the statue. For Aristotle, the most important cause is the final cause that is providing the purpose of the whole process. The fame or the money received by the sculptor for making the statue will be the final cause in this example. Thus, the purpose defines and guides the whole process and gives a meaning to it. Thus every process in this universe has a purpose and even every human action has a purpose. This concept of purpose gives the holistic outlook to the Aristotelian vision. Every tree grows with this purpose and this purpose gives it an organic development. There is a

proportion between the parts and there is an overall guidance to its growth. This organic whole controlling and guiding the parts is very much the foundation of the Aristotelian physics and metaphysics. The whole is more than the parts and an assembly of the parts will not get the whole.

Aristotle observed that his physics was unable to describe the totality of the universe and thus introduced the meta-physics. From the geocentric cosmology of a centre that is static and giving impetus to the motion of the planets, Aristotle proposed a mover that is static and stable yet imparting motion to everything else. Thus he introduced a metaphysical uncaused cause to complete the system of thought observing that such an explanation is necessary for completion. Aristotle found the insufficiency of physics in giving a complete description of the universe and thus took refuge in going beyond it, anchoring his thoughts in meta-physics and proposing the uncaused cause.

Christian Faith interpreted in terms of Greek Philosophy

In the development of Western thought, the next colourful stage came in the middle ages through the profound fusion of faith and religion with these Greek philosophical investigations. The Jewish religion and its offshoot Christianity penetrated the Greek philosophy and Roman culture during the middle ages. The Jewish concept of God, Yahweh and the Jesus Event together form the core of Christianity. The election of Abraham and the covenant Yahweh made with him through which he received the promise of becoming the father of a nation whose members are numerous like the stars of heaven and the sands of the sea shore. The pact is that Yahweh will be their only God and they will worship no other God than Yahweh. The Old Testament depicts the laxity of the people in worshipping Yahweh and sways over to other Gods and a furious Yahweh fumes and ferrets over this estrangement like a jealous lover and punishes Israel severely, the descendents of Abraham. This Abrahamic covenant was reinforced through the covenant made with Moses and Israel and through various Kings, Judges and Prophets of Israel. The arrival of the Messiah was part of the covenant and when at last he had come Israelites did not recognize and accept him. They rejected and crucified him because their expectations were different. They were awaiting the arrival of a political Messiah, the anointed King for a millennium and could not accept Jesus who come with a spiritual transformation. Through the incarnation, life, crucifixion, death and resurrection of Jesus, Christians consider the advent of the reign of God in history. This Christian salvific mystery was fused with the Roman culture and Greek philosophy paving its way for the European or Western culture. St. Augustine used the Platonic philosophy to interpret the Christian faith rationally while St. Thomas Aquinas used the Aristotelian philosophy. Till the 12th century the Augustinian Platonic idealism influenced the Western Culture while after that the Thomistic system of thought termed as Scholasticism took over the Western Culture. St. Thomas Aquinas identified the uncaused cause and the unmoved mover of Aristotelian metaphysics with God and rationally interpreted the Christian faith. Thus through Scholasticism, Aristotle gave the rational foundation to the Western

Culture which is predominantly Christian. Scholasticism was thus, a stunning fusion of faith and reason or religion and philosophy. Aristotle and St. Thomas gave the best model for theologizing, that is developing physics and transforming it into metaphysics and utilizing that metaphysics to interpret the encounter between the divine and the human relationship with the divine. There are not any more such exemplary models of philosophizing and theologizing after Aristotle and Aquinas. Another successful model is later developed by David Bohm.

Due to the over influence of Scholasticism and forgetting the warning of St. Thomas, in the medieval period Aristotelian geocentric cosmology and metaphysics was identified with faith and any challenge would be considered as a heresy and schism which would be a heavily punishable act because of Christianity's alignment with power. Thus, the identification of the Christian doctrine with Aristotelian metaphysics became the characteristic feature of the middle ages. Due to the introduction of Aristotelian thought and Scholasticism, nature was seen as created by God and is intelligible to human reason who in turn was created in His image. Thus nature was interpreted with an inherent order and regularity while the human reason was endowed with the power to penetrate and understand it. The assertion of the existence of the material reality with an inherent order capable of interpreting it in regular patterns was a great contribution in the intellectual growth of humanity. Compared to other cultures that denied the existence of matter, this basic presupposition made the big difference in the development of science in the West. However, the Church authorities fought with tooth and nail any deviations from the Thomistic – Aristotelian system of thought blindly believing that it formed the foundation of Christianity.

