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Error of Beginnings and the Beginning of Errors: Creation and the Origin of the Universe

Error de los principios y el principio de los errores: la creación y el origen del universo

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Abstract: Contemporary cosmological theories, from the singularity of the Big Bang, to quantum tunnelling from nothing, to various multiverse scenarios, have been the source of wide-ranging speculations about the creation of the universe. Some thinkers see the Big Bang as support for, if not confirmation of, the traditional doctrine of creation out-of-nothing. Others, who argue for an eternal series of big bangs, or view time itself as an emergent property in an already existing cosmos, or who think that science itself can account for the coming into existence of the world out of a primal nothing, conclude that cosmology now shows us that references to a creator are irrelevant. Such references are, in these views, artefacts from a less enlightened age. Most of the discussion about what cosmology tells us about creation suffers from a fundamental error about a necessary connection between the universe's being created and its having a temporal beginning. This is an error of beginnings, which is the beginning of many other errors. It was the genius of Thomas Aquinas (1224-1274) to point out this error and to offer a sophisticated discussion about the relationship

Resumen: Las teorías cosmológicas contemporáneas, desde la singularidad del Big Bang hasta el túnel cuántico desde la nada, pasando por diversos escenarios del multiverso, han sido fuente de amplias especulaciones sobre la creación del universo. Algunos pensadores ven el Big Bang como un apoyo, si no una confirmación, de la doctrina tradicional de la creación de la nada. Otros, que argumentan a favor de una serie eterna de Bigs Bangs, o que ven el tiempo mismo como una propiedad emergente en un cosmos ya existente, o quienes piensan que la ciencia misma puede dar cuenta del advenimiento del mundo a partir de una nada primordial, concluyen que la cosmología ahora nos muestra que las referencias a un creador son irrelevantes. En estas perspectivas, tales referencias son mecanismos de una época menos iluminada. Gran parte de la discusión sobre lo que la cosmología nos dice acerca de la creación sufre de un error fundamental acerca de una conexión necesaria entre el hecho de que el universo haya sido creado y el que tenga un comienzo temporal. Este es un error de los principios, el cual es el principio de muchos otros errores. Fue el genio de Tomás de Aquino (1224-1274) señalar este

among cosmology, philosophy, and theology concerning the ultimate origin of the universe. Thomas's analysis can help to resolve confusion in contemporary discussions about cosmology, the origin of the universe, and creation.

Keywords: Thomas Aquinas; *creatio ex nihilo*; Big Bang Cosmology; Multiverse

error y ofrecer una discusión sofisticada sobre la relación entre la cosmología, la filosofía y la teología con respecto al origen último del universo. El análisis de Tomás puede ayudar a resolver la confusión en las discusiones contemporáneas sobre la cosmología, el origen del universo y la creación.

Palabras clave: Tomás de Aquino, creatio ex nihilo, cosmología del Big Bang, multiverso

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Introduction

What is a beginning? It is a simple word, but difficult to define, in part because it admits of many applications. Beginning is a relative term –it always points to something beyond itself. Thus, to speak of a beginning necessarily includes a reference to some thing or things that follow from it. Looking back to a beginning already involves some recognition of what has come after, and there are as many beginnings as there are stories we tell about ourselves, our lives, our origins, and ultimately of the origin of all things –of the universe itself. Obviously, one thinks here of the opening words of the Bible: "In the beginning".

We are fascinated by beginnings, and no one more so than St. Augustine who, in his *Confessions*, offers a paradigmatic account of a search through time and memory to the very beginning of his life. The final books of the *Confessions* contain a systematic reflection on both time and memory, and then Augustine seeks to remember, as it were, the ultimate beginning of all existence by a careful reading and explication of the opening of Genesis. Augustine's search for beginnings is a search to find God as the origin and continuing presence in his own life and to find God as the Creator of the entire universe. Augustine locates his own beginning and the story of his life's unfolding in the broader context of the origin of all things.

