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Is Aristotelian-Thomistic Natural Philosophy Still Relevant to Cosmology?

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Abstract: Do advances in the natural sciences leave the followers of Aristotle and Aquinas without a cosmos? Is their natural philosophy irrelevant to modern cosmology and its Big Bang theory? The following essay answers these questions and argues that natural philosophy is perennially relevant to cosmology. It defends the idea that Aristotelian-Thomistic natural philosophy reaches a true, general definition of the universe: the unity of order of all mobile beings according to place, duration, and agent causality. The essay defends this conclusion while answering three opposing views, those of Jonathan Schaffer, Peter Simons, and Immanuel Kant. The true account is attained through reasoning about the nature of place, duration, and agent causality. Objections against these lines of argument are answered to clarify their continued relevance. Since it provides even our modern scientific cosmology with the necessarily assumed notion of the universe, Aristotelian-Thomistic natural philosophy is perennially relevant to cosmology.

Introduction¹

In his article “Thomas and the Universe,” published thirty years ago, Stanley Jaki criticizes many prominent Thomists for giving “at most a brief chapter or a subsection of it on Thomas and the universe with very little on the universe as such.”² Jaki means by the universe as such, “the very core of the notion of the universe, or its being the *totality* of consistently interacting things and their very unity.”³ Such a focus is philosophically essential, Jaki argues, and Thomists must study and learn from modern cosmology, since it can be used to illustrate in concrete detail many of St. Thomas’ philosophical conclusions about the universe, including its intelligibility, contingency, and purposive order. Jaki has in mind, among other things, the ability to model the universe mathematically, the fine-tuning of fundamental universal parameters, and the anthropic principle.⁴ Indeed, it is essential to Aristotelian-Thomistic general natural philosophy that it antecedently ground our knowledge of nature and consequently be refined by the particular natural sciences.⁵ In what follows, “general natural philosophy” is taken to be that disciplined inquiry about mobile being in common or simply speaking, in the tradition of Aristotle’s *Physics* and St. Thomas’ commentary.⁶ Many doubt the ability of this discipline to contribute anything beyond shallow generalities about causality, space, and time.⁷ It seems unable to say anything deep about the universe. Yet those same critics recognize that discussing the unity of the universe is a task for philosophy, not cosmology.⁸ Is Aristotelian-Thomistic natural philosophy anti-cosmological?⁹ Do the modern sciences leave the followers of Aristotle and Aquinas without a cosmos?¹⁰

If not, then how should those followers answer this question: What is the universe? Should

they say that the universe “is everything that is the case, it is the sum-total of what exists”? Yet, “What statement could be more self-evident, more luminously true, or more platitudinous?”¹¹ It requires little intellectual effort, and may not even be coherent depending on what the terms mean. Indeed, St. Thomas himself avoids such a catch-all answer.¹² In what follows, I defend the Aristotelian-Thomistic discovery of the universe (or “world”). We must first discover the existence of the universe as part and parcel with proposing its definition. This is because one cannot give a real definition of something that does not exist, and to define it before we know it exists would only be a real definition accidentally, or a nominal proposal. Not attending to this causes no small philosophical confusion when confronted with stipulated or nominal definitions of “universe,” “multiverse,” etc., that, since they lack a basis in what exists, are little more than imaginative or conceptual constructs.¹³ What this *a posteriori* discovery with subsequent real definition entails methodologically is discussed below.

For St. Thomas, the name “universe” signifies the unified diversity of all things as complete and one.¹⁴ As to its real definition, Aquinas holds that “The form of the universe consists in the distinction and order of its parts.”¹⁵ The perfection of a diverse, unified order characterizes the existence of the universe, for God not only gives existence to things, but He gives “existence with order in things [*esse cum ordine in rebus*].”¹⁶ How does general natural philosophy contribute to the discovery and subsequent definition of such an order? In what follows, I first propose three opposing alternative views. After presenting these alternatives, I examine the discovery of the true idea of the universe, thereby showing why natural philosophy is still relevant even to modern scientific cosmology.

I. Alternative Positions about the Universe

We should consider the following three alternative views since they each oppose one part of the true genus of the universe, namely, that the universe is a unity of order. Contrary to this view, Johnathan Schaffer maintains that the world is a single substance; Peter Simons defends the view that the universe is a pure multiplicity; and Immanuel Kant argues that the world is a mere idea.

I.A. The universe as one substance

Jonathan Schaffer defends “priority monism.”¹⁷ This is distinct from existence monism.¹⁸ Schaffer characterizes the difference as follows: “*Priority Monism* does not entail *Existence Monism* because the priority monist can and should allow for the existence of many derivative proper parts of the cosmos.”¹⁹ In short, the universe is the only substance. Everything else is a dependent or derivative part: real, but not a real substance.²⁰ Schaffer provides multiple arguments for priority monism, each partly motivated by science as a guide for ontology. That is, contrary to the plausible contention that ontology cannot be “read off of” scientific theories, Schaffer proposes that we follow the scientists and do just that.²¹ We will examine two of his arguments: the argument from physical field theories and the argument from “nomic integrity.”²²

The first argument appeals to both general relativity and quantum field theory. In each case, Schaffer claims, one must posit spacetime as the only substance, excluding the possibility of other substances. For instance, a physical geometry and mass-energy contents characterize general relativity’s spacetime manifold, the set of points where events occur. Ordinary material

objects like cosmologists or cats are merely sub-regions identical with sets of points of this manifold.²³ Their geometry or mass-energy are merely features of the underlying substance, spacetime. The mathematics of quantum field theory permits a similar argument. Quantum particles are to be understood as properties of points or small regions of spacetime. They are just localized excitations of energy. In short, the mathematical equations do not require the existence of any substance beyond spacetime itself, although this substance exhibits various properties.²⁴

Schaffer's nomic integrity argument could be understood as following the scholastic adage *agere sequitur esse*. Or, as Schaffer puts it, "*to be one is to act as one.*"²⁵ A true substance is that which truly obeys the laws of physics and thus exhibits "nomic integrity." The argument is as follows: "Something is a substance if and only if it evolves by the fundamental laws."²⁶ However, "the cosmos is the one and only thing that evolves by the fundamental laws."²⁷ Therefore, "The cosmos is the one and only substance."²⁸ To defend his first premise, Schaffer requires that "evolution" according to laws is indifferent to purported differences between observable objects following those laws (both cats and cosmologists are governed by gravity indifferently). Schaffer's second premise is a strong empirical claim: only the whole cosmos could evolve necessarily—and not merely contingently—according to the known physical laws.²⁹ He supports this using a whole-to-part argument. That is, the whole acts primarily; its parts act derivatively.³⁰ He supports this further claim through an appeal to the existence of conservation laws (e.g., the conservation of energy), and other physical laws about closed systems. Only the cosmos as a whole, Schaffer claims, obeys conservation laws exactly, and the cosmos is the only truly closed system.³¹ So, the cosmos is the one and only substance.

I.B. The universe as a multiplicity

In opposition to various analytic metaphysicians who argue that the name “world” or “universe” does not signify anything in reality, Peter Simons argues that the name does have a reference.³² An example of someone whom Simons would oppose is Bas C. van Fraassen, who thinks that the name “world” is merely a schematic, context-dependent term.³³ For van Fraassen, the sense of “world” depends upon its context of use. Accordingly, its reference shifts to quantify a domain of discourse, as in the phrase, “All the tears in the world won’t bring her back.” By contrast, Simons thinks that the name “universe” signifies the totality of all objects. He reaches this conclusion by a process of elimination. He reasons that either the universe is one thing or it is many things. If the universe is one thing, then how is it unified? Is it a part-whole unity, a mereological sum? Such a sum—if we are not monists—would be an odd thing that crisscrosses all categories.³⁴ Perhaps, however, the universe is one by being a single class, or the set of all things. However, according to set-theoretic paradoxes, there cannot be a universal set of all things.³⁵ On the other hand, if the universe cannot be one thing, it must be many things.³⁶ If so, then to which category does it belong? It seems that if the universe belongs to only one category, it is difficult to pick one category—the universe seems too diversified for that.³⁷ Yet if the universe belongs to many categories, then how can we speak of one universe?³⁸ Eventually, Simons settles on the view that “universe” signifies the plurality of all things in all categories:

If we allow that objects in each category may be designated nominally, all we need is a type-neutral nominal expression which will cover them all. We may nominate the expression ‘object’ to fulfill that role. If that works, then the universe is the totality of all objects.³⁹

Simons then claims that metaphysics cannot say anything about the *unity* of the universe.⁴⁰ This is because of how he has defined “universe” as a name referring to all existents across all categories, but nothing more. Discussing the unity of the universe is an empirical, and thus a scientific, matter.⁴¹

I.C. The universe as idea

Immanuel Kant argues, as part of his transcendental critique of rationalist metaphysics, that the world cannot be an objective reality since our concepts are applicable only “within the world.” Space, time, and causality cannot be used to contemplate the world *as such* because they would have to extend beyond the world in order to do so.⁴² Instead, all that the heirs of Kant are permitted—Stanley Jaki chides—is the “rather hollow dictum that the universe could at most be a regulating idea for practical purposes, even if it was, ontologically speaking, as Kant claimed, the bastard product of the metaphysical cravings of the intellect.”⁴³ That is, we have no *concept* of the world, but only an *idea* of the world.⁴⁴ Kant says that this idea has a

regulative use, namely that of directing the understanding to a certain goal respecting which the lines of direction of all its rules converge at one point, which, although it is only an idea (*focus imaginarius*)—i.e., a point from which the concepts of the understanding do not really proceed, since it lies entirely outside the bounds of possible experience—nonetheless still serves to obtain for these concepts the greatest unity alongside the greatest extension.⁴⁵

Kant’s analogy is from optics. All concave lenses, in the terminology of Kant’s day, possess an

“imaginary focus.”⁴⁶ This is an apparent focal point, on the side of the lens of the incoming light, from which point all the light rays emerging on the viewing side of the lens appear to diffuse. Because it is not a causal source of light, this imaginary point of diffusion and its associated images only seem to be there. Consequently, just as no real object is at the imaginary focus, so also there is no real object corresponding to our idea of the world. Nonetheless, the idea of the world unites the wide array of the aspects or parts of “itself” that we do experience.