Decline of Scholasticism and the rise of Cartesian Atomism

During the beginning of modernity, scholasticism was attacked by the visionaries. The whole agenda of scholasticism was reduced to reflections and debates on God, salvation and sin absolutely forgetting the nature and human life here on earth by mediocre elements interpreting commentaries on commentaries on Aristotle. The visionaries, among them theologians criticised the methodology, object of thought and proposed that there should be an emphasis on the study of nature and a new language should be developed in describing the world. They called for experimental evidence as the true methodology of acquiring and processing knowledge based on induction rather than the self evident axiomatic deductive methodology of Aristotle. They proved how Aristotle was wrong in many sense he was hurry to conclude without basic investigations. They argued that mathematics as the new language of science and nature the object of its thought so that the dynamics of nature could be understood and thus humanity could control and manipulate nature facilitating human life. Galileo, Leonardo Da Vinci, Cardinal Nicholas of Cusa, Descartes, Francis Bacon, Thomas Hobbes were some of those intellectuals who proposed for a shift of emphasis from God to nature. Bacon criticised the tribal social culture as a stumbling block for human progress and advocated for the elimination of these faulty individual and social habits. Thus the idols of the tribe, cave, market place and theatre were criticised and

caused a social restructuring that paved the way for the renewal of the society. Because of this theoretical input and the continuous emphasis on the elimination of the tribal outlook transformed the highly tribalised European society and paved for a universal outlook based on humanism and its rapid growth. This critical reflection on the society and its transformation should be an ideal for the caste divided Indian society where a critical approach to the stumbling blocks of human progress has never been made. This renaissance spirit separated theological reflections on God, soul and salvation from philosophical investigations on the nature. In modernity the rise of reason is visible and its ultimate ramification and refinement as scientific rationality is known as renaissance.

Cartesian doubt and search for the clear and distinct ideas proposed atomism as a methodology for the investigation of nature became an alternative to the scholasticism and became the dominant paradigm of science once again alienating the holistic outlook proposed by Aristotle and paved the way for a mechanistic interpretation of nature. He divided even human person as body and mind, the extended being and thinking being and called for an infinite division of material reality which paved rich dividends in humanity's search for its understanding and controlling of nature. The rapid growth of science and the rich facilities we are enjoying due to technology are because of this philosophical vision and shift of emphasis that caused a social upheaval. Most of these intellectuals who steered the modernity were strong believers and it is their faith that catapulted them to study nature as the handmaid of God and to discover His splendour and Majesty in nature. Kepler, Newton, Laplace and other such intellectual giants extended the philosophical vision on nature into scientific practice and discovered the dynamics of nature and engineered gadgets facilitating life in an unforeseen way. Immanuel Kant and Wilhelm Hegel investigated on the power of reason introduced by scholasticism and emphasised by modernity. Kant divided the reality as noumena and phenomena and observed that reason could not penetrate noumena and it is beyond any rational investigation. However Hegel claimed the unlimited power of absolute reason in penetrating the reality and gave hope and courage to all scientific investigations though he criticised it as well. This euphoria about the ultimate power of human reason led science to deny any metaphysical reality beyond its experimental objectivity. Thus Laplace interpreted God as a mere hypothesis which has no place in the description of the world. Thus the dogmatism that choked the nascent science turned the other way around denying and dismissing faith and religion as useless jugglery empowered by the enormous success of science and technology and its megalomaniac expression known as scientism.

Newtonian Mechanistic Vision

The Newtonian physical laws and the law of gravity paved the way for a mechanical interpretation of the world rejecting the Aristotelian holistic outlook. The intellectual engine for the penetration of the dynamics of nature and the description of it in terms of physical laws were the Cartesian doubt and the mechanistic paradigm, causing further fragmentation and alienation.

Knowing the present state of a system and the governing laws scientists thought that they could absolutely predict and determine the future of a system and the world at large. The overall outlook was thus a determinism and atomism leading to a philosophy of using, abusing, misusing and overusing the nature and leading to the present ecological catastrophe and resource crunch leading to again an investigation into the foundations of Western culture and science.