When Aristotle writes about beginnings, he reminds us that a small mistake in the beginning often expands exponentially to produce error after error (*De Caelo* I). This admonition has a special relevance in discussions with respect to cosmological, philosophical, and theological claims about the beginning of the universe and especially the relationship between claims in cosmology and traditional understandings of the doctri-

ne of creation. An initial error about different senses of what it means to begin is the beginning of all sorts of errors about the relationship between the doctrine of creation and the discoveries of contemporary science. Such errors often lead to a further error: to think that advances in cosmology have eliminated the need for a Creator. This conclusion, that there is no Creator, has its beginning in a fundamental error about the various *beginnings* that the natural sciences, philosophy, and theology address.

What can cosmologists tell us about the creation of the universe? An answer to this question requires us to be clear about the explanatory domains of the natural sciences, philosophy, and theology. In such an enterprise, there is no better guide than Thomas Aquinas. Perhaps it seems strange to argue that what Thomas has to say about creation and science can speak directly to debates in our own day about the philosophical and theological implications of current cosmological speculations. Despite dangers of falling into anachronistic commentary or of failing to recognize profound differences in the ways in which terms such as science, creation, and time have come to be used in the centuries that separate us from Thomas Aquinas, when it comes to drawing philosophical and theological conclusions from contemporary cosmology, insights from the Middle Ages remain valuable.

Astronomers often note that to look out at the heavens is to look back in time. Perhaps to look back in time to mediaeval discussions of creation and science will help us to look out more clearly and to avoid confusions about both what we are seeing and what the implications of contemporary science are. Before looking back to Thomas, I want to provide a brief survey of current cosmological claims.

Current Cosmology, Beginnings, and Creation

Recent developments in cosmology have been used to reach philosophical and theological conclusions about the beginning of the universe. In *The Grand Design,* Stephen Hawking and Leonard Mlodinow (2010) make the point that, just as the universe has no edge, so there is no boundary, no beginning to time. Therefore, to ask what happened before the beginning –or even at the beginning– would be meaningless:

> In the early universe –when the universe was small enough to be governed by both general relativity and quantum theory– there were effecti-

> vely four dimensions of space and none of time. That means that when we speak of the "beginning" of the universe, we are skirting the subtle issue that as we look backward toward the very early universe, time as we know it does not exist! We must accept that our usual ideas of space and time do not apply to the very early universe. That is beyond our experience, but not beyond our imagination. (p. 134)

Hawking has said that nothing caused the Big Bang because there was no time at such a putative beginning. For him (and for most people), the relationship between cause and effect is essentially a temporal one; a cause always precedes temporally its effect. When he applies this understanding of cause and effect to his cosmology that allows no time in which a creator would exist prior to what he creates, he concludes that since there is no time, and hence no causal nexus, there is no Creator. There are fundamental confusions in this analysis in which God's causality, for example, is considered as the same kind of causality that creatures exercise and that the relationship between cause and effect is *necessarily* a temporal one.

Recent theories concerning what happened *before the Big Bang* as well as those that speak of an endless series of big bangs or some version of a multiverse hypothesis are often attractive because they too deny a fundamental beginning to the universe and thus appear to make a Creator irrelevant. There is a desire in some cosmological circles to get rid of *the troubling singularity* of the Big Bang itself –a singularity that seems to indicate a beginning to the universe. Such theories allow cosmologists like Neil Turok and Paul Steinhardt to claim that "the big bang is not the beginning of space and time, but, rather, an event that is, in principle, fully describable using physical laws. Nor does the big bang happen only once. Instead, the universe undergoes cycles of evolution" (Turok & Steinhardt, 2007, p. 8).

Some cosmologists have used insights from quantum mechanics to offer accounts of the Big Bang itself. They speak of the Big Bang in terms of "quantum tunnelling from nothing", analogous to the way in which very small particles seem to emerge spontaneously from vacuums in laboratory experiments. Thus, they think that to explain the Big Bang in this way, as the fluctuation of a primal vacuum, eliminates the need to have a Creator and leads to the conclusion that physics itself is competent to explain the very beginning of the universe. One cosmologist, Alexander Vilenkin, argues that although the universe has a beginning, "modern physics can describe the emergence of the universe as a physical process that does not require a cause".

