

# Religious interferences at the origin of cosmology? The case of Georges Lemaître<sup>1</sup>

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## Abstract

In this contribution we are aiming to study the influences Georges Lemaître's work underwent due to some religious and anti-religious ideas. It is well-known that during his career Lemaître faced criticisms coming from non believing scientists who reproached him wrongly to have developed his primeval atom cosmology for apologetic reasons. The essence of this (wrong, in the case of Lemaître) reproach is the fact that “good” scientific *contents* cannot be influenced or parasitized by metaphysical or religious ideas. Nevertheless, we will see that it happens to be that religious and theological ideas can play an important role inside the science discovery processes, not at the level of epistemic contents but as an extrinsic stimulation of the scientist's action or as an epistemological tool helping to clarify the use of some fundamental concepts or notions.

It is perfectly justified to avoid the confusion between science and religion. This can be motivated by the right aim to respect the specific autonomy of each level of knowledge and by the need to avoid any form of concordism. But eschewing all influences of religious or theological ideas in the understanding of scientific discovery contexts, can lead to loose some important historical and epistemological aspects of the real scientific practices.

The paper tries to extract, from examples coming out of the biography of Msgr Lemaître, some typical ways theological ideas are able to interact or to interfere with scientific practice and contents.

**Keywords:** Cosmology, Lemaître, Primeval Atom, Einstein, Steady State, Creation

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## 1 SCIENTIFIC INTUITIONS OF RELIGIOUS ORIGIN

An important moment in Georges Lemaître's life is certainly the First World War that began precisely after he got his Bachelor in engineering sciences in Louvain. He served immediately at the beginning of the War as a volunteer in Infantry and afterwards in Artillery. He was committed in important battles along the Yser river. During rest time, Lemaître dedicated time for prayer and for reading many books. He studied carefully books of Poincaré, for example, *Electricité et Optique*. Reading in details the latter Lemaître wondered if the essence of the matter is made of particles (electrons) or waves (electromagnetic waves). He was searching some unifying foundation of the universe stuff. But during the same periods, Lemaître meditated the book of Psalms and the book of Genesis. He tempted to build for himself an exegesis of the three first verses of the Book of Genesis. This lead to a little essay entitled "Les trois premières paroles de Dieu" ("The three first words of God") (Lemaître, 1996). In the essay, he tried to give a symbolic meaning to the Bible terms (water, light, ...) referring to scientific concepts. For example, the biblical light of the "fiat lux" constitutes for him the fundamental reality existing at the very beginning and giving rise progressively to the matter by a kind of condensation. The biblical text could thus here to be taken as a kind of a physical description. The young soldier Lemaître spoke about his essay to some of his close friends. One of them, Joris van Severen, with whom he discussed many times, said in his notebook, on 17 April 1917, after having heard about this essay (Lambert 2007, 48):

Lemaître will change all the Science...He will build a powerful and wonderful cosmogony

On furlough in Paris, Lemaître presented his essay to the famous French writer Léon Bloy. Lemaître was fascinated by Bloy's books in which he presented and defended the message of the Blessed Virgin of La Salette. Bloy convinced Lemaître to leave out his symbolic exegesis mixing scientific concepts and biblical content, an "essay of scientific interpretation of the first verses of the Hexameron" he said (Lemaître 1996, 109). During his life Lemaître followed Bloy's advice. But nevertheless we can detect two places where the intuitions of "The three words of God" come curiously at the surface of his purely scientific contributions.

The first place is at the end of his famous 1927 paper explaining what will be called afterwards as the Hubble Law (Lemaître 1927). In a paragraph which has nothing to do with the rest of the paper, he suggests that the cause of the expansion of the universe could be the "pressure of radiation" due to the accumulation of light rays turning around in a closed universe. Curiously we find something similar in the essay, where light rays are seen to turn around also in the created world. Helge Kragh has well noted the cryptic and strange nature of this paragraph referring to the cause of the universe's expansion (Kragh 2004, 130):

Lemaître argued that the expanding universe needed a cause for its increasing departure from the static Einstein world. At the time he could not say what this cause was, except that it might have been 'set up' by the radiation itself, as he somewhat cryptically expressed it. Yet the mere willingness to look for a cause for the expansion is remarkable, as it underlines the physical nature of his model.