However, the scientific foundations given by Newton in describing the world were later refined by James Clerk Maxwell by introducing the electrodynamics equations and the concept of electrical and magnetic fields which were experimentally discovered by Michael Faraday leading again into a relativistic and quantum mechanical revolution. The confusion in the field description of Maxwell and the absolute space and time description of Newton was intuitively investigated by Einstein. Single-handedly he developed the special theory of relativity in 1905. However, it was Poincaré who suggested that a space and time description of the universe has to be fused into spacetime and Minkowski incorporated the Riemann curved space into relativity enabling Einstein to generalise the theory of relativity. Thus the matter, space-time continuum became the new paradigm in describing the universe as a holistic cosmic singularity.

The conceptual drizzling in the area of thermodynamics became a hurricane and shattered the dear concepts reigning physics though in 1912 Lord Kelvin declared that there were only a few clouds in science and most of the things were known and other unknown quantities could be known through the careful application of the Newtonian physical laws. However, the quantum concept introduced by Max Planck on 14th December in Berlin exposed a discontinuous, indeterministic, probabilistic and uncertain nature. In grappling with the problem of Black Body Radiation Max Planck never intended that his study would revolutionize our perception about the universe. However, Einstein boldly claimed the break with the classical ways of description and a group of intellectuals under the able guidance of Niels Bohr, Werner Heisenberg, Wolfgang Pauli, Erwin Schrödinger, Victor De Broglie, Max Born, John von Neumann and others developed quantum mechanics, interpreting nature as indeterministic and quantum mechanics as a closure. Eminent scientists like Einstein, Schrödinger, and Planck could not digest this claim of completion and thus the quantum schism began. This schism and debate is not yet over and many scientists observed that what we really lack are physical concepts and by simply meddling with mathematics alone could not help us in solving the conceptual problems of physics today. At this confused context comes David Bohm who refined and resolved the quantum relativistic problem through the introduction of a quantum potential revising the quantum mechanics from an ontological perspective trying to avoid the fragmentary, mechanical paradigm and interpreting from a holistic perspective.

As the scientific rationality was making quantum leaps, the nature and human life suffered a setback. Scientism overpowered human life and philosophers like Nietzsche, Husserl and Heidegger, criticised the march of science and started questioning the rational foundations and the ability of science in guiding life and describing the universe. Nietzsche inaugurated the

onslaught on the basic foundations of the western culture by proclaiming the death of God. When Nietzsche cried aloud the death of God he intended that the inherited notions of God and the world view were not life promising and hence to be replaced by a human spirituality based on the will to power. Nietzsche was not criticising the Christian religion alone but even more savagously the foundations of western science itself. He observed that science had done what the religion had done in a much worse way. When religion said that God was eternal, science replaced it with the slogan that matter as eternal and thus both religion and science gave an impoverished image of man. Nietzsche charged that both science and religion utterly failed to recognize the power inherent in the human and called for a radical renewal and rediscovery of human nature. He was introducing a Socratic criticism to the whole endeavour of knowledge. Religion and science according to him, instead of anchoring man at the centre of the life world misplaced him with God and matter erroneously and had done irreparable damage to the destiny of man as chaotic and indeterministic. Thus the rational foundations based on Descartes and Kant were outrightly rejected by Nietzsche and this clarion call was taken up by Husserl and Heidegger.

Crisis in the Culture

“The crisis of European Sciences and Transcendental Phenomenology” was the last great work published by Husserl where he delved deep into the general lament about the crisis in European culture and discovered that the root cause of the crisis was due to the Cartesian self doubt and scepticism of the philosophico-historical origins of the culture. Thus Husserl attempted to give a solid foundation beyond doubts that might become the corner stone for all disciplines which he called as phenomenology. Thus he set out to arrive at the essence of things at the realm of pure consciousness through a method consists in epoche- a series of reductions, namely phenomenological, eidetic and transcendental reductions. Heidegger turned the Husserlian bracketing methodology from the content of investigation into the how of investigation and arriving at the thing in itself or the disclosure of the being. The glorification of the reason inaugurated by the modern philosophers reaching to its zenith as scientific rationality is thus thrown away to the dust bin of history by Heidegger. He accused science of squeezing the essential characters of humanness and turning it into a need based product that could be fabricated. Thus he condemned science and technology with a tendency of calculation, machination and compositing and imposing its coercive forces on being undermining it as annihilable and coercible.