> What causes the universe to pop out of nothing? No cause is needed. If you have a radioactive atom, it will decay, and quantum mechanics gives the decay probability in a given interval of time, say, a minute. There is no reason why the atom decayed at this particular moment and not another. The process is completely random. No cause is needed for the quantum creation of the universe. (Vilenkin, 2016)

There are other thinkers who have embraced traditional Big Bang cosmology, that seems to affirm an absolute beginning to the universe, as providing scientific justification for, if not actual confirmation of, the Genesis account of creation. Even Pope Pius XII once remarked that this cosmology offered support for what the opening of Genesis revealed. The argument is that an initial singularity, outside the categories of space and time, points to a supernatural cause of the beginning of the universe. William Lane Craig (2006), one of the better-known proponents of this position, outlines his argument in a simple syllogism: 1) whatever begins to exist has a cause; 2) The universe began to exist. 3) Therefore, the universe has a cause (i.e., it is created). Craig's argument appears to have an immediate appeal. In addition to referring to contemporary Big Bang cosmology to support the conclusion that the universe is temporally finite, Craig also invokes philosophical arguments about the impossibility of past time's being infinite, an impossibility that leads ineluctably to the conclusion that the universe has a beginning.

The relationship between the temporal finitude of the universe and the conclusion that it is created can be found in the work of the Jesuit theologian and cosmologist, Robert J. Spitzer. In his book, *New Proofs for the Existence of God: Contributions of Contemporary Physics and Philosophy*, Spitzer (2010) claims that modern physics shows us that the past time of the universe is finite, and since the universe has a finite past it must have begun to be, and if the universe began to be, there must be a cause for this beginning; it must have been created. Spitzer accepts Vilenkin's arguments that the universe has a beginning, but, with Craig, rejects Vilenkin's denial that there must be a cause for this beginning (pp. 177-215).

In addition to whether or not cosmology discloses a beginning to the universe there is a more explicitly philosophical debate about whether any beginning to the universe requires a cause.

With respect to the question about causality, physicist Sean Carroll, in his book, *The Big Picture: On the Origins of Life, Meaning, and the Universe Itself*, says that:

> "Causation" […] a derived notion rather than a fundamental one, is best thought of as acting within individual theories that rely on the concept. Talking about "causes" is not the right vocabulary to use when thinking about how the universe works at a deep level. (2017, pp. 199; 375)

Carroll argues that the first premise in Craig's syllogism (that whatever begins to exist has a cause) is false. Indeed, Carroll rejects the legitimacy of asking for a cause of the universe as such:

> Why should we expect that there are causes or explanations or a reason why in the universe in which we live? It is because the physical world inside of which we are embedded has two important features. There are unbreakable patterns, laws of physics –things do not just happen, they obey laws– and there is an arrow of time stretching from the past to the future. The entropy was lower in the past and increases towards the future. Therefore, when you find some event or state of affairs B today, we can very often trace it back in time to one or a couple of possible predecessor events that we therefore call the cause of that, which leads to B according to the laws of physics. But crucially, both of these features of the universe [that] allow us to speak the language of causes and effects are completely absent when we talk about the universe as a whole. We do not think that our universe is part of a bigger ensemble that obeys laws. Even if it is part of the multiverse, the multiverse is not part of a bigger ensemble that obeys laws. Therefore, nothing gives us the right to demand some kind of external cause. (ReasonableFaith, 2014)

Carroll confuses one kind of causality –that between temporally separated events– with a much richer and broader notion of cause. He thinks that causality follows from the *laws of nature*, when, in fact, it is just the opposite. Indeed, laws of nature *reflect* the causal relations that exist in the world and thus these laws depend upon the priority of causal relations. In rejecting the application of his restricted notion of cause to the question of the cause of the universe, he mistakenly thinks that he shows the falsity of traditional arguments for a cause of existence as such –that is, ultimately, arguments for an Uncaused Cause.

Another cosmologist, Lee Smolin (2001), in *Three Roads to Quantum Gravity*, calls into question the meaningfulness of asking questions about an ultimate origin of the universe. His claim is that the universe "cannot have

been made by anything that exists outside of it, for by definition the universe is all there is, and there can be nothing outside it". Accordingly:

> the first principle of cosmology must be "There is nothing outside the universe". […] The first principle means that we take the universe to be, by definition, a closed system. It means that the explanation for anything in the universe can involve only other things that also exist in the universe. (p. 17)

We need to recognize, however, that there are different senses of "first principles" –some are first with respect to a restricted area of investigation (e.g., the natural sciences), others would be first in a kind of absolute sense, referring to all categories of explanation. There are many issues here about the nature of causality that we need to leave aside; I want to return to the question of creation and the beginning of the universe.