II. Natural Philosophy and the Universe

These three alternatives—the universe as one substance, as a pure multiplicity, or as a mere regulative idea—are each in part opposed to the general proposal of Aristotelian-Thomistic natural philosophy: that the universe is a unity of order. As a *unity*, the universe is really one, not a mere multiplicity; yet as a unity *of order*, it is not one substance; its unity is also real, not a mere idea, and we can have a real idea about it. Arguments for this view are possible from general natural philosophy. This “first physics”—if you will—underlies any more detailed study of the natural order, and it does so perennially and must be perennially recapitulated. Why? Because our minds have no innate ideas about nature.⁴⁷ Rather, the human mind is naturally situated for inquiry within the cosmos and needs a certain natural order of development regarding its conceptions about that order.

This natural order of development is described by Aristotle in the first chapter of his *Physics*.⁴⁸ The natural way of proceeding is from what is more known to us at first to what is

more known in itself. This requires that we proceed from more universal, indistinct grasps of things to more specific, determinate understandings. Our minds progress by acquiring more distinct and detailed concepts as well as by discovering arguments.⁴⁹ For instance, we begin natural philosophy—if we are doing it correctly—with the vague grasp of “mobile being” as its subject matter for inquiry, not “mobile body.” Why? Because mobile being is prior in the intellectual order, while mobile body is prior in the sensible order. In the intellectual order, our intellects first and naturally grasp mobile being; thus, to begin physics by studying mobile body would be unnatural. The proof of this is that one can demonstrate that every mobile being is a body, as Aristotle does in *Physics* VI.4. (That is, the argument shows that corporeal extension is a necessary condition for motion.) This is why mobile body is not the subject of natural philosophy, since no science demonstrates its own subject; rather, a science must assume the existence and definition of its subject.⁵⁰

This natural order of determination must also be true when it comes to cosmology. Cosmology cannot prove the existence and definition of its subject: the universe.⁵¹ Rather, it must assume it. This is still true of the modern science of cosmology, especially insofar as it makes use of mathematical physics (for that mathematics must be applied to some material object that is assumed to exist apart from one’s mathematical consideration). Consequently, its subject must be discovered by some other science.

Note that this does not mean that we are seeking a merely stipulated definition of the universe, or a nominal one. In order to achieve a real definition, one must first know that the thing in question exists, which requires that its existence be known *per aliud*, through its accidents, properties, or effects.⁵² This mode of discovery allows one to discover the definition of

physical entities *a posteriori*. The truth of such an achievement, in order to be successful, does not need to rule out *a priori* any merely stipulated definition of “the universe” that one might arrive at via another method—e.g., imagining that it might be possible based on seeing no logical contradiction in “a multiverse,” or claiming that some other sense of “universe” exists based upon reading one’s ontology off of mathematical models. Nor does such a conclusion exclude that the grasp of the real nature of the universe can be clarified by further inquiries. Indeed, this is just what one hopes to do, to achieve a further-enriched speculative grasp of the cosmos, whether through the natural sciences or metaphysics. Rather, based upon the empirical core of our common experience of the world and changing being in general, which is the level of determination proper to general natural philosophy, we are attempting to discover through *a posteriori* argument the existence of a being (or in this case, an order of beings) that we can then define based upon the character of the arguments used to reach insight into that existence.

St. Thomas himself implies the need for and the logical order of just such a discovery in his *prooemium* to the *De Caelo* commentary: principles treated in general natural philosophy are *applied by* cosmology in a more determinate way.⁵³ Therefore, if general natural philosophy begins to study mobile being simply speaking, and this leads to cosmology, whose subject is the universe, then somewhere along the way one must attain some insight about the existence and nature of the universe—at least, an insight that is sufficient to start cosmology. However, this discovery would not happen through theorems that, in Euclidean fashion, join natural philosophy to cosmology. Rather, in the case of cosmology’s subject, the application in question must be a determination or specification. Some more general grasp of the universe is determined first, and the universe is then investigated using cosmology’s own resources.⁵⁴

In general natural philosophy this can be done in three ways, using arguments from place, duration, and causality.⁵⁵ This approach is conditioned, for better or worse, upon the acceptance of Aristotle's definition of motion, the actuality of what exists in potency as such. Aristotelian motion implies a subject-accident ontology; such motion belongs *per se* to some subject. Adopting this definition is to deny accounts of motion that are merely relative or only "at-at" analyses of events in a continuum.⁵⁶ Based upon this assumption, general natural philosophy can discover that the universe is the unity of order, both topologically and through causality, of all mobile beings. That is, certain orders characterize the unified order of all mobile beings and thus make of them a universe. By an order being "topologically" unified, I mean that there is a single quantitative connectedness of its parts to adjacent parts, whether these are actually existing or only potentially existing parts.⁵⁷ The universe is topologically one in both the spatial arrangement and duration of its parts. I now turn to the three arguments whose conclusions will allow us to determine our definition of the universe; in the notes, I point out various supporting arguments regarding how this conclusion is still compatible with current science.

The argument from place is as follows. If change in place is a real categorical change, then whatever causes "being in place" must be immobile, for place cannot change in place.⁵⁸ Note that this requirement of immobility is a common opinion among physicists. Even frames of reference in relativity provide an immobility to the order of place, for the observer's frame of reference is, to that observer, immobile. However, could the set of all those local frames of reference jointly compose the order of place in the universe? For if some moving body—and its reference frame—provide the proper place for another moving body, this does not do away with the need for the immobility of place, but points to the need for sourcing that immobility

elsewhere. If there were no source or principle for the immobility of place, then there could be no real change of place to begin with. Consequently, the proper places of bodies must arise from some first, immobile provider of place. The medievals found this principle in the immobile celestial pole of the *primum mobile*. Even though this option is unavailable today, the argument requires that some ultimate principle of the immobility of place must exist because local motion exists. The very vagueness of the notion “some principle for the immobility of place” demands a more determinate investigation by cosmology. For their part, cosmologists maintain that a preferred reference frame for the universe in fact does exist, even if it is difficult to determine by observation. Universal place in cosmological models is defined relative to families of what are known as “co-moving observers,” and these can be determined, for instance, by observations of the cosmic microwave background.⁵⁹

In regard to duration, the argument concerns whether or not there is a single present throughout the universe. The following argument, from the nature of physical quantity, is distinct from arguments appealing to the causal processes measured by time.⁶⁰ It is as follows. Material substances and their parts are ontologically prior to the existence of their motions. Thus, extended substances with parts having relative position to each other are things whose quantified parts endure or exist all at once. Otherwise, there could be no real relation between the parts (e.g., no real relation exists between the parts of time, for they are not co-existent).⁶¹ In other words, all quantities whose parts have relative position are quantities with enduring parts.⁶² If quantitative parts have an actual spatial relation, then they share a single now; that is, co-enduring parts share a “now.”⁶³ This would be true of the parts which define place in the universe. For convenience, we call them “parts of space.” Yet the parts of space are really related

to each other. Therefore, the parts of space share a single now. That the parts of space are really related to each other does not require that this connection can be realized “at once” or “in the now” by a causal process or a signal (e.g., a gravitational “pull” or a flash of light). We merely require that one part is actually extrinsic to the other. Even the definition of simultaneity in relativity presupposes the co-endurance of the parts of space and their real relationship.⁶⁴ That is, the relativistic definition of simultaneity assumes the co-enduring reality of the parts of space as the light signal traverses the distance between events in order to define distant simultaneity.⁶⁵ We are left wondering: What principle is it that explains the unity of this “now” of the cosmos? It is important to note that this unity to the “now” must be in some way related to a causal process. Why? So as to avoid equivocation by relating the “now” defined by co-enduring parts to the Aristotelian “now” of time that is the measure of motion and causal processes. For the medievals, these “now’s” were not distinct, and the single universal present was grounded in the causal motion of the *primum mobile*. Today, it seems plausible that the expansion of physical space fills the role of a ticking “cosmic clock” whose change fundamentally measures the history of the universe.⁶⁶

Lastly, we consider causality. Of the arguments in Aristotle’s *Physics* concerning the totality of order between movers and mobiles, the most relevant is the one offered in Book VII.⁶⁷ In summary, the argument is as follows: Since every mobile is divisible (or, a body) and cannot as such be the source of its own motion, something else must be responsible for its motion. If this mover is, in turn, also in motion, it must have some other mover. This stretch of moved movers cannot be an infinite stretch of mobiles, and hence must be finite and terminate in a first mover that is not in motion *per se*. The corollary to this main conclusion is that a first moved mover or

set of such movers exists.

The key to this argument is showing that the physical continuum, of its own nature, cannot be a self-initiated source of motion. This is true, as St. Thomas argues, because there cannot be a mobile “whose motion does not depend upon its parts, just as if one were to show that nothing divisible can be the first being, because to be a divisible thing of such a kind depends upon parts.”⁶⁸ It is also important to note that this argument conceives of the physical continuum in its generality, abstracting from the specific natures of the movers involved. As St. Thomas comments, the argument views “the whole universe itself, through a certain kind of continuity.”⁶⁹ Through this argument, the general natural philosopher contemplates the entire universe under the notion of an amorphous, physically continuous causal contact, a “field” of mobile being.