These onslaughts against reason, against method and on the atomistic, sceptical foundations of Western culture and its offshoot science, exposing its vulnerabilities opening up the flood gates of counter cultures known differently as hippy, new age movements doubting everything and living in the randomness of the momentary searching for holistic alternatives. At this historic moment comes the physicist turned philosopher David Bohm, the palaeontologist philosopher turned theologian, Teilhard de Chardin, the revolutionary activist, spiritualist

Aurobindo, in the tradition of Aristotle, with their holistic vision of reality derived from quantum mechanics, evolutionary theory and Indian philosophy, applied their new creative insights systematically to the totality of reality in its cosmic dimensions as an anti dote for some of the problems of today, as the concept of holism is lost in the further development of humanity. The Aristotelian causal system is reduced into an instrumentalist dynamics by the development of science, paving the way for secularism, objectification, fragmentation and pragmatism rejecting the spiritual, the divine and the truth which was inextricably intertwined with the life of man. It is to be said that all the visionary leaders based their thoughts on a spiritual experience and developed these thoughts considering the spiritual dimension of humanity. However, gradually due to the onslaught of the atomistic science and its discoveries the spiritual dimension was totally denied and hence the transcendental dimension of humanity is eliminated degrading it in to a mere level of matter. In this atmosphere, the spiritual, philosophical visionaries came up with the new vision of an integration of science and spiritually deeply rooted in a transcendental reality.

Return to Holism

David Bohm as a physicist became aware about the nature of holism when he was doing research on a solenoid which was shielded yet could deflect a stream of particles even though such an effect could not be allowed classically. This phenomenon is known as Aharonov-Bohm effect. Later this interconnectivity which could be physically observable led him to develop an ontological interpretation of quantum mechanics which has the characteristic trade mark of non-locality. From this extraordinary experience in quantum physics, he moved to the philosophy of it and developed a deeper notion of the holomovement, explicate and implicate orders. As the Hegelian ground of everything, and described that the whole can be comprehended in terms of the explicating reality and everything that which is enfolding is once again merging into the implicate reality. Thus the holomovement, explicate and implicate orders, according to Bohm, inextricably intertwine the totality of the reality. For him, order and disorder are the two extreme ends of the chain of the reality. In order to explain his philosophy of holism, Bohm proposed a few analogies or metaphors.

Three Analogies for Holism – Implicate Explicate Orders

To illustrate the new order of undivided wholeness, Bohm offers the analogies of the hologram, the implicate dye drop and the higher dimensional fish tank. Analogies can only partially convey the meaning of wholeness. However, they provide an intuitive and imaginative picture of the implicate order. The hologram illustrates the wholeness aspect, the implicate dye drop elucidates the implicate - explicate relationship and an analogical picture of the structure of reality. Infinite dimensionality and the interconnectedness among these dimensions are depicted by the analogy of the higher-dimensional fish tank.

The Hologram

A hologram is a kind of photograph made by passing a laser beam through a half silvered mirror. Some of the beams are reflected by the mirror onto the object being photographed and then reflected back to a photographic plate. The rest of the laser goes directly through the mirror onto the photographic plate. When the two beams unite at the plate they interfere with each other to produce a pattern. The resulting interference pattern recorded on the plate is very complex and invisible to the naked eye. When the photographic plate is illuminated with a laser beam, an image of the original object in three dimensions is obtained from a range of possible points of view. Even though only a portion is illuminated the whole structure is visible. Any piece of the hologram can reconstruct the entire image. Bohm explains the technical aspects of hologram from the perspective of CM. So he says that matter is also made up of waves. Therefore matter itself is composed of interference patterns which interfere with the patterns of energy. What emerges is a pattern of matter and energy spreading ceaselessly throughout the universe, each region of space containing the whole. The hologram offers an unbroken holistic image of the universe.¹ According to Bohm the hologram is a starting point for a new description of reality: the enfolded order.² The hologram is merely an image of the state of the electromagnetic field and it is a state of movement. It is an example of the holomovement. Any movement, whether it be electromagnetic, sound or any other form, could constitute a hologram. The undefined totality of movement called holomovement is the ground of all manifestation.³

The undivided wholeness of modes of observation, instrumentation, and theoretical understanding indicated in the implicate order is illustrated by the hologram.⁴ In a photograph there is a one to one correspondence. That means a point in the object corresponds to a point in the image.⁵ But a point in a hologram confines all the points in an object. Each small part of the hologram contains information from the entire original image and therefore can produce the whole image from the part. An undivided wholeness is indicated here. The essence of the holographic concept is that images of the experiential objects are reconstituted when representations of sense experience in the form of distributed information systems are appropriately engaged.

