

THE GOD PARTICLE AS ‘KNOWING THE MIND OF GOD’: Moving from a Quantum Singularity towards a Cosmic Singularity

Mathew Chandrankunnel♦

1. Introduction

An unprecedented and an overwhelming enthusiasm were indeed exhibited by the print and electronic media on the discovery of the God particle. Media, both in India and abroad celebrated the event with attractive headlines and discussions with experts and thus fired even the imagination of the common people. Therefore, it would be worth to ponder over the deeper meaning and significance of this discovery and its probable repercussions in our life and the relevance for religion, especially for a Christian life in terms of reason and faith.

According to the standard model, the God particle is the last particle to be discovered that explains the Big Bang with which this universe began. Standard model describes the structure of matter and the forces that bind them together. The evolution of the universe from the cosmic atom, or nothingness is unravelled stage by stage by science and now with the discovery of the God particle we have reached almost to the Big Bang. The discovery traces what happened in this universe just a Pico second (10^{-12}) after the Big Bang which today calculated as 13.7 billion years ago. This new discovery illustrates how any particle acquire mass by encountering the Higgs Field while others just pass through the field and do not have mass. Hence the Higgs field which is composed of Higgs bosons, just like water constituted of H_2O molecules, is all powerful and spread everywhere of that time frame. As Einstein dreamed of ‘knowing the mind of God,’ this discovery is a step towards understanding the big bang and the structure of matter in this universe. Therefore, this discovery has two aspects: the discovery of a particle that gives mass to all other particles and indirectly confirming once again the beginning of our universe from

♦ **Prof. Dr. Mathew Chandrankunnel CMI** is the Professor of Philosophy of Science at Dharmaram Vidya Kshetram, Bangalore, and Director of Science and Technology, Laity Commission, Syro-Malabar Church. He has published extensively and presented papers in national and international conferences on religion and science interface. He has done his doctoral studies at Catholic University Leuven and post-doctoral research at Harvard University. He received the CTNS-Templeton award for the integration of science and religion in 2000.

nothingness. In order to understand the relevance of the discovery of the God particle, the human search for understanding the structure of matter is to be described.

In his famous book, *The God Particle: If the Universe Is the Answer, What is the Question?* Leon M. Ledderman,¹ a Nobel Laureate physicist, wrote on Democritus who proposed that underlying the plurality of the universe there were atoms. He also wrote on the event of Babel in the Bible, where human beings in their desire to become God attempted to build a sky tower reaching up to the seat of God. However, seeing the desire of humankind God confounded them through creating several languages and developed misunderstanding which made them to forget their desire and spread all over the world. However, Ledderman says that through science as the common language and the Large Hadron Collider (LHC) as the instrument, benevolent God is allowing human beings to understand God's thoughts! The detection of the God particle is a milestone in the search for understanding the structure of matter initiated both in the East by Kanada Maharshi and in the West by Thales who were searching to find the ultimate stuff with which the whole universe is built up of! It also gives an answer to the question of how some particles get mass while some others do not have! However, the discovery of the Higgs boson is not at all an end but leads to further searches such as super symmetry. It looks like that this discovery is leading us into further mysteries and the search will become an asymptotic process, in understanding the universe!

Around 500 BCE, Thales and his associates known as Milesians, belonging to the region of Asia Minor, part of the present day Turkey, a group of migrant Greek thinkers sought an answer for the question of whether all these different things have an underpinning common element. This search for finding an underlying principle behind the multiplicity or plurality experienced by humanity ultimately led to the proposal of atoms by the atomists, a group of thinkers led by Democritus. In the second century CE, Kanada, a philosopher belonging to the Vaisheshika school of thought, proposed that all matter is composed of indestructible atoms. Thus, in the West and the East, this search for the ultimate structure of matter was of prime importance. However, in the West, the atomistic proposal was rejected by Aristotle, because atoms were moving in empty

¹Leon M. Lederman, *The God Particle: If the Universe Is the Answer, What Is the Question?* New York: Mariner Publications, 2006. The second chapter details the conversation between Lederman and Democritus.

space and in that case there would be infinite speed which was not possible according to him philosophically. Though the problem of the one and many led to a correct solution, out of philosophical concerns, it was rejected out rightly. The further developments on the understanding of the structure of matter came up only in the 18th century in the West by the proposal of Avagadro² while in the East the intuition of Kanada was never taken up seriously. The philosophical question asked by the thinkers were taken up seriously by the scientists in the twentieth century and God particle comes up as a mile stone in this long search for understanding the structure of matter. However, it is yet premature to say that it is a closed issue since there are other proposals claiming that even these particles are composed of other fundamental particles, leading us to an endless asymptotic search.