The second place can be found in a paper (Lemaître 1930) which is very important in the genesis of the primeval atom hypothesis. This paper was influenced by Millikan's theory of Cosmic Rays. We know now that the famous American physicists did not accept the heat death predicted by the second law of thermodynamics. According to him this "death" could not be compatible with the Christian eschatology to which he was attached. With a collaborator, Harvey Cameron, they imagine a process that restore order in the universe in order to escape to the state of maximal entropy corresponding to the heat death (Kragh 2004, 90-92). It is interesting here to note that a religious belief motivates directly the construction of a new scientific theory. It is also worth notion that some time before, some scientists like Svante Arrhenius, Nobel laureate in 1903, who were materialists, imagine analog process in order to ensure an eternal stability of the universe's structure (Kragh 2008, 165-166). We have two opposite philosophical ideas leading to the same project in physics: to invent a "counterentropic" mech-

anism. Millikan and Cameron imagine that particles (protons and electrons) can be created from radiation being present in the universe, by a kind of condensation process. Spontaneously, these particles join together and the mass defect resulting of such a particle association is emitted under the form of radiations that Millikan and Cameron identify wrongly to the Cosmic Rays. The particle condensation process can go on, from radiation, without end avoiding the heat death. Lemaître, who got the opportunity to discuss with Millikan during his stay in the USA, was impressed by this hypothesis, but he only kept the idea that particles are created from a radiation background. In 1930, he took into account the expansion of the universe (which modifies the wavelength of any radiation) to conclude that (Lemaître 1930, 182; Lambert 2015, 144):

The possibility is now admissible that light was the primordial state of matter and that all matter condensed in stars was formed by the process proposed by Millikan.

It is interesting to note here that Lemaître alluded to this primordial “light”. Like in his essay of the war time, and in the conclusion of his 1927 paper, where he attributed as we have seen, the cause of the expansion of the universe to the “light” pressure, he is convinced here that the origin of matter in the universe is radiation, is light! At the beginning of the world, we have thus an amount of light. We can thus understand why, in 1931, Lemaître proposed considering the beginning of the universe from a unique primeval quantum that can be interpreted either as a wave (quantum of radiation) or as a particle (the famous *Primeval Atom*).

Probably the theme of light as the primordial stuff of the universe has played a role in Lemaître imagination. The biblical context is not used directly in Lemaître’s papers of course. But it is interesting to note that intuitions or images coming from his symbolic exegesis contribute to provide insights in a field he explored and where he did not know anything. Religious background plays the role here of a kind of intuition provider. Of course, when the theory was established, all these extra-scientific insights disappear with the context of discovery, leaving only the place to logical and empirical elements belonging to the justification context.

Science practice is not only built on pure rational and logical foundations. When entering in unknown areas scientists need to be helped by some guides, some regulating ideas... Imagination, esthetic considerations, philosophical assumptions and even religious (or sometimes anti-religious) prejudices can play some role providing such transitory guide.

But what is important to be said here is that such “philosophical” or “religious” input has not to be confused with what we could call the real metaphysical structure or content of science. Here for example, we cannot deny that some religious background (related to the meaning and the primordial role of “light”) is entangled, at the very beginning, with the process leading Lemaître to the idea of the primeval quantum. But we have to note two important things.

First, the event that provokes Lemaître’s 1931 paper (Lemaître 1931a) where he set out, for the first time, his idea of the primeval atom, was related to a reaction to a paper of Eddington who notified clearly his rejection of the idea of the beginning of the universe because he believed that such a beginning was a theological idea; in fact, he confused creation and *natural* beginning (Eddington 1931). Lemaître’s paper gives an argument to show that there exists a legitimate purely scientific notion of the “natural beginning” of the universe (corresponding to a state of minimal entropy). Therefore, we can say that if something “religious” is entangled in the process leading to the primeval quantum (“light was the primordial state of matter”), what provokes the famous 1931 Lemaître’s paper is motivated by a “secular” reaction to a misunderstood theological idea, namely the confusion, made by Eddington, between initial physical state and creation *ex nihilo*.