The Implicate Dye Drop

This analogy of the dye drops illustrates the enfolding and unfolding nature of the implicate - explicate order. The structure of reality as multi-layered is elucidated through this analogy. A drop of dye is placed in a viscous liquid such as glycerine which is encased between two glass cylinders, one inside the other. The outer cylinder is rotated slowly. As this is done, the dye drop threads out into the liquid. After a number of turns of the cylinder, the dye appears to have totally disappeared. In conventional terms the distribution of the dye is said to be random, with the initially ordered state passing into a higher order, as we explained in the section, order. If the cylinder is rotated backwards the same number of turns it was rotated forwards, the dye reconstitutes itself. The apparently random state is not one of disorder but of a hidden or implicit order. Bohm says that "this is the order that pervades the universe."⁶ When it evolves into a form that can be seen (like the

dye drop), it becomes explicate. Now imagine two drops inserted in different places in the glycerine and wind them in. In this the second drop is enfolded in the first one.

Suppose that a droplet of dye is added and is stirred n times. Another droplet is added and stirred n times again. Repeat this experiment with a long series of droplets, arranged in a straight line. After enfolding a large number of droplets, turn the stirring device so rapidly backwards that the individual droplets are perceived one by one. When the dye drops are dissolved into the viscous medium, it appears that they are distributed in a disorderly manner. But the stirring backwards shows that the droplets were dissolved in an orderly form or were implicated in the medium. The dissolution and the resolution of the n number of dye drops elucidate the infinite orders of explicate forms in the implicate order. The enfolding of orders in the holomovement and the unfolding of the explicate order are imaginatively presented through the analogy. In this example certain implicate orders become explicate, while explicate orders become implicate.

The Higher-Dimensional Fish Tank

In the fish tank analogy, the autonomy and the interdependence of the explicate orders with the holomovement are elucidated along with its multi-dimensionality. So far the implicate order was presented as a process of enfoldment and unfoldment, that is taking place in the ordinary three dimensional space.⁷ Projections of a higher-dimension can be illustrated by the fish tank. The experimental arrangement consists of a rectangular tank with transparent walls in which water is filled up to the brim. A living fish is moving in it and two television cameras are focused on the walls at right angles to each other. The corresponding television images are screened on the two televisions placed there. The images appearing on the screen are different; nonetheless there is a correspondence between them. At any given moment each image will generally look different from the other. The difference will be related, in the sense that when one image is seen executing certain movements, the other will also be executing corresponding movements. The contents on one screen will pass over to the other and vice versa. Thus always the image content on the other screen will correlate that of the other.

The two images do not refer to independent actualities but to a single actuality, which is the common ground of both. The images here on the screen are the two dimensional projections of a three dimensional reality. The movements of the fish are correlated in the two dimensional screens. There is an internal relationship between these two projections. Though each screen projection can be observed as autonomous motions, the inherent relationship between them is also observable. Analogically, each explicate order is autonomous, yet corresponds to the movement of the totality.⁸ The fish tank analogy depicts the relative autonomy and the interdependence of the explicate order with the holomovement in two dimensions. In the totality, the explicate orders are multidimensional projections of the holomovement.

Cosmology and the Implicate Order

So far Bohm was considering the general structure of matter and how it is related to the implicate order. Now let us examine the origin of the universe and see how it can be incorporated into the implicate order.