2. Search for the Structure of Matter

It was Ludwig Boltzmann who proposed the reality of atoms and molecules by the end of the 19th century. However, philosophers like Ernest Mach ridiculed him and he committed suicide due to depression in 1906. The structure of atom was later taken up by J. J. Thomson and Rutherford. J. J. Thomason proposed that atoms were like bun where the dry resins are like the electrons spread all over the outer surface of the atom. When under the instructions of Rutherford, Marsden did an experiment which revealed that there was a hard nucleus with positive charge and the electrons were revolving just like planets around the sun. Later research discovered that the protons and electrons together form the neutral particles called neutrons. Investigations found that protons are again composed for further elements called, mesons, pions, etc. By the end of 1950s there were more than 200 particles as constituent elements of proton, leading to square one, the problem of one and many.

Twentieth century also saw the development of the general theory of relativity and the quantum mechanics. General theory of relativity described the macroscopic universe and the ultrafast particles called photons having the maximum velocity. The equivalence principle proposed that a body falling under the force of gravity and a body moving with the velocity of light will experience time dilation, length contraction and its mass will reach infinity. Quantum Mechanics described the microscopic universe in terms of probability, uncertainty and

²Ronald F. Fox and Theodore P. Hill, “An Exact Value for ‘Avagadro’ Number,” *American Scientist* 95 (2007), 104-107.

complementarities with an underpinning philosophy of indeterminism. These two theories have problems in describing the universe with a coherent vision and it still remains an unsolved problem. However, the quantum field theory, integrating relativity and quantum mechanics, tried to understand the structure of matter in terms of constituent elements called quarks. Quarks were proposed by Murray Gellman in 1964. Quarks come in three pairs and, they are bound together by the four natural forces, namely, the gravitational force, the electromagnetic force, the strong and the weak force. The gravitational force binds massive bodies with very large distances while the electromagnetic force operates between the electron and the nucleus within a shorter distance. The strong and the weak force operate in the nucleus. The strong force binds together the mutually repelling protons while the weak force governs the radioactivity which is the expulsion of particles from nucleus decaying itself into an inferior element. The quantum field theory explains that these forces interact through particles. Thus electromagnetic force acts through photon, gravitational force through graviton, weak force through weak vector boson and strong force through the gluon.

3. Big Bang Theory of George Lemaître

Lemaître was one of the pioneers who applied Albert Einstein's theory of General Relativity to cosmology and proposed that the cosmos was confined to a tiny atom and an explosion expanded this universe when the space and time began. He was from Belgium, studied at the Universities of Leuven, Cambridge under the famous astronomer Eddington, and took doctorate from the Massachusetts Institute of Technology, United States. In a 1927 article that preceded Edwin Hubble's article by two years, Lemaître derived what came to be known as Hubble's law and proposed it as a generic phenomenon in relativistic cosmology. Lemaître also predicted the numerical value of the Hubble Constant.

Lemaître observed certain side effects for the De Sitter model which in the hindsight were very clear indication that any truly useful model of the cosmos in General Relativity had to be dynamic and static. Lemaître was wise enough to observe a certain phenomenon in the De Sitter model which the proponent himself was unaware of. De Sitter's solution showed that any particle introduced into his empty static Universe would appear to recede from any other particle and show some red-shift. This concept of red-shift later became widely accepted with Lemaître's theories and Hubble's observations. Lemaître also noticed that De Sitter made a

mistake by picking up a ‘preferred frame of reference’ for his argument. Where both Einstein and De Sitter actually assumed a homogenous and isotropic Universe, the latter made the mistake of assuming a lack of homogeneity in the space. This made him draw wrong conclusions according to Lemaître. Lemaître on the other hand showed how we can preserve this homogeneity and isotropy by changing the coordinates.