Secondly, we have to mention that what we have said does not mean that Lemaître wanted to deprive his hypothesis of any metaphysical or theological meaning. Not at all! But here he considered that this meaning was not immediately grasped, remaining at the level of mathematical and physical representations. He considered the theological content as valuable, but he also wanted to emphasize the fact that the deep theological meaning of God’s creation cannot be brought directly by physics. After having explained his purely scientific primeval atom hypothesis, in front of the participants of the Eleventh Solvay conference in 1958, he said clearly (Lemaître 1958a, 7):

It does not mean that cosmology has no meaning for philosophy

And, during the Council Vatican II time, responding to a question of Msgr Edouard Massaux, the future rector of the Catholic University of Louvain, concerning the origin of the primeval atom, Msgr Lemaître said (Lambert 2015, 150):

Of course, the primeval atom is created by God!

In order to understand the difference between “religious” motivations or background leading to new scientific ideas and deep theological

or metaphysical meaning of scientific contents (not confused or identified with these contents) we have to think for example to the Cantor theory of transfinite. It is true that Cantor had a religious motivation in proposing his study of the infinite sets (the “aleph” notion is a clue of that). But the real philosophical meaning or structure immanent to the theory of infinite sets has nothing to do with the initial Cantor’s motivation. There are deep philosophical issues that can be addressed from set theory and its rich and various axioms (for example: what is the ontological status of a set? What is the philosophical meaning of the axiom of choice, of the axiom saying that there exist infinite sets, and so on). But these legitimate and very interesting philosophical issues have nothing to do with Cantor’s will to find a mathematical approach to God’s attributes.

## 2 THE CONVICTION THAT THE ENIGMA HAS A SOLUTION

During all his life, Georges Lemaître was convinced that the universe can be understood by human intelligence. As early as in 1920-23, when he was at the Seminary, he expressed, in a manuscript entitled “La physique d’Einstein” the fact that universe is intelligible and perfectly adapted to our rational abilities (Lemaître 1996b, 226). For him, in fact, the universe is finite and has to be finite. This is perfectly in line with his thomistic training received at the Institute of philosophy of Louvain in 1919. On this point he is in opposition to Blaise Pascal. In 1958 he said explicitly (Lemaître 1958a, 7):

The view we have proposed [the primeval atom hypothesis] may be contrasted with that of Pascal in the *Pensées*. We may reverse Pascal’s wording and say that the Universe not being infinite neither in size nor in duration, has some proportion to mankind. Science has not to surrender in face of the Universe and when Pascal tries to infer the existence of God from the supposed infinitude of Nature, we may think that he is looking in the wrong direction. There is no natural limitation to the power of mind. The Universe does not make an exception it is not outside of its grip.

The conviction that universe has a structure that can be unveiled by human rationality is in fact rooted deeply in a religious belief. During a catholic congress in Malines in 1936, Canon Lemaître connected the task of unfolding the nature’s secrets with the discovery of some God intelligence’s reflex (Lemaître 1936, 65; translated from the French, de Felipe 2015):

[...]. It is man’s task to understand and value the creation that surrounds

him and to which he belongs, to perceive in it a reflection of the divine intelligence, by marveling at being surrounded by intelligible matter.

Lemaître was certainly convinced that his scientific task contributes to unveil something (a *vestigium*) of a divine *Logos*. Furthermore, it is God who gives to human beings to understand him through the empirical clues. At the end of a presentation of his cosmological ideas, the Belgian physicist said (Lemaître 1950, 55):

We cannot end this rapid review which we have made together of the most magnificent subject that the human mind may be tempted to explore without being proud of these splendid endeavors of Science in the conquest of the Earth, and also without expressing our gratitude to One Who has said: 'I am the Truth', One Who gave us the mind to understand Him and to recognize a glimpse of His glory in our universe which He has so wonderfully adjusted to the mental power with which He has endowed us.

According to Lemaître, science is the same for a believer and a non-believer. Nevertheless, the work of the believing scientist is strongly supported by the fact that inside his faith he knows that the enigma of the universe has a solution: the universe is comprehensible because he is created by an Intelligence. This gives a goal that maintain an optimism that is a necessary condition to continue the hard work of scientific activity. As he said (Lemaître 1936, 70; translated from the French, de Felipe 2015):

He [the Christian researcher] may even have an edge over his unbelieving colleague. Both strive to puzzle out nature's multiply interlocked palimpsest, on which the many traces of the various eras of our world's long history overlap and merge. But the believer knows that the puzzle can be solved, that it has an underlying logic finally worked out by an intelligent being, that the problem posed by nature was designed to be solved, and that its difficulty is, without doubt, in the reach of our human abilities, be it today or tomorrow. This knowledge might not provide him with new investigation resources, but it will help him support the healthy optimism without which his effort cannot long endure.