When the total energy in one cubic centimetre of a vacuum space with the shortest possible wavelength is calculated it turns out to be far beyond the total energy of all the matter in the known universe.⁹ What is meant by the empty space is that it is an energy source and that matter is only a wave-like excitation on top of this energy plenum, like a tiny ripple on the vast sea.¹⁰ The Vacuum “is where everything moves freely. It is the absence of everything . . . because `things are made up of matter.’”¹¹ This vast sea of energy plays a key role in the understanding of the cosmos as a whole and that this space is full rather than empty. It is important to understand this as the absence of “things” or matter. The physical laws that correlate between parts of matter cannot be employed to relate a vacuum and matter because they are of a different constitution.¹² According to Bohm, matter is enfolded in vacuum; space and time are also implicit in vacuum.¹³ Vacuum is the undivided wholeness, everything is ultimately connected there.¹⁴ What is perceived through the senses as empty is actually full which is the ground for the existence of everything. The things that appear to the senses are derivative forms and their true meaning arises only when considered about the plenum. Bohm affirms that:

this plenum is, . . . the holomovement, the immense sea of energy..... This sea [of energy] is to be understood in terms of a multidimensional implicate order, . . . while the entire universe of matter as we generally observe it is to be treated as a comparatively small pattern of excitation. This excitation pattern is relatively autonomous and gives rise to approximately recurrent, stable and separable projections into a three dimensional explicate order of manifestation, which is more or less equivalent to that of space as we commonly experience it.¹⁵

Big Bang & Holomovement

The big bang theory concerning the origin of the universe is also incorporated into the implicate theory. Some fifteen billions' years ago, space had a point structure and there was no time in this point, before the big bang. According to the metaphysics of Bohm, the big bang was only a matter pulse in the immense energy of ocean and the present universe evolved from this matter pulse.¹⁶ We are an inextricable part of the universe and hence we experienced the ripple as a big bang.¹⁷

So far we have been examining the tenets of the Bohmian holism concerning matter. In Bohmian terminology, holomovement is the totality of material reality. All the explicate orders or forms are evolving from this totality. Bohm equated empty space with holomovement because it is the energy plenum, source of all matter. According to him matter is only an island in this vast ocean of energy. As a next step in encompassing all reality, Bohm proposes that life is an explicate order in the holomovement. Let us explore this hypothesis.

The Implicate Order and Life

In his attempt to construct an all comprehensive metaphysics of reality, Bohm extends the implicate order to life. An analogy is used to propose the connection between life and the implicate order.¹⁸ Consider a seed. It is planted in the earth and it grows. The seed contains genetic information and the material substance of the plant is drawn from the environment guided by this information. The germ in the seed guides this energy transformation from air, water, soil, sunlight etc., to the material of the living plant. The information contained in the seed directs the material environment to become animate in the plant.

Bohm's argument is that the process of growth of a plant is a continual transformation of the material substance into a living substance. He interprets it as a process of enfolding and unfolding, a recurrent stable order.¹⁹ Then Bohm raises the question of how one can distinguish between life and matter in this transformation. "As the plant is formed, maintained and dissolved by the exchange of matter and energy with its environment, at which point can we say that there is a sharp distinction between what is alive and what is not?"²⁰ According to him there is no sharp point that separate between matter and life. Life is latent in the matter. He concludes these observances by saying that life belongs to a totality, including the spheres of plants and the environment.²¹ When life is not manifested it is implicit in some way in matter.²² He is of the opinion that it doesn't mean the reduction of life into matter.²³ Life and matter are explicate orders, part of the totality and hence inextricably interwoven through their participation in the holomovement. Life and matter are reduced to the holomovement; but not to each other. A specific explicate order where matter is evidently transforming into life cannot be pointed out.

Thus as shown earlier, the holomovement is the ground - life-implicit - of both animate and inanimate matter.²⁴ Matter and life are united through the holomovement without a reduction of one to the other, but reduced to the ultimate totality. These two forms of the explicate orders are relatively autonomous sub-totalities held together by the law of holonomy.²⁵

It is to be commented that Bohm has not developed a detailed analysis on the interrelationship between life and matter and the threshold between matter and life is left without any serious discussion. A passing remark and the analogy of the seed explain the interaction between life and matter. However, the interphase between mind and matter is discussed in detail. So we have to say that Bohm have not given sufficient explanation on how life and matter have the holomovement as the ultimate ground of their existence.