As was the case with the first two arguments, this generic conception was specified by the medievals in their cosmology of celestial spheres. If we are not satisfied with instrumentalist interpretations of today’s cosmological models, then perhaps physical space could provide a unifying principle of place, time, and motion. Physical space—conceived by the cosmologist through the symbolic abstractions of equations in general relativity—is some manner of agency for the local motion of bodies in the universe. Physical space “not only conditions the behavior of inert masses, but is also conditioned in its state by them.”⁷⁰ This role of physical space seems plausible insofar as it is a substratum required for the existence of gravitational fields, underlies the Hubble flow or expansion of space, and provides necessary but not sufficient conditions for the interaction of ponderable matter and radiation in the cosmos.⁷¹ On this account, physical space would be the modern counterpart to the *primum mobile* of Aquinas’s medieval cosmology.

These are the three lines of argument that must be defended in order to maintain that place,

duration, and causality can be used to determine our thinking about the universe antecedent to cosmology. Since these three arguments qualify how a multitude of mobile beings are unified, they reveal an implicit assumption of my approach: the true genus of the universe is not one category (e.g., substance). The universe's "sort" is a unified order of many beings in many categories. Indeed: the universe is the unity of order, both topologically in place and duration as well as through physical agent causality, of all mobile beings.⁷² All mobile beings are united by first principles of place, duration, and agent causality.⁷³ We can know, with the certainty proper to general natural philosophy, *that* these principles exist even if we do not know exactly what they are or whether they concur in a unique physical being.

This is the idea of the universe implicitly assumed by cosmology. It then makes this general notion of the universe more determinate under two conditions: coherence and specification.⁷⁴ Cosmology specifies its assumed notion of the universe through the empirical discovery and theoretical explanation of the determinate features of the universe. That is, specificity arises by determining the precise characteristics of topological connectedness and causal structure in the universe. Cosmology must also provide a coherent account when it proposes these specifications. In particular, any causal mechanisms or universe-wide properties proposed cannot make the existence of the universe and its general features an impossibility. For example, Newtonian physics could not provide a coherent cosmology because it led to paradoxical conclusions about gravity at cosmological scales.⁷⁵ Relativistic accounts of gravity in the cosmos avoid this problem.⁷⁶ The coherence and specification conditions are important because they reveal that general natural philosophy provides cosmology with a notion of the universe that is coherently specifiable. In this way, natural philosophy is indispensable to cosmology. Of course,

metaphysics is also indispensable to cosmology. Indeed, the notion of the universe discovered by natural philosophy stands as imperfect to a more complete notion that could be attained through metaphysics. At present, however, we must be satisfied with what natural philosophy provides.⁷⁷

III. Answering the Alternatives

While answering the opposing views, I appeal to the Aristotelian-Thomistic notion of abstraction from matter. This illustrates another way in which general natural philosophy is relevant to cosmology, since it can rightfully employ these distinctions about abstraction.

III.A. Schaffer

Schaffer's account of the ordinary substances of common experience, such as cosmologists or cats, is too coarse-grained to cut nature at its proper joints.⁷⁸ His first argument hinges upon the plausibility of reading ontology directly off of the notion of the spacetime manifold and its various "fields." At the very least, this assumes that our mathematical concepts of the world are adequate to track its true ontology; the Aristotelian-Thomist has various answers to this assumption.⁷⁹ This assumption also lurks in Schaffer's argument from nomic integrity, which is committed to a questionable fundamentalism. This nomic fundamentalism is the view that the laws of physics at the most fundamental level or smallest scale "exhaustively govern all of material reality."⁸⁰ It is not clear that this fundamentalism is true, even on its own terms.⁸¹ It is also questionable whether fundamental laws can account for more complex structures at greater

scales. For instance, Dennis Noble has argued that one cannot understand the organic functioning of an animal's heart in this "bottom-up" way.⁸²

Furthermore, the second premise in the nomic integrity argument—"The cosmos is the one and only thing that evolves by the fundamental laws"—begs the question. Schaffer maintains that physical laws or the conservation of energy are strictly true only of closed systems, and that the cosmos is the only closed system.⁸³ (An aside: some physicists argue that energy is *not* conserved in the universe as a whole; the implication would be that the universe is *not* a closed system.⁸⁴) Schaffer claims:

One cannot correctly specify independent evolutions of distinct subsystems first, and then patch together the dynamics of the whole. We can only specify evolutions in the context of the whole system. The evolutions of subsystems are thus to be understood as derivative abstractions from the fundamental evolution of the whole system.⁸⁵

That is, Schaffer's conception of when laws are true runs from whole to parts. However, the evidence for conservation of energy and evolution by other physical laws runs in the opposite direction, since it is drawn from sub-domains of the universe. Specifically, it depends upon observations conducted on sufficiently isolated, controlled sub-systems of the universe (e.g., a laboratory, the solar system) whose behavior, predicted by laws, obtains within the range of instrumental error. So, to arrive at a statement about the whole universe's behavior, one would have to argue by fallacy of composition.⁸⁶ Schaffer does not avoid this, and not merely because nomic fundamentalism leads him to say that *since* these laws are only approximately true of the parts, *therefore* they must be strictly true of the whole.⁸⁷ His view also rests on the claim that the

universe, unlike its sub-domains, is the only perfectly closed system. However, a “closed system” is first known as an idealized consideration of only a part of the universe. Therefore, making an idealized “closed system” of the universe is possible only by composition.⁸⁸ So, at best we have a disjunction: either physical laws are strictly true of idealized, “closed” subsystems of the universe and only approximately true of the concrete whole (e.g., as Aristotelians and Thomists argue), or the physical laws are strictly true of the whole and approximately verified in its parts (as Schaffer would have it). Schaffer begs the question by this undefended assumption about how we can abstractly conceive of an idealized universe as a whole.⁸⁹

III.B. Simons

The Aristotelian-Thomist can agree with Simons that the universe must be defined, in part, as a plurality of realities found in many categories. However, disagreement arises regarding whether the universe is a unified cosmos. Simons claims: “For all we metaphysicians know or need to know there may be regions of being which are and forever will remain causally or even spatiotemporally inaccessible from here.”⁹⁰ He cites Platonism and David Lewis’ modal realism as examples. For his part, Simons maintains that metaphysics can only establish a minimalistic notion of “universe” as a simultaneously existing, empirical plurality of objects.⁹¹ This view is insufficient, first of all, because it solves deep disagreements among various metaphysical schools through mere definition.⁹² Furthermore, Simons also claims that

it is clearly no part of the metaphysician’s task to discover whether the universe is a system of a particular sort, or several systems, or none. That is the job of empirical

scientists to discover and explore.⁹³

This implies that it is the job of *cosmology* to settle the question of whether multiverses exist or not.⁹⁴ However, the multiverse—whether in cosmology or quantum physics—is not a scientific conclusion but a philosophical claim.⁹⁵ One reason for this is that the existence or non-existence of the multiverse cannot be settled through the empirical methods of cosmology.⁹⁶ By contrast, the Aristotelian-Thomist can maintain that there are routes by which the philosopher could address the unity of the universe; the route we have seen is through natural philosophy.⁹⁷

III.C. Kant

It should be clear that the Aristotelian-Thomist can agree with Kant that the universe *as such* is not an object given to us in our immediate sense experience. Its existence can only be grasped after a process of reasoning. However, this does not necessitate the view that the universe is only a regulative idea.⁹⁸ The difference between the Thomist and the Kantian lies in their opposed views of the nature of reasoning and understanding. Aquinas distinguishes reasoning from simple understanding, and claims that in both ways we know realities.⁹⁹ *Ratio* stands to *intellectus* as motion to rest, or as the circle to its center, or as time to eternity. Reasoning begins and ends with understanding, and so reasoning can lead to a deeper, unified understanding of a multitude, whether merely as a unity or in its real unity. Reason can also approach an understanding of the same reality under diverse modes of consideration. By distinguishing the imperfect from the perfect way to discover the notion of the universe, we have indicated how this would be the case for the Thomist.¹⁰⁰

In lieu of a critique of Kant's *Critique*, we will answer Kant's analogy with one of our own.

The universe is as the unity of a circle, which is caused by its principles (namely, its center and radius). Imagine that we were the miniature—but not infinitesimal—mathematical inhabitants of a circle’s circumference. Through careful empirical measurement and geometric reasoning we could discover the real unity of the circle without ever visiting its center. Analogously, we discover the principles of unity to the universe by reasoning in general natural philosophy. Once they are known, we use these principles to form an idea of the universe as a unity of order. In this way, one can have a true, speculative idea of the universe, and not merely a pragmatic or platitudinous one. We could thereupon deepen our understanding through the science of cosmology. Nevertheless, “the fact that we cannot simultaneously grasp a whole and its parts shows the difficulty involved”¹⁰¹ in grasping the true idea of the universe.

IV. Conclusion

Apart from inquiry into the generalities of nature, a perennial question facing the human mind is the existence and nature of the total concrete order of being, the universe. The alternatives we have presented are among the answers to the question “What is the universe?”, answers that have taken various forms throughout history. I have attempted to outline how the universe is correctly discovered in Aristotelian-Thomistic general natural philosophy. Perhaps these arguments also instill some vigor into the old Thomistic position that “the proper perfection of the ensemble of the universe consists in the unity of the coordination of its parts.”¹⁰² By rediscovering the universe in natural philosophy, I hope to have shown its perennial relevance for cosmology.