In a way, the current debate is primarily about whether or not cosmology discloses a beginning of the universe: Hawking, for example, denies the intelligibility of such a notion and others argue for variations of an eternal universe. William Lane Craig and Robert Spitzer claim that cosmology does indeed point to a beginning. The debate, framed in such terms about a beginning, lead the exponents either to reject or to embrace the idea of creation. Despite fundamental differences as to what contemporary cosmology tells us, all these views tend to identify what it means for the universe to be created with its having a temporal beginning. This emphasis on beginnings leads to confusion about creation. The error here is to think that creation necessarily means that the universe has a temporal beginning. If creation and beginning are connected in this way, it becomes easy to see how a denial of there being a beginning leads to a denial of creation and that an affirmation of a scientific account of a beginning leads to an affirmation of creation.

Confusions about Nothing

Another reason for thinking that creation must involve a beginning concern what "nothing" means, in the expression "creation out of nothing". The tendency is to think that coming to be out of nothing must refer to a beginning. A counter-argument, of course, is to say that an eternal universe, one without a beginning, cannot be created out-of-nothing, not only because there is no beginning, but also because for something to come to be out of nothing would

violate a first principle of all science: that from nothing, nothing can come. For all the changes that the natural sciences study, any coming into existence requires something prior, from which the change occurs. But, just as there are confusions about beginning, so too there are confusions about nothing, as well as confusions about what "coming into existence" means.

Alexander Vilenkin (1983), who accepts a version of quantum tunneling from nothing as a description of the origin of the universe, notes that the "nothing" in his account is a "state with no classical space-time […] the realm of unrestrained quantum gravity; it is a rather bizarre state in which all our basic notions of space, time, energy, entropy, etc. lose their meaning". Vilenkin offers the following thought experiment: Imagine spacetime as the surface of a sphere and then suppose that the sphere is shrinking, like a balloon losing its air. As the radius grows smaller, it eventually goes to zero. The surface of the sphere disappears and with it spacetime itself.

> We have arrived at nothingness. We have also arrived at a precise definition of nothingness: a closed spacetime of zero radius. This is the most complete and utter nothingness that scientific concepts can capture. It is mathematically devoid not only of stuff but also of location and duration. (p. 2851)

However, the "'nothing" in some cosmological models that speak of the Big Bang in terms of "quantum tunnelling from nothing", is not the nothing referred to in the traditional sense of creation out of nothing. The "nothing"' in these cosmological reflections may very well be nothing like our present universe, but it is not the absolute nothing central to what it means to create; it is only that about which the theories say nothing.

Another example of confusion about different senses of 'nothing' can be seen in Lawrence Krauss' *A Universe from Nothing. Why There is Something Rather Than Nothing*. Krauss (2012b) thinks that:

> The question of why there is something rather than nothing is really a scientific question, not a religious or philosophical question, because both nothing and something are scientific concepts, and our discoveries over the past 30 years have completely changed what we mean by nothing.

Hence, no appeal to a creator is needed; science is sufficient to explain something's coming from nothing.

Offering a striking landscape of ever deeper senses of "nothing", beyond even that of vacuums and empty space, he concludes:

> We have discovered that all signs suggest a universe that could and plausibly did arise from a deeper nothing –involving the absence of space itself– and which one day may return to nothing via processes that may not only be comprehensible but also processes that do not require any external control or direction. (Krauss, 2012a, p. 183)

Despite a widespread interest in "nothing", or various levels of nothingness, the nothing to which many authors refer is really something, even at times a quasi-ambiguous reality. But the nothing in the traditional understanding of creation out of nothing only refers to the absence of everything other than God. In a way, however, to speak of "other than God" risks the danger of locating God and things on the same metaphysical plane, perhaps differing only in degree. Nor ought we to think that creation out-of-nothing means that there are two "realities", two ultimate principles: God and nothing. Creation out-of-nothing does not mean that God changes nothing into something; rather it is a way of affirming that it is God alone, and nothing else, who is the cause of absolutely everything that is.