We see here, according to the testimony of Canon Lemaître, an important influence of religious belief on scientific action. Religious belief produces at the same time a psychological influence on the scientist (to know that there exists a deep intelligibility can strongly motivate the scientific enterprise) but also contributes to help him to express his fundamental assumption in the rationality of the universe and also in his unity.

### 3 INHIBITIONS COMING FROM ANTI-THEOLOGICAL PREJUDICES

Up to now we have shed some light on influences that religious beliefs can exert on scientific practices. Here we want to show that anti-religious beliefs or anti-theological opinions can have some consequences on the construction of scientific theories themselves. There are indeed real interferences between such convictions and beliefs and the scientific theoretical frameworks.

Georges Lemaître was the first physicist who gave the explanation of what we call now the Hubble Law ( $v = Hd$ ) saying that the speeds ( $v$ ) of the far galaxies are proportional to their distances ( $d$ ) up to a constant ( $H$ ) called now the Hubble constant. He explained that using a cosmological model, solution of Einstein equations of general relativity, representing an expanding universe. No religious or theological ideas motivated this explanation. Lemaître had become familiar to the solutions of Einstein equations in 1920-23 but above all during his stay in Cambridge, UK (1923-1924) and at the MIT (1924-1925). He got the intuition of an expanding universe working on the empty universe of de Sitter probably due to interactions with the astronomer Silberstein. He had gotten the opportunity to collect some important and up to date data concerning the speed and the distances of the galaxies during a journey through the USA where he visited the biggest observatories of his time. Using a particular expanding universe (corresponding to a spherical and massive universe undergoing an exponential expansion without beginning nor end) he explained the red shift of the galaxies (which measure their speeds) and computed the Hubble constant. The explanation proceeds here of a logical dynamics inner to physics and astronomy, without any religious interferences.

Lemaître published his paper on the galaxies redshifts in 1927. Immediately he had to suffer objections. The strongest one went from Einstein himself. He had read the paper which was given to him by a friend. Einstein met Lemaître during a Solvay conference in Brussels in October 1927. At the end of a conversation about Lemaître's expanding universe, Einstein (Lemaître 1958b, 129):

concluded by saying that, from the physics perspective, this seemed to him absolutely abominable.

What's the root of such strange reaction? It comes from the fact that the Einstein's implicit philosophy is inspired by Spinoza. According to the Dutch philosopher "God" (*Deus*) is identified with the "Substance", the "Na-



ture” (*Natura*): “*Deus sive Natura*”. Therefore, due to the immutability of God, we cannot accept any motion or evolution of the Nature itself. As Spinoza said in his famous book, *Ethics*,

the whole of Nature is one individual whose parts—that is, all bodies—vary in infinite ways without any change of the whole individual (*absque ulla totius individui mutatione*). (*Ethique* II, scolie of Lemma VII; English translation, Jonathan Bennett, <http://www.earlymoderntexts.com/assets/pdfs/spinoza1665.pdf>).

Einstein thus rejected the idea of an evolving universe, i.e. a world with a real history. This “theological” prejudice lead him also to criticize strongly the works of Alexander Friedmann who discovered independently of Lemaître the idea of expanding (and contracting) universes. During many years, Einstein’s philosophical or theological reaction inhibited the research of cosmological models able to explain for example Hubble law.

Let us remark that we could as well call Einstein reaction an “anti-theological” one, because his concept of God is in fact Nature as a whole (which has nothing to do with the idea of a personal God).

We have seen above that Eddington could not accept the idea of a *natural* beginning of the universe because it confused it with the one of creation. The reason of this is coming from the fact that Eddington, as a Quaker, did not tolerate any connection between religion and science (because, for him, religion is a purely spiritual area). He said strongly (Eddington 1931, 450): “the notion of a beginning of the present order of nature is repugnant for me”. He was thus ready to exclude cosmological models with initial singularity for this reason.