Endnotes

¹ This paper was written as part of my postdoctoral research project, supported by a grant from CONICYT, FONDECYT, Postdoctoral Proj. No. 3170446. The author gratefully acknowledges this financial support and the faculty and staff of his home institution, Pontificia Universidad Católica de Chile, Instituto de Filosofía. Research for this paper was also conducted at the University of Notre Dame, as a guest of the John J. Reilly Center for Science, Technology and Values and the Jacques Maritain Center, and the author thanks Anjan Chakravartty, John O’Callaghan, and their staffs for their support and hospitality during that visit. For their comments on earlier drafts of this paper, which have greatly improved its quality but not eliminated any errors remaining due to the stubbornness of its author, I thank Marina Brungardt, Christopher Blum, Daniel Lendman, Timothy Kearns, Andrew Seeley, and Thomas McLaughlin. I also thank the audience of the colloquium at the Center for Thomistic Studies at the University of St. Thomas, Houston, for their questions and comments during a presentation of an earlier version of this paper. Finally, in gratitude for his advice, insight, and friendship, I dedicate this paper to Tom McLaughlin.

² See Stanley L. Jaki, “Thomas and the Universe,” *The Thomist: A Speculative Quarterly Review* 53.4 (1989): 545. Those critiqued include D’Arcy, Copleston, Sertillanges, Maritain, Garrigou-Lagrange, and Gilson.

³ Ibid. Jaki’s own work includes detailed studies of scientists and philosophers who fail to attend to this central theme of the universe as such. These include his *God and the Cosmologists*, 2nd ed. (Pinckney, MI: Real View Books, 1998) and *Is There a Universe? The Forwood Lectures for 1992* (Liverpool: Liverpool University Press, 1993). One should also consult his older *The Paradox of Olbers’ Paradox: A Case History of Scientific Thought* (Pinckney, Mich.: Herder and Herder, 1969), which is the ur-source for many of his later concerns.

⁴ See Jaki, “Thomas and the Universe,” 571–72 for the complete peroration. As for his comparison to Aquinas, he uses as an example Aquinas’ comments regarding God’s free choice about the contingent, quantitative details of the universe, see *ibid.*, 567, referring to St. Thomas’s discussion in the corpus of *De potentia*, q. 3, a. 17.

⁵ In an article fifty years ago entitled “Philosophies of Nature,” Ernan McMullin categorized the various approaches to natural philosophy in three ways, based upon whether its proponents claim a source of warrant or evidence independent of the natural sciences, dependent upon them, or a mix of the two; see Ernan McMullin, “Philosophies of Nature,” *The New Scholasticism* 43.1 (1969): 29–74. A recent reconsideration and critique of this article’s main argument is found in Christopher O. Blum, “Nature and Modernity: Can One Philosophize about Nature Today?” *Proceedings of the American Catholic Philosophical Association* 91 (2017): 51–62. McMullin placed the Aristotelian, and presumably also the Thomistic, approach within the first category (natural philosophies with an independent warrant). Is this in fact the case? Charles De Koninck and William Wallace, for instance, argue convincingly for something closer to the third, “mixed” category. For a treatment which anticipated McMullin’s and serves effectively as a critique, see Charles De Koninck, “The Unity and Diversity of Natural Science,” in *The Philosophy of Physics*, ed. by V. E. Smith, 5–24 (New York: St. John’s University Press, 1961). See also William A. Wallace, *The Modeling of Nature: Philosophy of Science and Philosophy of Nature in Synthesis* (Washington, DC: The Catholic University of America Press, 1996), 227, 235.

⁶ It would be the burden of a different paper to defend the existence and nature of this most general and first “part” of natural philosophy as a whole; see John G. Brungardt, “The *Primum Mobile* in the Thomistic Aristotelianism of Charles De Koninck: On Natural Philosophy as Architectonic,” Ph.D. Thesis, The Catholic University of America, 2016; hereafter, “On Natural Philosophy as Architectonic.” “General natural philosophy” studies mobile being as such, prior to the more particular considerations of the species of natural philosophy such as cosmology, chemistry, biology, etc. This can be seen from St. Thomas in his *prooemium* to his commentary on the *Physics* and is a view followed by other commentators, such as John of St. Thomas. See St. Thomas, *In Phys.*, lib. 1, lect. 1, n. 4: “Hic autem est liber *Physicorum*, qui etiam dicitur *de Physico* sive *Naturali Auditu*, quia per modum doctrinae ad audientes traditus fuit: cuius subiectum est ens mobile simpliciter.” (Leon.2.4) Also, John of St. Thomas (Poinsot) *Cursus Philosophicus Thomisticus, Volumen II: Physica*, Pars I, ed. by B. Reiser (Taurini: Marietti, 1930–37) 8: “The material subject or object belonging to [natural philosophy] is natural or mobile body, while the formal object is explicated through mobile being or the mobile as such.” (The translation is my own.) In his *prooemium*, Averroes compares this part of natural philosophy to elements or roots, see Steven Harvey, “The Hebrew Translation of Averroes’ *Prooemium* to His ‘Long Commentary on Aristotle’s *Physics*,’” *Proceedings of the American Academy for Jewish Research* 52 (January 1, 1985): 81: “The relation of [the *Physics*] within natural science is the relation of the elements of a thing to the thing. This book includes those things that are the principles and roots, which are common to whatever the student of this science wishes to discuss.” The Coimbra commentary notes that some consider general natural philosophy to be a mere metaphysical “vestibule” that one enters before the natural sciences, such that “physics” really begins with cosmology in the *De Caelo*; see *Commentariorum Collegii Conimbricensis Societatis Iesu, In Octo Libros Physicorum Aristotelis Stagiritae, Pars Prima* (Coloniae: Lazarus Zetznerus, 1625), q. 5, a. 7, pp. 50–51. The reply is that general natural philosophy is not metaphysical due to the nature of the abstraction involved.

⁷ Ernan McMullin, “Is Philosophy Relevant to Cosmology?” *American Philosophical Quarterly* 18.3 (1981): 177–89; see 187: “The Aristotelian, or broadly empiricist, approach is to assume that the knower can formulate on the basis of his everyday experience some very general principles in regard to motion, cause, space and the like. Because the categories employed are understood in a non-problematic way and are validated by even the simplest experiences of the world, the principles take on the character of very general truths about the world.”

⁸ *Ibid.*, 181.

⁹ Answering this critique, and preventing a lack of “depth” in Thomistic natural philosophy, is central to the work of Charles De Koninck. For representative writings, see his “Les sciences expérimentales sont-elles distinctes de la philosophie de la nature?” *Culture* 2.4 (1941): 465–76, translated in *The Writings of Charles De Koninck: Volume One*, ed. and trans. by R. McInerny (Notre Dame, IN: University of Notre Dame Press, 2008); as well as Charles De Koninck, “Introduction à l’étude de l’âme,” *Laval théologique et philosophique* 3.1 (1947): 9–65. De Koninck’s transition from a view akin to Maritain’s, maintaining the separation of natural philosophy and science, to their continuity is discussed in my article “Charles De Koninck and the Sapiential Character of Natural Philosophy,” *American Catholic Philosophical Quarterly* 90, no. 1 (2016): 1–24.

¹⁰ Raymond J. Nogar, “Cosmology Without a Cosmos,” in *From an Abundant Spring: The Walter Farrell Memorial Volume of The Thomist*, ed. by W. Farrell (New York: P.J. Kenedy & Sons, 1952), 390, 391; William A. Wallace, “Thomism and Modern Science: Relationships Past, Present, and Future,” *The Thomist* 32, no. 1 (1968): 67–83, makes a similar assessment of Thomistic natural philosophy in the late 19th and early 20th centuries, at 77: “Thus begins Thomism’s uneasy rapprochement with contemporary thought: Thomistic cosmology, now recognized as ‘without a cosmos,’ is restricted to a few generalities, and Thomism itself is seen as a magnificent synthesis, erected on simple sense observation alone, and standing in complete independence of modern science.” Finally, Oliva Blanchette, *The Perfection of the Universe According to Aquinas: A Teleological Cosmology* (University Park, PA: Pennsylvania State University, 1992), 3, notes that the dominant tendency among Thomistic treatments is to separate Aquinas’ philosophy of being from his philosophy of the universe.

¹¹ José Benardete, *Infinity: An Essay in Metaphysics* (London: Oxford University Press, 1964), 102 (includes the prior quotation).

¹² This is clear from the *prooemium* to his commentary on Aristotle's *De Caelo*, prooem., n. 5:

“Constituitur autem universum corporeum ex suis partibus secundum ordinem situs: et ideo de illis solum partibus universi determinatur in hoc libro, quae primo et per se habent situm in universo, scilicet de corporibus simplicibus.” (Leon.3.3)

¹³ It should also be clear that this argument does not concern “possible worlds.” The philosopher’s imagination-laden subreption in postulating possible worlds has been discussed and critiqued by others: see David S. Oderberg, *Real Essentialism* (London/New York: Routledge, 2009), 1–12, as well as James F. Ross, *Thought and World: The Hidden Necessities* (Notre Dame, IN: University of Notre Dame Press, 2008), 23–43.

¹⁴ See St. Thomas Aquinas, *In I Sent.*, d. 44, q. 1, a. 2, ad 2: “[O]mnes res, prout modo sunt in suo complemento, dicuntur unus mundus, vel unum universum.” Also, *In De Caelo*, lib. 1, l. 2, n. 11: “Et dicit quod totum, idest universum, cuius partes sunt particularia corpora, necesse est quod sit perfectum omnibus modis; et sicut ipsum nomen universi significat, omniquaque, idest omnibus modis, perfectum, et non secundum unum modum ita quod non secundum alium: quia et habet omnes dimensiones, et comprehendit in se omnia corpora.” The Latin of Aquinas is taken from the electronically curated texts of Enrique Alarcon, url: <www.corpusthomisticum.org>; however, the Leonine will also be cited for translated quotations from Aquinas.

¹⁵ St. Thomas Aquinas, *ScG*, II.39: “Forma autem universi consistit in distinctione et ordine partium eius.”