Confusions concerning creation and cosmology run the gamut from denials of creation because the universe is conceived as having no beginning, to explanations of a beginning in exclusively scientific terms which avoid any appeal to a Creator, to denying the intelligibility of asking questions about the cause of the universe itself, to opposing claims that the Big Bang offers a kind of scientific warrant for belief in God's creation of the universe. All of these theories, both in favour of and opposed to the idea of creation, share what I have called the error of beginnings. But if creation ought not to be identified *necessarily* with the beginning of the universe, what does creation mean?

The Metaphysics of Creation: Creation is Note a Change

Contrary to all these claims that use cosmology either to deny or to affirm creation, we need to recognize that creation is a metaphysical and theological affirmation that all that is, in whatever way or ways it is, depends upon God as cause. The natural sciences, including cosmology, have as their subject the world of changing things: from subatomic particles to acorns to

galaxies. Whenever there is a change there must be something that changes. Whether these changes are biological or cosmological, without beginning or end, or temporally finite, they remain processes. The scientific principle that from nothing, nothing comes, is true –but it is a truth with respect to the changes that occur within the world. Creation, on the other hand, is the radical causing of the whole existence of whatever exists. Creation is not a change. To cause completely something to exist is not to produce a change in something, is not to work on or with some existing material. At the very least, this is the traditional understanding of creation.

Cosmology and all the other natural sciences offer accounts of change; they do not address the metaphysical and theological questions of creation; they do not speak to why there is something rather than nothing. It is a mistake to use arguments in the natural sciences to deny creation. It is also a mistake to appeal to cosmology as a confirmation of creation. Discussions of creation are different from arguments from order and design to a source of order and design. Similarly, discussions about the fine-tuning of the initial conditions of the universe do not directly concern the topic of creation; thus, whether or not multiverse theories do away with the need to explain such fine-tuning, they do not provide a commentary on creation. Creation, as we have seen, offers an explanation of why things exist at all. It may very well be that natural philosophy, working with the discoveries of the empirical sciences, can lead us to knowledge of the existence of God, but this would not yet be knowledge of God as Creator; for this type of knowledge we need metaphysics and, ultimately, revelation.

What it means for God to create is radically different from any kind of human making. When human beings make things they work with already existing material to produce something new. The human act of creating is not the complete cause of what is produced; but God's creative act is the complete cause of what is produced; this sense of being the complete cause is captured in the expression "out of nothing". To be such a complete cause of all that is requires an infinite power, and no creature, no human being, possesses such infinite power. God wills things to be and thus they are. To say that God is the complete cause of all that is does not negate the role of other causes which are part of the created natural order. Creatures, both animate and inanimate, are real causes of the wide array of changes that occur in the world, but God alone is the universal cause of being as such. God's causality is so different from the causality of creatures that there is no competition between the two, that is, we do not need to limit, as it were, God's causality to make room for the causality of creatures. God causes creatures to be causes.

Thomas Aquinas on Creation

My analysis thus far has been heavily influenced by the thought of Thomas Aquinas, but now I will be a little more explicit in my reference to him. Already in the thirteenth century the groundwork was set for the fundamental understanding of creation and its relationship to the natural sciences. Working within the context of Aristotelian science and aided by the insights of Muslim and Jewish thinkers, as well as his Christian predecessors, Thomas Aquinas provided an analysis of creation and science which remains true. One of the key texts from Thomas is from his treatise *On Separate Substances:* "Over and above the mode of becoming by which something comes to be through change or motion, there must be a mode of becoming or origin of things without any mutation or motion, through the influx of being" (*On Sep. Subs*., c. 9). For Thomas creation means a dependence in being –which is a notion in metaphysics, not in the natural sciences. To be caused to be by God means to be dependent upon God for the fact that one is. The relationship here between divine cause and created effect is one of metaphysical dependence; indeed, the fundamental sense of causality involves dependence and not any temporal relationship of prior and posterior.

Notice that Thomas distinguishes between "the mode of becoming by which something comes to be through change or motion" from the more fundamental sense of creation that he identifies as the "influx of being". The latter, the "influx of being", is the causing of existence *as such*. The "as such" is an important phrase. It helps us to recognize the difference between causing something to come to be or to exist in the ways in which, for example, animals produce (cause to exist) offspring, and God's causing of the actuality of whatever is as it is.