When Lemaître presented his primeval atom hypothesis to Einstein during their discussions in the USA at the beginning of the thirties, the German physicist made still strong objections. According to him as well as to Eddington, the initial singularity, the natural beginning of the universe cannot be nothing but a creation in the theological sense. What is interesting for us here is the fact that Einstein asked Lemaître to show that the initial singularity could be deleted introducing some small anisotropy in the model. Lemaître proved that the kind of anisotropies Einstein thought about were not sufficient to suppress the initial singularity (Lemaître 1958b, 129-130):

I met again with Einstein (...) in California, at the Athenaeum in Pasadena Speaking of his doubts concerning the inevitability, under certain conditions of the singularity (the zero value of the space radius), Einstein proposed a very simplified model of the universe for which I had no difficulty in calculating the energy tensor.

Einstein refused creation because of his Spinozist philosophy which excludes any for of creation in a theological sense. Then this prejudice leads him to favor models without natural beginning. Lemaître for his own part, is working without the inhibition of this prejudice. Then he is free to accept or to refuse models with initial singularity on the ground of scientific arguments only. For that question, Lemaître was not influenced by theological questions. Speaking about the initial singularity he said (Lemaître 1958a, 7):

It is an inaccessible ground of space-time. Such a picture finds a natural geometrical support in the point-singularity which arises in Friedmann's theory. The radius of space can start from zero. Such singular event which arises when space has a zero-volume is a bottom of space-time which terminates every line of space-time. I do not pretend that such a singularity is inescapable in Friedman's theory, but I simply point out it fits with the quantum outlook as a *natural beginning* of multiplicity and of space-time.

It is very interesting to contrast the dogmatic attitude of Einstein who refused a cosmological model on the ground of "anti-theological" prejudice with the open minded attitude of Canon Lemaître saying: "I do not pretend that such a singularity is inescapable". In fact, he accepted not to know the ultimate answer waiting for more information. He only showed that science could describe coherently and with its own means the notion of a natural beginning, without resorting to philosophical ideas or mainly without any religious interferences.

#### 4 STEADY STATE COSMOLOGY AND THE MISINTERPRETED *UN'ORA* ADDRESS

We want to give another example of influence of "anti-theological" ideas on scientific practice that played a major role in Lemaître's career. Between 1931 and 1965 there were no observations able to confirm the existence of a high density state of the universe in the past. The primeval atom hypothesis was thus rejected by a great number of physicists. Furthermore, amongst the latters, materialists rejected also this hypothesis because they believed that it implied the belief in God creator of the cosmos. Bondi, Hoyle and Gold developed at the end of the Forties the so-called *Steady State Cosmology* assuming the existence of an expanding universe without beginning and end, remaining eternally the same thanks to a continuous creation of matter. Curiously, to avoid a what they identify as a "creation" at the beginning of the world they postulated a permanent creation of matter assuming a highly hypothetical process. In fact, this process of continuous creation

was not supported by any observation or deduced from any serious theoretical framework. It is introduced only to serve the materialist vision of the eternity of the universe.

This Steady State cosmology and the materialist position of Hoyle was strongly criticized by the director of the Vatican Observatory, Giovanni Stein in a 1951 paper entitled “*Creazione senza creatore?*” The paper emphasizes the problems of introducing an unjustified matter creation process which looks like a kind of *deus ex machina* (Stein 1951, 351):

Così ad una sana critica, la creazione continua ci appare come un *deus ex machine* escogitato di sana pianta per trasformare il mondo da un stato transitorio ad uno stato di perpetuazione spontanea, senz’inizio e senza fine. Quando poi si rifletta che tutto ciò, come esplicitamente si afferma, dovrebbe avvenire con esclusione assoluta di un qualsiasi creatore poichè “è contrario allo spirito della ricerca scientifica di considerare degli effetti osservabili come provenienti da cause che la scienza non conosce”, quasi che fosse possibile un effetto senza causa, allora si può misurare in tutta la sua aberrante anomalia l’inconsistenza scientifica di un’ipotesi strombazzata con sì stravagante asseveranza.