Mind and the Implicate Order

As I have already stated, mind has also an implicate dynamics. Bohm arrived at this idea through mathematics. He showed already that matter has an implicate processes. From the suggestions of the great algebraists Bohm developed a theory of mind. The Hegelian influence is also possible to detect. In a nutshell, mental thoughts undergoes the same implicate process of dialectic. The play of the opposites and the raise to a complete suspension of these two by sublimation to a higher level which encompasses the two but not as the same. Thought or the mental

processes are physical processes. Information and meaning are constituents of these processes. It involves memory also. The complex correspondence between thought and its object is to be understood in the wider context of the whole processes, i.e., the implicate order. As usual Bohm uses the analogy of a honey bee in this connection. Through its dance it conveys a message, an indication of an object that is to be found in the depth of the process through the implicate order. Karl Pribram's holographic description of the neural activities gave Bohm an added support in his endeavour. Hiley pursues the unification of matter and mind through the implicate order. Listening and vision elucidates the implicate dynamics of mind. Bohm deviates from the usual description of matter-mind as psycho-somatic. He proposes this relationship as soma-significance. Energy is the connecting factor between these two processes. Thus Bohm derives the implicate dynamics of mind and declares that the age-old problem of matter-mind is solved through his implicate dynamics. Still there are unclear details to be fixed but a robust frame work for holism is established by Bohm. However, according to Bohm, there is an ultimate reality from which everything emerged and into which everything will submerge which he called as the holomovement, and the observable realities of matter, life and mind are explicating from it and thus proposes an ultimate super consciousness or movement as the underpinning reality. The other counterparts of Bohm in this attempt is Chardin, a Christian thinker and Aurobindo a Hindu mystic.

Omegalization of Chardin

Teilhard de Chardin was Jesuit palaeontologist who integrated the theory of evolution with the Christian faith. He proposed that in the beginning there was a swarming of particles and the physical universe, the earth and its environment conducive to life was developed. Then the life evolved and from there the mind. According to him, even in matter life and mind is latent and it is guided by a divine providence. The radial energy and the tangential energy guided the evolution and thus as the complexity increased, consciousness also increased and the evolution is irreversible. Thus, there are critical thresholds like biogenesis, nousgenesis and ultimately everything leads to single super consciousness which he called as Omega. Thus according to Chardin, the totality of the world, evolved from a single point and enfolds in myriads ways and then merges into the Omega, describing a holistic account of the totality of the universe.

Involution and Evolution

The political activist and revolutionary Aurobindo became a philosopher and mystic thinking about the future of humanity. According to him, there is a two way process, humanity evolving to higher complexities while the divine is involuting into the humanity from above. This evolution and involution are the two way process that guides the progress of humanity through a disciplined life towards a super consciousness.

Holism: prospects for Future

The development of science and technology was due to the belief of a pattern and regularity inscribed into the nature by the divine. Thus, the practice of science and technology was initially an understanding about the divine and in the service of the divine and hence a sacred activity. Gradually, a reductionist tendency crept into the scientific endeavour and the sacred element was eliminated almost rejecting the place of the divine and trying to explain the sacred in terms of residue and erasing it from the human sphere of activities as a mere mythological factor. Science and technology has a great role to play in the secularization of the culture and the society in the twentieth and the twenty first century. When Laplace was asked by Napoleon that in his book *Le Celestial Mechanique* there was no mention of God, it was said that Laplace retorted back saying that I did not need that hypothesis to explain the mechanics of the universe. Also in the twentieth century when Youri Gagarin, the first astronaut went around the outer space, he claimed that I searched for God and I could not find. The description of Dawkins, the Nobel Prize winner in genetics, God as delusion is also an index of the reverberating influence of the rejection of God, sacred and the spiritual by the science and technology. Also from the chaos and complexity, there is a tendency to explain the elements like unity, spirituality in terms of emergent behaviours. Perhaps because of these tendencies, humanity is facing a crisis, a crisis in terms of truth leading to a crisis in faith ultimately paving for an all out crisis in the culture leading to meaninglessness and hopelessness. Thus it is very important to look for the holistic account of humanity, in terms of something beyond it, a transcendent reality, that can only give meaning and hope to it in times of tribulations and misery.