Thomas's philosophical analysis of the complete dependence of all existing things –precisely as existing– occurs in the discipline of metaphysics, and it involves a profound understanding of the difference between what a thing is and the very existence of a thing and the existence of all of its features. He argues that no existing thing can be the fundamental cause of its own existence. Causing of existence in this fundamental sense is what creation is.

As Thomas often notes: *creatio non est mutatio* [creation is not a change][1]. The doctrine of creation tells us why there is something rather

[1] In the *C. G.* II, c. 18, 2, Thomas observes: "creation is not a change, but the very dependency of the created act of being upon the principle from which it is produced. And

than nothing, and this topic is in a category beyond the explanatory domain of the natural sciences.

When speaking about the origin of the universe, understood as God's causing it to come into existence, Thomas Aquinas observes that there are two complementary senses of creation out-of-nothing: one philosophical, the other theological. The philosophical sense means that God, with no material cause, makes all things to exist as beings that are radically different from Himself and yet completely dependent upon His causality. This philosophical sense of creation has two essential elements: 1) there is no material cause in creation –no *stuff* whatsoever out of which God makes the world; and 2) the creature is completely dependent, throughout its entire duration, upon the constant causality of the Creator. This philosophical sense of creation is the sense in which creation out of nothing is a subject in metaphysics, concerning the complete dependence of all that is on a cause of existence.

Creation is not primarily some distant event; rather, it is the on-going complete causing of the existence of all that is. At this very moment, were God not causing all that is to exist, there would be nothing at all. Creation concerns first of all the origin of the universe, not its temporal beginning. Indeed, it is important to recognize this distinction between origin and beginning. The former affirms the complete, continuing dependence of all that is on God as cause. Whatever is created has its origin in God. But we ought not to think that to be created must mean that whatever is created has a temporal beginning. It may very well be that the universe had a temporal beginning, as the traditional interpretation of the opening of Genesis acknowledges, but there is no contradiction in the notion of an eternal, created universe: for were the universe to be without a beginning it still would have an origin, it still would be created. This was precisely the position of Thomas Aquinas, who accepted as a matter of faith that the universe had a temporal beginning but also defended the intelligibility of a universe, created and eternal. Unlike his teacher, Albert the Great, or his colleague at the University of Paris, Bonaventure, Thomas did not think that "out of nothing" *had* to mean "after nothing", such that a created eternal universe was impossible.

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thus creation is a kind of relation…". Prior to this observation, Thomas says: "Now, what has been said makes apparent the fruitless effort of those who impugn creation by arguments derived from the nature of motion or change –the contention, for example, that creation, like other motions or changes, must take place in a subject, or that in creation non-being must be transmuted into being…".

As we have already seen in Stephen Hawking's denial of God's causing the universe to be because there is no time, hence no temporal priority, hence no causality to be exercised, cause and effect are often seen as necessarily involving a temporal sequence. But Thomas can speak of an eternal universe's being caused by God because he does not limit the relationship between cause and effect to a temporal sequence and, of course, he distinguishes between God's causality and that which creatures exercise. God's causality as Creator is prior to the created effect, but the priority is not a temporal one.

It is the failure to recognize that to be created does not necessarily entail a temporal beginning that causes considerable confusion in contemporary debates about the implications of cosmology for arguments about whether or not the universe is created. This error about beginnings continues to be the beginning of all sorts of errors about what cosmology can properly describe and what creation is.

Thomas thought that neither science nor philosophy could know whether the universe had a beginning. He did think that metaphysics could show us that the universe is created; in his first magisterial treatment of creation he remarked: "not only does faith hold that there is creation, reason also demonstrates it" (*In II Sent*., dist. 1, q. 1, a. 2). The demonstration to which he refers is in metaphysics and begins with the distinction between the existence and essence of things.

The distinction between existence and essence, and not simply the notion of contingency, defines what it is to be created. As Thomas says in *De ente et essentia,* any existing thing, "the existence of which is other than its nature," must "have its existence from some other thing" (*De Ente*, c. 5). Or, as he notes in the *Summa Theologiae*: "God alone is Being by virtue of his own essence, since his essence is his existence; whereas every creature has being by participation, so that its essence is not its existence" (*S. Th.* I, q. 104, a. 1).