¹⁶ St. Thomas, *In Div. Nom.*, 7.4: “Deinde, cum dicit: *et quidem . . .* manifestat quoddam quod dixerat, scilicet quod Deus ex omnibus cognoscatur; et dicit quod ideo est, quia ipsa divina sapientia est omnium causa effectiva, inquantum res producit in esse et non solum rebus dat esse, sed etiam esse cum ordine in rebus, inquantum res invicem se coadunant in ordinem ad ultimum finem; et ulterius, est causa indissolubilitatis huius concordiae et huius ordinis, quae semper manent, qualitercumque rebus immutatis.”

¹⁷ See Jonathan Schaffer, “Spacetime the One Substance,” *Philosophical Studies* 145.1 (2009): 131–48; “Monism: The Priority of the Whole,” *Philosophical Review* 119.1 (2010): 31–76; “The Internal Relatedness of All Things,” *Mind* 119.474 (2010): 341–76; and finally, “The Action of the Whole,” *Aristotelian Society Supplementary Volume* 87.1 (2013): 67–87. For reasons of space, we focus on the articles from 2009 and 2013.

¹⁸ See Schaffer, “Monism,” 66: “If *Existence Monism* holds, then the cosmos is the only actual concrete object.”

¹⁹ Ibid.

²⁰ See Tuomas E. Tahko, “Disentangling Nature’s Joints,” in *Neo-Aristotelian Perspectives on Contemporary Science*, ed. by W. M. R. Simpson, R. C. Koons, and N. J. Teh, 147–66 (New York: Routledge, 2017), 148: “For Schaffer, ‘substance’ is a fundamental entity, but Schaffer’s monism does not deny that there could be other ‘things’ in the world, it’s just that those ‘things’ are not (fundamental) substances, but rather mere arbitrary parts of the cosmos. So, the view is that the cosmos, the integrated whole, is ontologically prior to these arbitrary parts.”

²¹ See Bas C. van Fraassen, “‘World’ Is Not a Count Noun,” *Noûs* 29, no. 2 (1995): 141; also see his reworked and expanded remarks on this theme in *The Empirical Stance* (New Haven: Yale University Press, 2002), 1–30, titled “Against Analytic Metaphysics,” at 7. Schaffer cites John Earman, *World Enough and Space-Time: Absolute vs. Relational Theories of Space and Time* (Cambridge, MA: MIT Press, 1989), 115, in support (See Schaffer, “Spacetime,” 142): “Modern field theory is *not implausibly read as saying* the physical world is fully described by giving the values of various fields, whether scalar, vector, or tensor, which fields are attributes of the space-time manifold M.”

²² This leaves out various of Schaffer’s metaphysical and mereological arguments which develop his account of priority monism. However, these arguments are further from the Thomistic starting point in natural philosophy and would require separate arguments to address them. The three arguments indicated from the sciences and the nature of physical law are more commensurable with our approach here since they are based upon common ground that we must both assume; they thus make better adversaries.

²³ See Schaffer, "Spacetime," 142. He quotes John Norton approvingly, *ibid.*: "Similarly Norton notes: 'a spacetime is a manifold of events with certain fields defined on the manifold. The literal reading is that this manifold is an independently existing structure that bears properties.'"

²⁴ See *ibid.*, 143: "Fundamental physics does not need to explain why, for instance, the geometrical properties of material objects are a perfect fit for the geometrical properties of the spacetime regions they occupy, for the equations do not posit anything distinct from regions."

²⁵ Schaffer, "The Action of the Whole," 72; emphasis in original.

²⁶ *Ibid.*, 67.

²⁷ *Ibid.*

²⁸ *Ibid.*

²⁹ *Ibid.*, 74: "The cosmos is the whole material universe. The existence of such a thing claims intuitive and empirical support. Intuitively, the cosmos is hardly a strange fusion undreamt of by the folk, but is an entity for which natural language supplies a singular term. Empirically, the cosmos is an entity posited in physics, and indeed the subject of cosmology, which Hawley and Holcombe characterize as 'the study of the formation, structure, and evolution of the universe as a whole.' Only the most radical views of mereological composition, contravening both intuition and science, could refuse the cosmos." This is, again, contrary to what some analytic metaphysicians would prefer; see the works of Van Fraassen cited above.

³⁰ *Ibid.*, 74, and see 75: "One cannot correctly specify independent evolutions of distinct subsystems first, and then patch together the dynamics of the whole. We can only specify evolutions in the context of the whole system. The evolutions of subsystems are thus to be understood as derivative abstractions from the fundamental evolution of the whole system." Note that it is a strength of Schaffer's position that he attributes to substances something along the lines of behavior belonging to them primarily and essentially, which the Aristotelian and Thomist can immediately recognize and subsequently work with.

³¹ Ibid., 77: “A third reason supporting Russellian Laws comes from conservation laws, which only apply to the whole. No subsystem need be conservative so long as the remainder ‘compensates.’ . . . Indeed, by Noether’s theorem, conservation laws can be understood as space-time symmetries, where a symmetry is an invariance under certain global transformations. Such laws are global by construction.” Note that the first two reasons which Schaffer provides, that only the cosmos is dispositionally and actually immune from disruption (as the only closed system), are antecedent conditions for the third reason (if the cosmos is dispositionally and actually the only undisruptable system, then conservation laws will be true of it). So, if the first two reasons fail, then the third will also. I return to this in the reply to Schaffer’s view.

³² See Peter Simons, “The Universe,” *Ratio* 16.3 (2003): 236–50; consider also a reply by Achille C. Varzi, “The Universe Among Other Things,” *Ratio* 19.1 (2006): 107–20.

³³ See Van Fraassen, “‘World’ Is Not a Count Noun,” as well as *The Empirical Stance*, 19, 24–25.

³⁴ Simons, “The Universe,” 237: “A transcategorial sum is odd,” says Simons, “because it has parts in different categories, so either it itself belongs to one of these categories, or it does not.”

³⁵ See *ibid.*, 238, where Simons also argues that it cannot be a “proper class,” because if the class is an individual, “then it is either concrete, in space and time, or abstract. If it is abstract, we have the same problem we had with the universal set. If it is concrete, then most plausibly it is a mereological sum, as before.”

³⁶ See *ibid.*, 238.

³⁷ See *ibid.*, 239.

³⁸ See *ibid.*, 240.

³⁹ *Ibid.*, 247.

⁴⁰ See Simons, “The Universe,” 248: “It is not part of the metaphysician’s calling to pronounce on whether the universe actually is or is not a single connected system, at least not in any physico-cosmological sense.”

⁴¹ See *ibid.*, 249, quoted in my reply, below.

⁴² Immanuel Kant, *The Critique of Pure Reason*, trans. P. Guyer and A. Wood (Cambridge University Press, 1999) A677/B705: “The concepts of reality, substance, causality, even that of necessity in existence have, beyond their use in making possible the empirical conception of an object, no significance at all which might determine any object. They can therefore be used for explaining the possibility of things in the world of sense, but not the possibility of a world-whole itself, because this ground of explanation would have to be outside the world and hence it would not be an object of a possible experience.”

⁴³ Jaki, “Thomas and the Universe,” 558.

⁴⁴ Since the world is not an object of possible experience, and only these are objective for Kant, the world is not objectively real; see Benardete, *Infinity*, 110. Consequently, and counterintuitively, I cannot truly say that I am an object “in” the world, although *practically speaking* I can assume that this is true.

⁴⁵ Kant, *Critique of Pure Reason*, A644/B672.

⁴⁶ Kant discusses this optical phenomenon in his pre-critical *Dreams of a Spirit-Seer Elucidated by Dreams of Metaphysics*, see *Theoretical Philosophy (1755–1770)*, trans. and ed. by D. Walford and R. Meerbote (Cambridge/New York: Cambridge University Press, 1992), 331–34 (AK 2:344–46). For a lucid explanation by one of Kant’s contemporaries, see Leonhard Euler (c. 1760–62) in *Letters of Euler on Different Subjects in Physics and Philosophy Addressed to a German Princess*, trans. H. Hunter, 2nd ed., vol. 2 (London: H. Murray, 1802) Letter 83, 330–31.

⁴⁷ Charles De Koninck, “Un paradoxe du devenir par contradiction,” *Laval théologique et philosophique* 12, no. 1 (1956): 10–11.

⁴⁸ See Aristotle, *Physics*, I.1. Unless indicated, quotations or references are from *The Complete Works of Aristotle: The Revised Oxford Translation, One-Volume Digital Edition*, ed. by J. Barnes (Princeton, NJ: Princeton University Press, 2014).

⁴⁹ Although they are distinct processes; See Charles De Koninck, “Introduction à l’étude de l’âme,” *Laval théologique et philosophique* 3, no. 1 (1947): 23–27, for an articulation of their distinction.

⁵⁰ St. Thomas, *In Phys.*, lect. 1, n. 4; see also Aristotle, *Posterior Analytics*, I.6, 75a29–37. The clearest exposition of this demonstration, that every mobile must be divisible and hence a body, is given in Marcus R. Berquist, “The Proof of the First Mover in *Physics* VII, 1,” *The Aquinas Review* 17 (2010): 44–70; see also Richard F. Hassing, “Thomas Aquinas on *Physics* VII.1 and the Aristotelian Science of the Physical Continuum,” in *Nature and Scientific Method*, ed. by Daniel O. Dahlstrom, vol. 22. *Studies in Philosophy and the History of Philosophy* (Washington, DC: Catholic University of America Press, 1991), 127–57. Recently, interest in the proof has been revived by Travis Dumsday, “Atoms, Gunk, and God: Natural Theology and the Debate over the Fundamental Composition of Matter,” *The Thomist: A Speculative Quarterly Review* 80, no. 2 (2016): 227–71, see 236–39.