On the contrary, his author brings to light Georges Lemaître’s prudence and modesty assessing in 1948 his own primeval atom hypothesis using Descartes’ words: “*Mundus est fabula*” (Lemaître 1948). Stein’s paper is very important because it certainly influenced Pius XII when he wrote the discourse *Un’Ora* he pronounced in front of the Pontifical Academy of Sciences on 22 November 1951. The director of the *Specola Vaticana* has frequent contact with the Pope who had great interest for astronomy and the pontifical address is very close Stein’s paper with respect to some points. This pontifical talk is very often misunderstood. Sometimes it is read as a defense of the primeval atom hypothesis with a concordist-like style. But, if there is indeed an implicit allusion to the beginning of the universe as described by the Belgian cosmologist, the latter is not explicitly quoted. In fact, in the context of the opposition to the “new theology” and of the work for a positive reception of the Encyclical *Humani Generis* (Desmazières 2015), the address wants to show that the proofs of God’s existence of St Thomas Aquinas can be revitalized founding new supports in the contemporary science. The *Un’Ora* address shows that physics (thermodynamics, nuclear physics, cosmology) can brought some data to defend the mutability of the universe and then to give a new foundation to initiate the thomistic proof of God existence based on the motion (the change). In this context, the *Steady State Cosmology*

(which denies the fundamental change in the cosmos) is explicitly dismissed as a gratuitous hypothesis (Pius XII 1951, 136).

The fatal destiny, which only hypotheses, sometimes far too gratuitous ones such as that of the continuous renewal of creation, forcibly try to deny, but which instead comes from positive experience, eloquently postulates the existence of a necessary Being.

The mutability of the universe finds indeed a support in the theory of the expanding universe and that's the reason why the Pope resorts, without quoting him, to Lemaître's hypothesis. Svante Arrhenius, we have spoken above, is also criticized in the address as well as his idea of an eternal universe. If we read carefully Pius XII's talk, we can see that there is no real concordism. Pius XII tries to use the up-to-date science to provide a new starting point to the thomistic "*viae*" without confusing the level of theology and the one specific to science. This was explicitly noted by a colleague of Msgr Lemaître, the well-known thomistic philosopher of Louvain, Fernand Van Steenberghen who was also together with him member of the sacerdotal Fraternity called "Les Amis de Jésus". In his book entitled "Dieu caché. Comment savons-nous que Dieu existe?", Van Steenberghen said referring to the address *Un'Ora* (Van Steenberghen 1960, 130-131):

Pie XII a été vivement frappé et manifestement ravi par les découvertes récentes de la physique et par l'orientation nouvelle qu'elles donnent aux théories cosmogoniques des savants. Loin de contredire les thèses de la philosophie traditionnelle ou les données de la révélation chrétienne, la physique révèle des *faits* qui renforcent les points de départ empiriques des preuves philosophiques de l'existence de Dieu [...] Cependant, on l'aura remarqué, chaque fois que son admiration pour les découvertes de la science risque de l'entraîner à des déclarations imprudentes, Pie XII s'arrête à temps et apporte les nuances et les réserves requises : à elles seules, dit-il, la science ne saurait prouver l'existence de Dieu ; c'est lorsqu'il pense en philosophe que le savant y parvient.

Georges Lemaître thought exactly the same thing. In a conference in 1963 entitled "Univers et Atome", he declares, concerning this papal address (Lambert 2007, 200):

Au sujet de l'attitude du souverain pontife, il est clair qu'elle se situe sur le terrain qui lui est propre et qu'elle n'a aucune relation avec les théories d'Eddington ou les miennes. Mon nom n'est d'ailleurs pas cité dans ce discours du pape.

But it is interesting to note that Pius XII, as well as the director of his *Specola*, Fr. Stein, denounced the irruption of a gratuitous hypothesis motivated in fact by a materialistic conviction, inside natural science which has to be based on positive data and well-established hypotheses. Religious starting point can thus be sometimes interesting, because it can serve to detect anti-religious idea, which try to modify ideologically some theoretical contents of science. Of course the same situation could exist with religious ideas trying to modify scientific framework for ideological reasons. But here it is worth noting that Pius XII was right criticizing the *Steady State Cosmology* which was left out after the discovery of the *Cosmological Microwave Background* (C.M.B.) by Penzias and Wilson in 1965!