Another significant contribution of Lemaître is his viewpoint that the scale factor, or radius of the Universe need not be constant, as was the case in both Einstein’s and De Sitter’s original models. It was a momentous and crucial discovery as far as the concept of an expanding Universe was concerned. Radius and time are interrelated. So by keeping the radius factor irregular, Lemaître showed mathematically that radius is a time-increasing function and that the distance between all points in the space is constantly increasing. Lemaître also showed that if Einstein kept his Universe homogenous, it would no longer remain spherical instead an ever extending space. Thus the stable Universe of Einstein was written off for good. However, Lemaître chose to depict the De Sitter model as an incomplete replica of an expanding Universe which could predict even the concept of red-shift, without the proponent himself knowing about it. In the 1925 paper, Lemaître also gave an indication for a law which would be later called Hubble’s Law. Lemaître’s model involved an evolving Universe, with red-shifted nebulae illustrating space-time expansion and expanding with nebulae receding at radial velocities directly proportional to their distances.

Between 1925 and 1927 Lemaître worked on a paper which contained the details of a complete solution to Einstein’s equations that would fully model an expanding Universe. His theory was firmly footed on the previous two models but he accommodated into his equations data from the existing astronomical observations of red-shifted nebulae in order to establish the fact that the Universe has been expanding. Using Hubble’s estimates of time and with the help of Einstein and De Sitter models he even obtained precisely a radius for his own model of the Universe. His theory of the primeval atom from which the cosmos originated came only as his next interest. By extrapolating backward in time, Lemaître envisioned all the heavenly bodies squeezed into a super compact primordial matter which he called the ‘primeval atom’. Then all at once there was this moment of creation and the single atom suddenly decayed generating all the matter in the Universe. Here Lemaître made the speculation that the cosmic rays observable today might be the remnants of this initial decay.

Alexander Friedmann, a mathematician who solved Einstein's relativistic field equations, found that the universe began from a time zero giving mathematical foundations to the Big Bang theoretical pronouncements of Lemaître. Later Hubble discovered that the galaxies are moving away from each other as if there was a big explosion in the very beginning of time. Arno Penzias and Robert Wilson made an accidental discovery of Cosmic Microwave Background Radiation in 1964 proving the Big Bang cosmology and received Nobel Prize for this discovery. The Big Bang cosmology proposed by Lemaître, thus, explains the origin, evolution and the future of our immense cosmos from a cosmic singularity, a primeval atom.

4. Significance of the God Particle

The God particle sheds light on these two searches, the beginning of the universe and the structure of the universe. The God particle is said to be the last particle to be detected in the Standard model that explains the origin of matter in this universe. The standard model combines the structure of matter in terms of quarks and the force particles and the big bang of the universe. In the standard model there are some particles with mass and some particles like the photons without mass. How these particles achieve mass became a problem which was theoretically solved by Peter Higgs in 1964. He proposed that particles that interact with the Higgs field will attain mass while the particles which simply pass through them without interaction will not attain mass. Just after pico seconds (10^{-12}) after the Big Bang, the Higgs field was pervading in the universe and it is this field that gave mass to the particles. Otherwise there would not have been any atom, elements, humans or even universe itself. Hence this field is very important and the discovery of the particle sheds light into the origin of the universe and the development of the structure of matter. A field is composed of particles; just like water is composed of molecules of hydrogen and oxygen.

It is the Higgs field which produces Higgsboson, that gives mass to fundamental particles and hence it is christened as God particle by Leon Lederman, a Noble prize winner. He propagated the name by giving it as a title for a popular science book. The naming of the particle as God particle has also generated enthusiasm among the populace and it fired their imagination. However, the discovery of the Higgsboson does not mean that it is an end in search of the constituent elements of this universe. Now it is proposed that the quarks are made up of preons and rishons and this

search can go on endlessly. There is also the theory of super symmetry which proposes other particles. So the discovery of the Higgsboson is therefore not an end in itself; it is an asymptotic process. Let us now examine, the relevance of this discovery for faith and reason.