As is well known, St. Thomas is disagreeing with St. Albert here, and as William Wallace points out, it is St. Albert’s view that was taught to Isaac Newton as an undergraduate, and which Newton took up, although in mathematical form, in his *Principia*. See William A. Wallace, “Newton’s Early Writings: Beginnings of a New Direction,” in *Newton and the New Direction in Science*, ed. by G. V. Coyne, S.J., M. Heller, and J. Zyncinski (Citta del Vaticano: Specola Vaticana, 1988), 25–27, which discusses a passage from Newton’s student notebook about the *Physiologia Peripatetica* of John Magirus. Wallace notes, 27: “Newton’s entry . . . to the effect that the subject of physics is ‘the natural mobile body’ represents a controversial teaching. Thomas Aquinas held, contrary to Albertus Magnus, that this subject was mobile being (*ens mobile*) on the ground that its being ‘a body’ could be demonstrated. . . . Magirus discusses these and other opinions in his commentary, and attributes his teaching to the *recentiores* (i.e., the moderns), for which he cites Zabarella. . . . Newton, typically, shows no awareness of the problem and merely states Magirus’s resolution of it.”

⁵¹ To show this by a contrasting sign, histories of 20th-century cosmology such as *The Day We Found the Universe*, by Marcia Bartusiak (New York: Vintage Books, 2010), highlight the idea that modern cosmology seeks to discover principles of the universe in a determinate way, and thereby cosmologists know the universe more distinctly than they did before, thanks to their models and observations. However, this seemingly paradoxical idea is already well-understood by the Aristotelian-Thomistic logic of science; as De Koninck observes in “Abstraction from Matter: Notes on St. Thomas’s Prologue to the Physics (I),” *Laval théologique et philosophique* 13, no. 2 (1957): 146: “There is, then, no contradiction in saying, on the one hand, that students should know ‘from the very beginning of their course. . . what the science is about,’ and, on the other hand, that ‘the last thing to be discovered in any science is what the science is really about.’” De Koninck quotes A. N. Whitehead, although he utilizes the idea to exhibit the Aristotelian understanding of a science’s subject.

⁵² See Aristotle, *Posterior Analytics*, II.1, and II.8.

⁵³ This comparison is discussed by De Koninck, “Introduction à l’étude de l’âme,” 54–63; as well as Jean-Baptiste Échivard, *Une introduction a la philosophie. Les proemes des lectures de saint Thomas d’Aquin aux oeuvres principales d’Aristote*, vol. 1, *L’esprit des disciplines philosophique fondamentales*, and vol. 2, *Science rationnelle et philosophie de la nature* (Paris: François-Xavier de Guibert, 2004). In the *De Caelo* prooemium itself, in an extensive, two-part, four level analysis, St. Thomas compares the order which ought to be followed in practical reason to the order of speculative reason. The result is that speculative reason, in its various considerations of some subject, ought to proceed from what is more common to what is less common, from the whole to the parts, from the simple to the composed, and from principal to secondary parts. Consider the first, where speculative reason proceeds from the more to the less common in some subject. What is discovered about mobile being in general in the *Physics* must be applied to the various subject parts of natural philosophy in a more determinate way; cosmology, in particular, must apply these general considerations to all locally mobile bodies. The other three orders of speculative reason—from whole to parts, simples to composites, and principal to secondary parts—are carried out within cosmology so as to more determinately know its subject, the universe. St. Thomas describes the first order as follows, *In De Caelo*, Prooem., n. 3: “For first one determines about the common things of nature in the book of the *Physics*, in which the mobile insofar as it is mobile is treated. Whence it remains in the other books of natural science to apply [*applicare*] these common things to the proper subjects. The subject of motion, however, is magnitude and body, because nothing moves unless it has quantity. . . . And thus [the *De Caelo*] is reasonably placed first in order after the *Physics*. Because of this, body is immediately considered at the beginning of this book, to which it is necessary to apply [*applicari*] all those things which were related about motion in the book of the *Physics*.” (Leon.3:2; the translation is my own.)

⁵⁴ Again, see De Koninck, “Introduction à l’étude de l’âme,” 23–27, for an articulation of the difference between the processes of determination and demonstration. The specification of the subject of cosmology would be arrived at by determination *a posteriori*, and the subject of cosmology, the universe, seen more clearly in light of the arguments (whether demonstrative or dialectical) in that science.

⁵⁵ If successful, this would in part—and only in part—address McMullin’s concern that Aristotelian natural philosophy gives us nothing but generalities of space, time, and causality. We still end up with generalities, but of a character that helps us determine the universe in our conceptions, not merely a conceptual array. One can also determine the natural philosophical grounds of the universe by taking a broad view of hylomorphism, but this is done in close conjunction with cosmology, and hence is not theoretic activity antecedent to but posterior to cosmology. This latter route is taken in John G. Brungardt, “World Enough and Form: Why Cosmology Needs Hylomorphism,” *Synthese* (Online First, February 6, 2019), Special Issue: Form, Structure, and Hylomorphism; <https://doi.org/10.1007/s11229-019-02112-0>.

⁵⁶ I recognize that separate arguments would be necessary to address proponents of these views.

⁵⁷ Topology was originally called *analysis situs* by Euler, and the Aristotelian and medieval notion of *situs* works well here; see St. Thomas, *In Phys.*, lib. IV, lect. 7, n. 4, and lib. III, lect. 5, n. 15. Something that is unified topologically has a single *situs* or arrangement of its parts. Modern geometers distinguish a hierarchy of structure in space; see Tim Maudlin, *Philosophy of Physics: Space and Time*, Princeton Foundations of Contemporary Philosophy, vol. 5 (Princeton, NJ: Princeton University Press, 2012), 5–8, for a discussion of this structure in the object of geometry and the difference between topological, affine, and metric structure. The topological structure of a manifold is the manner in which its set of points is connected, connectable, or continuous. The notion of “topological” adopted in my argument only requires the level of structure given by this connectedness (e.g., drawing a continuous line with a pencil).

⁵⁸ Consider Aristotle, *Physics*, IV.4, 212a15–21.

⁵⁹ The structure of place in the cosmos can be calculated by cosmologists against the comoving reference frame of cosmic background radiation; see George F. R. Ellis, Roy Maartens, and Malcolm A. H. MacCallum, *Relativistic Cosmology* (Cambridge University Press, 2012), 20–21: “Observationally, the 4-velocity of such a family [of fundamental or comoving observers] can be determined either (a) by measuring the motion of matter in an averaging volume (e.g., a local cluster of galaxies) and determining a suitable average of those motions, or (b) from the CMB [cosmic microwave background] anisotropy measurements. There is a preferred frame of motion in the real universe such that the radiation background is (approximately) isotropic; this is a classic case of a broken symmetry (the solution breaks the symmetry of the equations). [One cannot observe this velocity from within an isolated box, e.g. if closed off in a laboratory with no windows; thus this does not violate the principle of special relativity.] We move with almost that preferred velocity, which can be dynamically related to that of the matter present in the universe (the ‘Great Attractor’ is thought to be responsible for our own peculiar velocity relative to the cosmological background). Our usual assumption is that the matter and CMB velocities agree.” (The previous quote incorporates text from a footnote in brackets.) What exactly is a “broken symmetry”? Why this emphasis upon “the real universe”? See George F. R. Ellis and Ruth M. Williams, *Flat and Curved Space-Times*, 2nd ed. (Oxford/New York: Oxford University Press, 2000), 236: “The basic idea is that *particular solutions to the laws of physics in general do not have the same symmetries as the laws themselves*. Thus in the case of cosmology, as has been emphasized at the end of Section 3.1, there is a preferred rest frame in cosmology, defined by the CBR. This breaks the Lorentz invariance of the laws of physics, expressed via relativity theory But that invariance of the laws themselves does not mean that solutions of the gravitational equations will also have that symmetry, so there is no contradiction. There is indeed a preferred rest frame in the universe, and we are close to such a rest frame (we are moving at about 300km/sec relative to it). This will happen in any solution where the existence of matter defines a local rest-frame, so it is not very mysterious, but it is still important to realize that this is indeed the situation.”

⁶⁰ Here, I borrow arguments made by Richard Swinburne and Glen Coughlin. See Richard Swinburne, “Verificationism and Theories of Space-Time,” in *Space, Time and Causality*, ed. R. Swinburne, Royal Institute of Philosophy Conferences 157 (Dordrecht: D. Reidel, 1983), 63–76; and R. Glen Coughlin, “The Existence and Nature of Time,” *The Aquinas Review* 16 (2009): 119–61, and his follow-up article, “The Ground and Properties of Time,” *The Aquinas Review* 19 (2013-2014): 23–78, especially 72–73.

The argument I present adds a distinction, however (which seems to me necessary in order to avoid equivocation), between the “now” defined by co-enduring parts and the “now” of a causal process.

However, these two must be related in some way, if only because the duration and “now” of co-enduring parts of substance is entirely manifested and measured through the change of accidents measured by time and its “now.” That is, the simultaneity is topological and not metric; see n. 66 below. I thank Joseph Cosgrove for his helpful comments on this subject, via personal communication.

⁶¹ See Aristotle, *Categories*, ch. 6, 5a25ff. One might object that this begs the question against the block universe view, where the parts of time *do have* relative position to each other. However, the block universe account is most congenial to an “at-at” analysis of motion, which is denied by my assumption of the Aristotelian definition of motion. Here, one should consider Edward Feser, “Actuality, Potentiality, and Relativity’s Block Universe,” in *Neo-Aristotelian Perspectives on Contemporary Science*, ed. by W. M. R. Simpson, R. C. Koons, and N. J. Teh, (New York: Routledge, 2017), 35–60.