To be created is to be a being "by participation", and here Thomas adopts a Platonic notion of a hierarchy of being to which he adds a characteristically Aristotelian element, according to which the ultimate principle is not only an exemplar cause but also an efficient cause. In each of his magisterial discussions of creation, Thomas emphasizes, as he says the *Summa Theologiae*, "from the fact that a thing has being by participation, it follows that it is caused" (*S. Th.* I, q. 44, a. 1).

Thomas would have warned against those today who use Big Bang cosmology, for example, to conclude that the universe has a beginning and

therefore must be created. He was always alert to reject the use of bad arguments in support of what is believed:

> That the world had a beginning […] is an object of faith, but not a demonstration or science. And we do well to keep this in mind; otherwise, if we presumptuously undertake to demonstrate what is of faith, we may introduce arguments that are not strictly conclusive; and this would furnish infidels with an occasion for scoffing, as they would think that we assent to truths of faith on such grounds. (*S. Th.* I, 46, a. 2)

The singularity in traditional Big Bang cosmology may represent the beginning of the universe we observe, but we cannot conclude that it is the absolute beginning, the kind of beginning which would indicate creation. As some contemporary cosmologists recognize, there could very well be something before the Big Bang.

When it came to how to read the opening of *Genesis*, Thomas observed that what is essential is the "fact of creation", not the "manner or mode" of the formation of the world. Questions concerning order, design, and chance in nature refer to the "manner or mode" of formation of the world. Attempts in the natural sciences to explain these facets of nature do not challenge the "fact of creation". A world with a temporal beginning concerns the kind of world God has created. It may very well be easier to accept that a world which has an absolute temporal beginning is a created world, and such a world may be especially appropriate for understanding sacred history, important as it is for believers. But an eternal world, one without a beginning to time, would be no less a created world.

Thomas, of course, believed that the universe had a temporal beginning. This was the common view of the Church Fathers and was solemnly proclaimed as Church dogma in the Fourth Lateran Council (1215). He recognized that what was given in faith –that the universe had a temporal beginning– completed and perfected what reason could know about creation. After all, reason itself (in metaphysics) accounted for creation without any reference to temporality.

Conclusion

Cosmological theories are easily used, or rather misused, to support or to deny creation. Each time, however, as I have suggested, "to create" has

been joined inextricably to temporal finitude such that to be created necessarily means to begin to be; thus, to deny a beginning is to deny creation. It was the genius of Thomas Aquinas to distinguish between creation understood philosophically, with no reference to temporality, and creation understood theologically, which included the recognition that the universe does have an absolute temporal beginning.

There is a wider confusion at work here as well –wider than the confusing of creation with beginnings. It is the failure to distinguish between creation and the changes that occur within the created order and hence the failure to recognize that the natural sciences, including cosmology, have nothing to tell us about the ultimate cause of existence of things. God's creative power is exercised throughout the entire course of cosmic history, in whatever ways that history has unfolded. No explanation of cosmological or biological change, no matter how radically random or contingent such an explanation claims to be, challenges the metaphysical account of creation, that is, of the dependence of the existence of all things upon God as cause. When some thinkers deny creation on the basis of theories in the natural sciences, or use cosmology to confirm creation, or reject the conclusions of science in defense of creation, they misunderstand creation or the natural sciences, or both.

Experiments being performed at the Large Hadron Collider –the huge underground particle accelerator on the Swiss-French border– may bring us closer to what happened just after the Big Bang; but they will tell us nothing about creation. The distance between minute fractions of a second after the Big Bang and creation is, in a sense, infinite. We do not get closer to creation by getting closer to the Big Bang. Furthermore, as we have seen, some contemporary cosmologists argue that there could very well be something before the Big Bang. Similarly, excitement about the recent discovery of gravitational waves, referred to as "ripples in the fabric of space-time", has encouraged some, like the cosmologists Neil Turok, to speculate that we may soon be able "to see what happened at the moment the universe began". But, for whatever beginning these gravitational waves might provide evidence, it is not the kind of absolute beginning central to the doctrine of creation: a beginning, or origin, that, as we have seen, is first of all separate from any notion of time.

We need to avoid the error of thinking that discussions in the natural sciences about beginnings have anything to tell us about the creation of the universe.

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