## 5 THE EPISTEMOLOGICAL ROLE OF CHRISTIAN PHILOSOPHY AND THEOLOGY

Lemaître's primeval atom hypothesis is a way to describe a natural (physical) beginning of the universe. As we have seen above some physicists, and far from least important ones, confused this notion with a creation in a metaphysical or theological sense. Lemaître thanks to his serious thomistic training knew that creation is a metaphysical *relation* by which God gives the existence to the world *ex nihilo subjecti*. Creation is not a question of beginning. In a text edited long after Lemaître's death, but written in the end of the Thirties he said (Lemaître 1985, 47):

What happened before that? Before that we have to face the zero value of the radius (of the universe). We have discussed how far it had to be taken as strictly zero, and we have seen that it means a very trifling quantity, let us say few light-hours. We may speak of this as of a beginning; I do not say a creation. Physically it is a beginning in the sense that if something had happened before it, it has no observable influence on the behavior of our universe, as any feature of matter before this beginning has been completely lost by the extreme contraction at the theoretical zero. A pre-existence of the universe has a metaphysical character. Physically everything happens as if the theoretical zero was really a beginning. The question if it was really a beginning or rather a creation: something starting from nothing, is a philosophical question that cannot be settled by physical or astronomical considerations.

Thomistic philosophy gives him a tool to avoid an epistemological confusion and to feel free to explore cosmological models with initial singularity. According to Georges Lemaître's epistemology, natural beginning can

be entirely described by scientific methods and therefore it can be adopted by believers but also by materialists. After having presented his primeval atom hypothesis during the 1958 Solvay Conference, he continues saying (Lemaître 1958a, 7):

This is the philosophical background of the Primeval Atom hypothesis. As far as I can see, such a theory remains entirely outside any metaphysical or religious question. It leaves the materialist free to deny any transcendental Being. He may keep, for the bottom of space-time, the same attitude of mind he has been able to adopt for events occurring in non-singular places in space-time. For a believer, it removes any attempt to familiarity with God, as were Laplace's chiquenaude or Jeans' finger. It is consonant with the wording of Isaias speaking of the "Hidden God", hidden even in the beginning of creature. It does not mean that cosmology has no meaning for philosophy...

This attitude was already the one he expressed in this unpublished conclusion to his 1931 paper in *Nature*. The latter does not refer to any philosophical background. He leaves open the metaphysical questions that remained hidden (Georges Lemaître 1931b):

I think that every one who believes in a supreme being supporting every being and every acting believes also that God is essentially hidden and may be glad to see how present physics provides a veil hiding the creation.

What is important for our aim here is the fact that Christian philosophy can bring with it some very interesting conceptual tools that are not easily available in other ones. For example, in traditions where creation is not present or even rejected, it is not easy to find some fine nuances helping to distinguish between natural beginning, ontological beginning and creation. Christian philosophy was in a certain sense obliged to think about creation, origin, beginning, etc. During his career, Lemaître's training was very useful to defend the scientific autonomy of his cosmological approach and to protect his theological convictions against dangerous confusions between immanence and transcendence.

It is interesting to note that theology can imply some philosophical requirements that reveal themselves to be coherent with the interpretation of some scientific descriptions. For example, Christian theology of creation is not compatible with a world history that would be completely an *a priori* determined like the Spinoza Substance. It would be as well not coherent with an anthropology deprived of free-will. In Lemaître's cosmology, all the empirical world history is coming from the primeval atom, but contrary to

the Spinozist Substance (*Natura*), this history is not predetermined, the dis-integrations of the primeval atom, giving rise to space, time and matter, are completely unpredictable (Lemaître 1967, 161; our translation):

In Laplace's determinism, everything is written, evolution is similar to the implacable rotation of a recorded magnetic tape or the engraved spiral of a phonograph disc. Everything that would be heard would have been read from the tape or the disc. It is quite another story with the advent of modern physics and, according to the present theory these concepts should also apply to the universe, at least to the beginning of its evolution. This beginning is perfectly simple, indivisible, undifferentiated, "atomic" in the Greek sense of this world. The world differentiates as it evolves; it does not consist in the spinning out, the decoding of a recording. Rather it consists in a song, each note of which is new and unpredictable. The world made itself and made itself randomly.