5. Towards a Convergence of Science and Theology

Pope John Paul II investigated the interrelationship between theology, philosophy and natural sciences while commenting Newton’s *Philosophiae Naturalis Principia Mathematica* in his introduction to the papers of Pontifical Academy of Sciences.³ Pope John Paul II observed the fragmentary nature of the world. He narrated the division between rich nations and poor nations; northern and western regions of the earth; the antagonism between races and religions that split countries into warring camps; even among academic communities separation between truth and values exists and the isolation of the academic cultures into scientific, humanistic and religious makes a common discourse “difficult if not at times impossible.”⁴ However, he is optimistic that

in large sectors of the human community a growing critical openness towards people of different competencies and viewpoints. More and more frequently, people are seeking intellectual coherence and collaboration, and are discovering values and experiences they have in common even within their diversities.⁵

“This openness,” according to the Pope, “is a notable feature of the scientific communities, based on common interests, common goals, and a common enterprise, along with a deep awareness that the insights and attainments of one are often important for the progress of the other.” The Pope envisions a nuanced interchange between science and religion with a dynamic openness among communities. In his address to the Pontifical Academy of Sciences in 1982, Pope John Paul II categorically stated that “there no longer exists the ancient opposition between true science and authentic faith” and he assured the scientific community that “the Church is your ally.”⁶

³Message of Pope John Paul II to George Coyne, Director of Vatican Observatory, 1 June 1988. Hereafter referred to as John Paul, 1988.

⁴John Paul, 1988.

⁵John Paul, 1988.

⁶Pope John Paul II, “Science Must Contribute to True Progress of Mankind,” *L’Osservatore Romano*, 4 October 1982.

In 1990 a group of well known scientists like Carl Sagan, Hans Bethe, Freeman Dyson, and Stephen Jay Gould issued an open letter to the religious community to encourage a spirit of common cause and joint action to save the earth. “As scientists many of us have profound experiences of awe and reverence before the universe. We understand that what is regarded as sacred is more likely to be treated with care and respect. Our planetary home should be so regarded.”⁷ In response to a letter by a group of religious leaders like Joseph Cardinal Bernardin, Archbishop Iakovos, Robert Schuller and Elie Weisel welcomed the letter as “unique moment and opportunity in relationship of science and religion.”⁸ As a result of these mutual and complementary initiatives, a major conference was conducted in 1992 with over 150 religious leaders and scientists coming together to make a joint appeal to save and protect the environment.⁹ Thus, by opening one to the other, common ground and important questions concerning both the fields can be discovered that are vital for the larger interests of the human community. This integration of disciplines and quest for a common ground are all the more evident in scientific disciplines presenting “our universe as a whole and of the incredibly rich variety of intricately related processes and structures which constitute its animate and inanimate components.”¹⁰ Pope John Paul II anticipates a better understanding of ourselves and the universe which could be translated into technology to facilitate life further. This knowledge can also be utilised, unfortunately, to destroy and diminish human life on global scale.

Pope John Paul II expressed the desire for dynamic integration by illustrating the physicists urge to unify the four forces into a grand unified theory.¹¹ The theory of Relativity proposes a physical continuum and genetics envisions a biological continuum. Thus, the scientific disciplines are increasingly unifying the cosmos and life through their explanatory

⁷“An Open Letter to the Religious Community,” January, 1990. It is available from the Science Office of the National Religious Partnership for the Environment, P.O. Box 9105, Cambridge, Massachusetts, USA.

⁸Quoted in Peter W. Bakken, John Gibb Engel, and J. Ronal, *Ecology, Justice, and Science and Christian Faith: A Critical Guide to the Literature*, Westport, Connecticut: Greenwood Press, 1995, 4.

⁹“Declaration of the Mission to Washington,” Joint Appeal by Religious Leaders as Scientists for the Environment, reprinted in Roger S. Gottlieb, ed., *This Sacred Earth: Religion, Nature and Environment*, New York: Routledge, 1996, 640-642.

¹⁰John Paul, 1988.