⁶² Note that one might object here that the “now” defined from this co-endurance is not the same as the “now” of time, which measures a motion, not extended parts. The answer is to connect the existence of parts of substance (which parts are *not* motions) to the time which measures their motion (which *is* a fluctuating being, the measure of motion). This is done through agent causality.

⁶³ Again, this “now,” defined by enduring parts, is not yet the “now” of time as the measure of motion, although the former seems the necessary foundation of the latter. One could also make a *reductio* argument here, as does Coughlin, “The Ground and Properties of Time,” 71: “If two times existed, they obviously could not be simultaneous, nor could they be before or after each other. And if two times have no shared before’s and after’s, they would be the counted before’s and after’s, i.e., the counted dispositions, of two motions, dispositions which would stand in no relation to each other. How, then, would we speak of them?” Or, Coughlin goes on to add, even know them?

⁶⁴ See Albert Einstein, *Relativity: The Special and General Theory, A Popular Exposition*, trans. by R. R. Lawson (New York: Wing Books, 1961) 26ff. Also, see Coughlin, “Appendix 9: Time,” 271 in his translation of Aristotle’s *Physics, or Natural Hearing* (South Bend, IN: St. Augustine’s Press, 2004). Swinburne, “Verificationism and Theories of Space-Time,” 70–72, offers a similar argument. A similar view is expressed by Roberto Mangabeira Unger and Lee Smolin. *The Singular Universe and the Reality of Time: A Proposal in Natural Philosophy* (Cambridge: Cambridge University Press, 2014), 418: “The assertion that what is real is real in a moment conflicts with the relativity of simultaneity according to which the definition of simultaneous but distant events depends on the motion of an observer. Unless we want to retreat to a kind of event or observer solipsism in which what is real is relative to observers or events, we need a real and global notion of the present.” This “observer solipsism” is also described by Arthur S. Eddington, “Physics and Philosophy.” *Philosophy* 8.29 (1933): 35: “By limiting the sensory equipment of our observers, we do a great deal to prevent their quarreling. . . . He removed all the retina except one small patch. The observer could no longer recognize form or extension, but he could tell whether two things were touching or not—whether two points were distinct or in apparent coincidence.” For further consideration of this “solipsism” (whether point-like or “local”) and how it undermines the reality of becoming, see Joseph K. Cosgrove, *Relativity without Spacetime* (New York, NY: Springer Science+Business Media, 2018), 172–76. See n. 66 for more.

⁶⁵ Put in other terms, objects at a space-like separation—as opposed to time-like separation—in relativistic spacetime diagrams exhibit this property of an unobservable simultaneity that extends throughout the universe. That is, the simultaneity is topological, not metric; *aging is frame-relative, but simultaneity is not*, to borrow Joseph Cosgrove’s helpful phrase (personal communication). The measured rate of time must be grounded in the causal powers at work. Some philosophers of physics, apart from Aristotelian or Thomists, also note the need for a causal process to define time, and not a mere phenomenological connection of time to motion. Thus, Harvey Brown argues, even Einstein’s definition of time is merely a “principle” account, and lacks a constructive account from underlying causes. That is, Einstein does not tell us how to measure time in his system by constructing a physical clock using the principles of relativity. See Harvey R. Brown, *Physical Relativity: Space-Time Structure from a Dynamical Perspective* (Oxford: Clarendon Press, 2005), and see Marco Giovanelli, “‘But One Must Not Legalize the Mentioned Sin’: Phenomenological vs. Dynamical Treatments of Rods and Clocks in Einstein’s Thought,” *Studies in History and Philosophy of Science Part B: Studies in History and Philosophy of Modern Physics* 48 (2014): 20–44.

⁶⁶ A single time for the cosmos seems both required for a realistic interpretation of the age of the universe and mathematically permissible on certain novel approaches to relativity: See Unger and Smolin, *The Singular Universe*, 418–21; in particular, 420: “A global preferred time would have to be relational, in that it would be determined by the dynamics and state of the universe as a whole. It would thus not be determinable in terms of information local to an observer. Such a relational local time could then be consistent with the relativity of simultaneity holding locally in regions of spacetime.” The mathematical formalism that permits this is shape dynamics; see also Flavio Mercati, *Shape Dynamics: Relativity and Relationalism* (Oxford: Oxford University Press, 2018).

Cosgrove, *Relativity without Spacetime*, 169–72, argues for a different approach, by emphasizing the distinction between metric and topological simultaneity. These would have been only notionally distinct in Newton's case, but are really distinct in the general theory of relativity due to the local influence of the gravitational field (see *ibid.*, 170). He notes that empirical approaches (such as those mentioned in n. 59) presuppose (through the cosmological principle) the homogeneity and isotropy of the expanding universe. While this secures a global average of metric time due to becoming (and, I would add, the actualization of causal powers implied), this approach presupposes a global simultaneity, topologically speaking.

⁶⁷ See *Physics*, VII.1. The argument which Aristotle makes can be divided into two parts: a defense of its minor premise (241b34–242a49; *textus alter*: 241b24–242a15) and major premise (242a49–243a31; *textus alter*: 242a16–243a2). Again, the clearest exposition is given by Berquist, “The Proof of the First Mover in *Physics* VII, 1.”

⁶⁸ St. Thomas, *In Phys.*, lib. VII, lect. 1, n. 6 (Leon.2.323). The “first mobile” Aquinas considers is the counterfactual case of a mobile in motion primarily and *per se*, that is, in motion through no other thing.

⁶⁹ St. Thomas observes, *In Phys.*, lib. VII, lect. 2, n. 4, that Aristotle’s mode of argument takes as a contrary-to-fact supposition that the universe of all mobile bodies is a certain type of continuum: “Therefore, let one of these ways be taken, namely that from all the infinite mobiles and movers, one thing is made, *namely the whole universe itself*, through a certain kind of continuous stretch [*per continuationem quandam*].” Concerning the peculiarity of this denatured physical quantity, see Hassing, “Physical Continuum,” 125, fn. 45: “We thus have three kinds of magnitude: (1) mathematical continuum, (2) physical continuum, and (3) magnitude of a body of determinate nature. The latter cannot be divided to infinity without corrupting the nature in question. This threefold Aristotelian distinction was discussed among medieval commentators.” Hassing finds this in Pierre Duhem, *Medieval Cosmology: Theories of Infinity, Place, Time, Void, and the Plurality of Worlds*, ed. and trans. by R. Ariew (Chicago: University of Chicago Press, 1985) 35–45.

⁷⁰ Albert Einstein, “Ether and the Theory of Relativity,” in *The Genesis of General Relativity: Sources and Interpretations*, ed. by J. Renn, M. Schemmel, C. Smeenk, C. Martin, and L. Divarci, vol. 3, Boston Studies in the Philosophy of Science 250 (Dordrecht: Springer, 2007) 617; see also 618: “This spacetime variability of the reciprocal relations of the standards of space and time, or, perhaps, the recognition of the fact that empty space in its physical relation is neither homogeneous nor isotropic, compelling us to describe its state by ten functions (the gravitation potentials $g_{\mu\nu}$), has, I think, finally disposed of the view that space is physically empty.” This behavior of physical space would, in some way, make a *sui generis* type of motion, the expansion of space, prior even to local motion. (This expansion is not growth, since space does not assimilate from without, nor a local motion, since it does not expand into anything; the change in metric structure is closest to a qualitative alteration, but one which results in *having more space* and not a mere change of shape.) The agent causality of space, through this *sui generis* motion, would therefore be responsible for conditioning the *termini ad quos* to which local motions are ordered, for a motion is causally sustained both by its order to a *terminus*, whether actual or potential, and the agent cause of its motion. Thus, even if some places are merely potentially *termini*, they would exist within the power of physical space as an agency; this would address concerns in Coughlin, “The Existence and Nature of Time,” 150–51, about the completion of the universe as to its various places.

⁷¹ See Brungardt, “On Natural Philosophy as Architectonic,” 265–342.

⁷² This is equivalent to Jaki's notion, that what defines the universe is "its being the *totality* of consistently interacting things and their very unity." (Jaki, "Thomas and the Universe," 545.) "Consistently interacting things" is captured by "physical agent causality," and "their very unity" is expressed through causality and the twofold topology of the universe according to place and duration. Still, Jaki's notion has in view that "specification" and "coherence" which are further determinations added by cosmology itself, as I discuss next.

⁷³ Since this "unity of order" is principled by an agency of some kind, it must also be united by final causality. Thus, inquiries more specific than general natural philosophy would aim to discover in more detail the final causality that constitutes the universe's order.

⁷⁴ I draw these notions of coherence and specification from Jaki, "Thomas and the Universe." See 571 (for coherence): "By achieving a contradiction-free account of the totality of gravitationally interacting things, modern scientific cosmology implicitly discredits the very heart of Kantian agnosticism, the calling into doubt of the intellectual respectability of the notion of the universe." And *ibid.* (for specification): "In addition, by showing over the mind-boggling span of 70 orders of magnitude a most specific universe, modern scientific cosmology provides a powerful illustration of the contingency of the universe. Like any specific thing, the specific universe, too, has to be the result of a choice among a great many possibilities. But since the universe is the totality of things, the choice for its specificity can only be looked for 'outside' that totality where only God can be found."