Random processes are the trace of some contingency. Necessity and contingency are both present in Lemaître wonderful cosmogony. To sum up, we can say that thomisitic philosophy plays two major roles in the context of Lemaître's cosmological work. First, it serves to provide some *conceptual distinctions* that are not or few present in other traditions (where the concept of creation is absent or denied). Secondly, it gives some *requirements* that are not directly imposed to the physical description of the world but that happen to be coherent with it (random processes are *clues* for the existence of contingency). There is no direct confusion between science and theology because the first element helps precisely to avoid such confusion and the second can only be checked *a posteriori* showing (and not building or forcing!) a coherence between philosophical requirements of theological content and philosophical interpretations of scientific data or theories.

## 6 SCIENCE AND RELIGION: INTERACTIONS AND INTERFERENCES

Let us give now a summary of several influences of religious ideas on scientific activities and theories we have discovered in Msgr Lemaître's life. These influences can probably be found also in many biographies of important scientists even in a very recent past.

### 6.1 *Heuristic influence*

Some religious ideas can bring insights or intuitions in phases where scientists explore some unknown fields. In Lemaître's early career, the idea, coming from his symbolic exegesis, that "light is the fundamental ingredient to

build all the world matter” is an example of this. Note that it is only a way to go towards the discovery of new concepts when no other means are at the scientist’s disposal. This is not a very important influence (because these intuitions are forgotten very often after the conceptual discovery) when we try to understand, *a posteriori*, the logical and conceptual structure of scientific content. But nevertheless it has to be taken into account in order to understand the historical process by which science is built.

But we can consider another heuristic influence. The way used here to go to a scientific discovery or theoretical construction is not like a scaffold that is disassembled after the work is done. In fact, it is rather a sound means to orient or to accept a choice of a principle or of an axiom. When Georges Lemaître assumed *randomness* in the disintegration process of his primeval atom, refusing a totally predetermined mechanism, it is probably due to his training in quantum physics but also because the latter is coherent with a philosophy of nature consonant with his theology of creation.

## 6.2 *Psychological influence*

Religious background happens to be sometimes valuable to motivate the scientist in his daily work. We have seen that Lemaître considered that the believer has the advantage to know that the enigma addressed by the phenomena has a solution. And this can be a strong motivation to find it. Some kind of scientific optimism is then related to the religious belief.

But note that anti-religious motivations (the will to avoid the creation of the world by God) can also induce some strong psychological influence leading to develop some theory rather than another. Hermann Bondi, Fred Hoyle and Thomas Gold developed their *Steady State Cosmology* and Albert Einstein refused the expansion of the universe and the primeval atom hypothesis due to their opposition to Christian God’s existence or to the theological idea of creation. This influence is an important bias we have to take into account if we want to understand the theoretical choices made by cosmologist even today.

## 6.3 *Epistemological influence*

We have seen that anti-theological prejudices can interfere with scientific contents. Sometimes, it has been important to detect these prejudices and to reject them because they could lead to some inadequacy with the empirical data or to some inhibitions in building theoretical modellings. Philosophical background coming from theology can be useful to bring some fine con-



ceptual distinctions that scientists, having no contact with this background, cannot easily grasp. It is certain that the thomistic training of Georges Lemaître provided him the distinction between creation and beginning allowing him to justify the pure scientific legitimacy of a notion of natural beginning.

We have not to underestimate this fact because the influence of this philosophical distinction is what free Lemaître of any inhibition concerning the description of the physical beginning of the cosmos, and what have paved the way to what is now the Big bang cosmology. It would be very interesting to study, in the history of science past and recent, the role of philosophical tools coming from theological doctrines in the process of guiding scientific (theoretical or experimental) practices.

At the end of this contribution we discover something that is consonant with what Pope Francis said in his Encyclical Letter, *Lumen Fidei*, nr 34):

The gaze of science thus benefits from faith: faith encourages the scientist to remain constantly open to reality in all its inexhaustible richness. Faith awakens the critical sense by preventing research from being satisfied with its own formulae and helps it to realize that nature is always greater. By stimulating wonder before the profound mystery of creation, faith broadens the horizons of reason to shed greater light on the world which discloses itself to scientific investigation.

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## NOTES

1. A substantial part of this paper was already published in Dominique Lambert, „Wurde die Urknalltheorie aus Glauben geboren? Lemaîtres Uratom-Hypothese“ in *Die Vermessung der Welt und die Frage nach Gott. Theologie und Naturwissenschaft im dialog II* (Losch, A. & Vogelsang, F., eds.), Bonn, Evangelische Akademie im Rheinland, 2018, pp. 93-104.



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