¹¹John Paul, 1988.

theories. The Aristotelian division of the terrestrial and the celestial was eliminated by Galileo paving the way for this cosmic integration. So, the Pope urges the scientists to continue the search for unity not only among scientific disciplines but integrating all forms of knowing processes. In this aspect he exhorts the scientists and the theologians or science and religion to work toward a unity for the better of humanity. As Pratt correctly observed, often the warpath between faith and reason or religion and science is due to our misinterpretation. “The book of nature and the word of God emanate from the same infallible author, and therefore cannot be at variance. But man is a fallible interpreter, and by mistaking one or both of these divine records, he forces them too often into unnatural conflict.”¹² Pope John Paul II in the same vein, invited theologians to assimilate in their theological parlance the discoveries of science as the ancient Israelites integrated the cosmology of their neighbouring cultures.¹³ A powerful clarion call is made by Pope John Paul II to both scientists and theologians in the following paragraph to interact and work together as a much needed ministry.

In this process of mutual learning, those members of the Church who are themselves either active scientists or, in some special cases, both scientists and theologians could serve as a key resource. They can also provide a much needed ministry to others struggling to integrate the worlds of science and religion in their own intellectual and spiritual lives, as well as to those who face difficult moral decisions in matters of technological research application... The matter is urgent. Contemporary developments in science challenge theology far more deeply than did the introduction of Aristotle into Western Europe in the thirteenth century.¹⁴

Pope John Paul II also inquires how science will benefit from this integration? He strongly points out that science develops best when its concepts and conclusions are integrated into the broader human culture. Therefore scientists cannot work in complete isolation from the issues discussed by the philosophers and theologians. So, according to Pope John Paul II, by contributing to such issues, the scientists can realize more fully their human potentialities.¹⁵ Hence the dynamic interaction between sciences, religion, humanities is an inevitable path for better human well

¹²J. H. Pratt, *Scripture and Science not at Variance*, London: Hatchards, 1972, 8.

¹³John Paul, 1988.

¹⁴John Paul, 1988.

¹⁵John Paul, 1988.

being. This close collaboration will definitely be beneficial to all disciplines because each can point out the limitations of the other and thus help in transcending limitations in their search for authenticity.

6. Science and Religion Reaching Out to a Trans-Cosmic Singularity!

The relevance of this discovery is with respect to the confirmation of the Big Bang model about the origin of the universe. Thus, both scientific experiment and faith experience comes to a convergence about the creation from nothingness. In Christianity from its very inception, a convergence of rationality and faith has been established through the vision of Paul, Justin, Clement of Alexandria, Augustine and other intellectuals who tried skilfully to interpret the Christian faith in terms of Greek rational philosophical categories. This positive outlook which has already been set is continued throughout the history. Nicholas of Cusa, Anselm, Aquinas, etc., in the Middle Ages, the Council of Trent, Luther, Calvin, Loyola in the beginning of modernity and Vatican Council II in the twentieth century pioneered a revitalization and reinterpretation of the faith in terms of the constituent trends of those consecutive periods. Let us examine how natural sciences were encountered by the theologians of the twentieth century, so that we can build on their contributions to develop a theology of science.

Karl Rahner, Wolfhart Pannenberg, and Jürgen Moltmann are among the theologians who took the natural and physical sciences seriously in their theologizing. Rahner gave an account of the role of Christ in the cosmos, the role of human beings in an evolving world including the meaning of monogenism, basing on the philosophy of Husserl. Pannenberg developed a systematic account of a dialogue between science and theology grounded on the Biblical creation narrative influenced by Hegelian concepts of freedom and the spirit. Moltmann combined truth and the yet to be achieved *eschaton*, in reaching out to science in an alliance for saving the planet from destruction, influenced by the left Hegelians and Bloch. Bernard Lonergan observed that the general agreement on the method of knowledge acquisition and processing helped the sciences to march on with rapid progress and proposed such a methodology in the theological sciences with his general empirical method as a solution.¹⁶ The general empirical method is indeed a new

¹⁶Bernard Lonergan, *Insight: A Study of Human Understanding, Collected Works of Lonergan*, vol. 3, Toronto: University of Toronto Press, 1957, 1997; *Method in Theology*, New York: Herder and Herder, 1972.

interpretation of the insights of Aquinas for the contemporary time known as critical realism, the truth seeking elements in both religion and science.