Also the science and technology is making quantum leaps and trying to explain the realms of matter in terms of the ultimate particles like the quarks, the four forces which could be reduced into a single force explaining the symmetry of the universe; life in terms of the DNA, genes, codons, chemicals and understanding the coding of the ultimate language of life so that science could encode it; the description of mental life in terms of neurons and its parallel processing and the deeper chaotic dynamics; in short, the information technology, biotechnology, nano technology and the neurotechnology claiming that they could explain, matter, life and mind in terms of its constituent parts and filling up the gaps between them. However, then science and technology will be making the false claim of understanding everything in terms of its constituent observable parts, in a mechanistic reductionist explanation which could not adequately describe the richness of matter, life and mind. Moreover, science and technology is merely a life facilitating mechanism and it need to be complimented by a meaning giving mechanism. Otherwise, there is the possibility of the inordinate developments of scientific tools like cloning, for destructive purposes ultimately leading humanity to serious further crisis like the ecological disaster, turning technology into a horror than a means to provide hope. It is also essential that the inclusion of the transcendent reality as the ultimate beginning and end of the cosmic processes, endorsing the role of the divine and the response towards it as faith and a belief in the spirituality and sacredness of the Supreme Consciousness can only guide the progress of humanity. A progress rejecting the transcendent reality and the elements of sacredness and spiritual outlook can only lead us to hopelessness, meaninglessness, fragmentation, isolation and crisis. Thus, science and technology, by showing its

own limits, need to have its own other, the sacred to compliment it and lead it to the realization of fullness in an absolute sacred reality. Craig Dilworth who critically reviewed the dominant present world views and observed that: “if we consider the dominant secular and materialistic worldview of the present, clearly it has been conditioned by the physicalist metaphysics of modern science.”²⁶ Then he asks: “Could a new metaphysics succeed in laying the foundation for a new world view; and if so what would be the fundamental characteristics of such metaphysics?” Dilworth concludes with the following observation.

One aspect that there seems general agreement regarding, among those who have given consideration to the matter, is that the new metaphysics, like the biologically oriented, would have to give a central place to the notion of the whole, while at the same time recognising the success of atomism in its concentration on the importance of the part.

As Dilworth has correctly discerned the future will be for a vision which is biological in nature and which will give priority for holism incorporating the success of atomism. In short, as we have almost completed quarter of the Twenty first century, the vision of holism provides a new way to think about reality, awakening a fresh research outlook on its structures and a new methodology for sustainable progress.

This article is a summation of the themes articulated in the book, Mathew Chandrankunnel, *Philosophy of Quantum Mechanics: Quantum Holism to Cosmic Holism, the physics and philosophy of David Bohm*, Global Vision Publications, New Delhi, 2008.

¹ F. D. PEAT. *Infinite Potential: The Life and Times of David Bohm*. Addison-Wesely. Reading-Massachusetts. 1997. p. 119. I have discussed and clarified the issues discussed in the book of Peat with Sarah Bohm and Prof. Basil Hiley. Hereafter the book is referred to as Peat(1984).

² K. Wilber. *The Holographic Paradigm and Other Paradoxes: Exploring the Leading Edge of Science*. Shambala. Colorado. 1982. p. 6.

³ Wilber(1982). p. 51.

⁴ David Bohm, *Wholeness and the Implicate Order*, Routledge and Kegan Paul, London, 1980. pp. 143-147. Hereafter referred to as Bohm, 1980.

⁵ A photographic film records the light intensities reflected from the objects within the camera field. Each part stores information which arrives from a corresponding point in the visual field, and thus the film's record "looks like" the visual field.

⁶ Peat(1984). p. 121.

⁷ Bohm(1980). p. 186-189. *Looking Glass*. p. 130-133.

⁸ Bohm(1980). p. 188-189.

⁹ Bohm(1980). p. 191.

¹⁰ Bohm(1980). p. 191.

¹¹ Bohm, (1978). p. 101.

¹² Bohm(1978). p. 101.

¹³ Bohm(1978). p. 101.

¹⁴ Bohm(1978). p. 101.

¹⁵ Bohm(1978). p. 192.

¹⁶ Bohm(1980). p. 192.

¹⁷ Bohm(1980). p. 192.

¹⁸ This analogy is described in Bohm(1980). p. 192.

¹⁹ Bohm(1980). p. 192.

²⁰ Bohm(1980). p. 192.

²¹ Bohm(1980). p. 192.

²² Bohm(1980). p. 192.

²³ Bohm(1980), pp. 192-193.

²⁴ Bohm(1980), p. 193.

²⁵ Bohm(1980), p. 196.

²⁶ C. Dilworth. The Metaphysics of Science. Kluwer. Dordrecht. 1996. This and the following citations are from pp. 207-208.

Key words: philosophy of holism, science, technology, quantum mechanics, transcendent reality

Ключевые слова: философия холизма, наука, технология, квантовая механика, трансцендентная реальность