Polkinghorne, a mathematical physicist who worked under Nobel Prize winners like Abdus Salam, Paul M Dirac, became an Anglican priest and developed an interactive dialogue between science and theology.¹⁷ He also belonged to the school of critical realism and proposed that the mechanical clock like descriptions of the world initiated by Laplace to Dawkins is to be replaced by a cloud like descriptions containing a single reality where, matter, mind and soul are different aspects of the same underlying reality with higher levels of causation. He almost identified God with that of the quantum vacuum, explaining that from the perspective of an undergraduate, this would be the nearest analogy for God. Arthur Peacock, a biochemist turned Anglican priest was another theologian who has contributed to the development of a theology of science based on the process philosophy of Whitehead.¹⁸ He claimed himself as a panentheist, who considered that evolution is the disguised friend of Christianity and Jesus is the pinnacle of human evolution, an actualization of the evolutionary potentiality which can be considered as the consummation of God’s purposes. John F. Haught is a well respected Catholic theologian, who discussed the science-religion issues from a theological and rational perspective and even appeared as an expert witness in the United States Court of Justice during the intelligent design controversy involving the Dover School Board.¹⁹ He argues against the nihilistic, secularist and materialistic tendency derived from the sciences that God is a hypothesis and argues that God cannot be reduced into a series of propositions as held by Dawkins. Ian Barbour is a historian of

¹⁷Polkinghorne, *Traffic in Truth: Exchanges between Sciences and Theology*, Canterbury: Canterbury Press/Fortress, 2000; *Quantum Physics and Theology: An Unexpected Kinship*, London: SPCK 2007; *Exploring Reality: The Intertwining of Science and Religion*, London: SPCK 2005; *From Physicist to Priest: An Autobiography*, London: SPCK, 2007; *Theology in the Context of Science*, London: SPCK, 2008.

¹⁸Arthur Peacock, ed., *The Sciences and Theology in the Twentieth Century*, Notre Dame: Notre Dame Press, 1981.

¹⁹John F. Haught, *Science and Religion: In Search of Cosmic Purpose*, Georgetown: Georgetown University Press, 2001; *Deeper Than Darwin: The Prospect for Religion in the Age of Evolution*, Westview Press, 2003; *Is Nature Enough? Meaning and Truth in the Age of Science*, Cambridge: Cambridge University Press, 2006; *Making Sense of Evolution: Darwin, God and the Drama of Life*, London: Westminster/John Knox Press, 2010.

Science-Religion issues who demarcates that there are four possible encounters between them, namely, conflict, independence, dialogue and integration.²⁰

It was Teilhard de Chardin, as a palaeontologist and spiritualist who inspired the generations through his integrated vision of science, theology, philosophy and spirituality, who influenced Vatican Council II. His *Future of Man*, *Phenomenon of Man* and *the Divine Milieu* propose a holistic theological account of the origin of the universe from God and evolve in and through space and spearhead towards God. For him, the beginning is A, which he interpreted as God and evolves towards Ω , the resurrected Christ, guided by the principles of the complexity and consciousness, tangential and radial energy, through a process of cosmogenesis, biogenesis, noosgenesis, socialization, planetization and omegalization. Science has actually no definite goal for its realization, but Chardin is proposing a final end from his theology and spirituality. According to him, there is continuity and even in the matter, life is latent and in life mind is latent. So by an integrated vision of science and Christian theology, Chardin proposes a converging Omega point where the matter, life and mind fuse into a supreme consciousness.

Now scientific experiments are drawing closer to the initial moments of the Big Bang event, that happened 13.7 billion years ago while the religious experience pinpoints to a creation out of nothingness. The religious experience and the scientific experiments are converging towards the beginning of the universe. Science could not yet explain how the whole matter was confined into a tiny atom and it too explains the initial explosion as a mystery. Thus, as quantum relativistic cosmology points out, the universe began from a tiny atom, a quantum singularity as shown by the discovery of the God particle. It may also be pointed out that scientific experiments and religious experience can, thus the converge towards a goal as described by Chardin towards a trans Cosmic Singularity, a Super-consciousness, describing the evolution of the universe from a quantum singularity towards a cosmic singularity incorporating science and reason.

²⁰Ian Barbour, *Religion and Science: Historical and Contemporary Issues*, London: SCM Press, 1978