⁷⁵ That is, a Newtonian universe of infinite size with a homogeneous distribution of matter could not exist, because the instantaneously transmitted gravitational pull across such a universe would be infinite. The alternative—limiting the size of the universe and fine-tuning the initial distribution of mass—would be an ad hoc modification that is not accounted for by the principles of Newtonian mechanics. See Stanley L. Jaki, “Thomas and the Universe,” 545–72, and his *Is There a Universe?* Jaki notes that a certain schizophrenia arose about “the all” from paradoxes that Newtonian physics generates. On the one hand, scientists pointed out the paradoxical character of an infinite, homogeneous universe, yet on the other hand, they did not bother to look for the reasons to explain how the universe exists as it does with the structure it has, but fell into thinking of the universe as infinite. The gravitational paradoxes were known even known to Newton. See Edward Harrison, “Newton and the Infinite Universe,” *Physics Today* 39.2 (1986): 24–32, and his *Darkness at Night: A Riddle of the Universe* (Harvard University Press, January 1989), 68–80. In the former (27–28, 29), he argues that Newton could have easily performed the calculations concerning how long the collapse of such systems would take, which depends upon the density of the sidereal system and not its volume, and suggests Newton would have arrived at a figure of approximately 100 million years. He then summarizes the paradox nicely, 29: “In a fixed element of solid angle the number of stars increases as the square of the radial distance, whereas each star exerts a pull inversely as the square of its distance. Hence in an infinite universe uniformly populated with stars the integrated gravitational force in any direction becomes infinitely great.” For similar discussions, see Alan Guth, *The Inflationary Universe: The Quest for a New Theory of Cosmic Origins* (Reading, Mass.: Addison-Wesley, 1997), 295–97, and Einstein, *Relativity*, 119–21.

⁷⁶ Although the standard cosmological model has paradoxes of its own; see Steven Weinberg, “The Cosmological Constant Problems (Talk given at Dark Matter 2000, February, 2000).” ArXiv:Astro-Ph/0005265, May 11, 2000; url: <<http://arxiv.org/abs/astro-ph/0005265>>.

⁷⁷ This claim about metaphysics must be developed at greater length in an article in preparation. First of all, the imperfect definition excludes created immaterial substances; proof of their existence would expand our notion of “universe” to all beings and modes of order, and not just all mobile beings and order arising from material substances. Second, the universe is more perfectly understood when seen as a created effect of God and not merely via the limited intelligibility provided through physical causes of motion. Third, the universe is more completely known when seen in light of its twofold common good, namely, seeing its intrinsic common good of order and its extrinsic, Divine common good; see Aristotle, *Metaphysics*, XII.10. This twofold common good provides a completion to the notion of the universe that is only partially available to natural philosophy insofar as it grasps the good of the universe through the teleology of the motions and generations of physical bodies and not through the immaterial principles of being as such. Fourth, the reason for the order of the universe can be defended by metaphysics insofar as that order is due to the universe being a likeness of God. St. Thomas proposes just such a “quasi-deduction” of the order in universe in *Summa contra Gentiles* III.97. It is name a “quasi-deduction” by L. B. Geiger, O.P., *La participation dans la philosophie de S. Thomas d’Aquin*, 2ème éd, Bibiothèque Thomiste 23 (Paris: Librairie Philosophique J. Vrin, 1953), 397n. Finally, only metaphysics could properly address the transcendental properties of universe: e.g., its unity, goodness, truth, and beauty.

⁷⁸ This has been discussed by Tuomas Tahko, who provides a convincing case against Schaffer’s “priority monism.” See Tuomas E. Tahko, “Disentangling Nature’s Joints.”

⁷⁹ A more nuanced understanding of the character of mathematical abstractions and utilizing them to model concrete realities avoids this. For instance, our proposals about physical space do not require that it is a physical substance colocated with other substances, but merely that the mathematics used to understand the relevant fields of cosmological models track a measurable substratum common to physical substances.

⁸⁰ Xavi Lanao and Nicholas J. Teh. “Dodging the Fundamentalist Threat,” in *Neo-Aristotelian Perspectives on Contemporary Science*, 15.

⁸¹ As argued by Lanao and Teh, above.

⁸² See Denis Noble, “A Theory of Biological Relativity: No Privileged Level of Causation,” *Interface Focus* 2.1 (2012): 55–64. The basic argument is that genomic parts are not sufficient to explain organic function; non-genomic parts are required, especially given about spatial arrangement and the boundary conditions of cell structure. See also Noble’s book, *Dance to the Tune of Life: Biological Relativity* (Cambridge: Cambridge University Press, 2016).

⁸³ We will not contest this understanding of physical law at present. One should consider Travis Dumsday, “Laws of Nature Don’t Have *Ceteris Paribus* Clauses, They Are *Ceteris Paribus* Clauses,” *Ratio* 26.2 (2013): 134–47, as well as the work of Nancy Cartwright in her *How the Laws of Physics Lie* (Oxford: Clarendon Press, 1983), *Nature’s Capacities and Their Measurement* (Oxford: Clarendon Press, 1989), and *The Dappled World: A Study of the Boundaries of Science* (Cambridge/New York: Cambridge University Press, 1999).

⁸⁴ See Edward R. Harrison, “Mining Energy in an Expanding Universe,” *The Astrophysical Journal* 446 (1995): 63–66; he also discusses it in his book *Cosmology: The Science of the Universe*, 2nd ed. (Cambridge: Cambridge University Press, 2000) 348–49; see also John Frederick Hawley and Katherine A. Holcomb, *Foundations of Modern Cosmology* (Oxford: Oxford University Press, 2005) 414–15.

⁸⁵ Schaffer, “The Action of the Whole,” 75.

⁸⁶ This is related to what Unger and Smolin call the “cosmological fallacy” based upon science’s constitution by the “Newtonian paradigm” of understanding nature. See *The Singular Universe*, 19–22, and 373, 375–77.

⁸⁷ See Schaffer, “The Action of the Whole,” 74–75.

⁸⁸ Apart from Cartwright’s work, the inadequacy of the mathematically ideal to understand the natural order is recognized by Unger and Smolin and discussed at length; see Pt. I, ch. 6 and Pt. II, ch. 5. It bears noting—since it is an attitude one encounters—that Unger and Smolin’s arguments ought not be dismissed out of hand simply because they are among a relative few reflecting on the philosophical assumptions of modern science and their proposals are not in line with the standard philosophical assumptions of a presumed, apparent, or postulated majority of physicists. An unreflective majority, should it exist, is no better for its numbers. Unger and Smolin’s philosophical arguments should be addressed philosophically.

⁸⁹ This is seen indirectly when Schaffer cites, but does not adequately address, the alternative epistemology of Nancy Cartwright; see his “The Action of the Whole,” 76, fn. 14: “In a partially related vein, [Nancy Cartwright] argues that the laws of physics ‘lie,’ and are at best idealizations. Russellian Laws can be understood as the claim that Cartwright is almost completely right. There is just one system, namely the cosmos, about which the laws speak truly.” Schaffer cites Cartwright’s *How the Laws of Physics Lie*, but does not refer to her subsequent works, *Nature’s Capacities and Their Measurement*, or *The Dappled World*.

⁹⁰ Simons, “The Universe,” 248.

⁹¹ See *ibid.*, 248: “If the universe or some part or parts of it forms a system or systems in some sensible meaning of that term, whether spatiotemporal, causal or epochal or whatever, the metaphysician’s may not legislate that the term ‘universe’ ought to exclude such a possibility.” See also 249, and his reason for saying the universe is an empirical multiplicity, namely, “because one might say there is a minimal condition all objects in the universe have to satisfy, namely they all have to exist.” St. Thomas also recognizes this minimal condition; see St. Thomas, *In Div. Nom.*, c. 4, lect. 6, n. 364, and yet he adds three others to constitute a much stronger notion of the universe. The parts or constituents of the universe must not only exist at the same time, but they must be joined together, work together in operation, and exhibit a certain proportion or harmony. I examine this more robust notion of the universe in an article in preparation.

⁹² Besides Aristotelian and Thomistic arguments against Platonic hyperrealism, one should also consider arguments against possible worlds; see the work of David Oderberg or James Ross, referenced in n. 13.

⁹³ See Simons, “The Universe,” 249.

⁹⁴ I take it that Simons did not mean to imply that cosmology gets to settle whether or not Platonism or modal realism are true.

⁹⁵ See George F. R. Ellis, “Does the Multiverse Really Exist?” *Scientific American* 305.2 (2011): 38–43, as well as George F. R. Ellis, U. Kirchner, and W. R. Stoeger. “Multiverses and Physical Cosmology,” *Monthly Notices of the Royal Astronomical Society* 347.3 (2004): 921–36. See also Brungardt, “World Enough and Form,” §5.2, 24–27.

⁹⁶ The close alternative to the multiverse, namely, a “multi-domain universe” composed of regions no longer in spatially continuous contact would still be a universe; see Ellis et al., “Multiverses and Physical Cosmology,” 921–22: “Some refer to the separate expanding universe regions in chaotic inflation as ‘universes’, even though they have a common causal origin and are all part of the same single space–time. In our view (as ‘uni’ means ‘one’) the Universe is by definition the one unique connected existing space–time of which our observed expanding cosmological domain is a part. We will refer to situations such as in chaotic inflation as a multidomain universe, as opposed to a completely causally disconnected multiverse. Throughout this paper, when our discussion pertains equally well to disjoint collections of universes (multiverses in the strict sense) and to the different domains of a multidomain universe, we shall for simplicity simply use the word ‘ensemble’. When an ensemble of universes is all subregions of a larger connected space-time—the ‘Universe as a whole’—we have the multidomain situation, which should be described as such. Then we can reserve ‘multiverse’ for the collection of genuinely disconnected ‘universes’—those which are not locally causally related.”

⁹⁷ The second, metaphysical route argues to the unity of the universe from its ultimate agent and final causes. When St. Thomas argues for the uniqueness of the world, he does so on the basis of the unicity of the First Mover, or from its single order to the First Mover as an end. He also maintains that, were God to make a “multiverse,” then either this would contravene his wisdom (if these different universes were alike) or the entire set of such universes would then be the universe by their relation to God as cause and exhibiting diverse perfections. This metaphysical route can also develop Simons’ claim that the universe must be a multiple-category reality. The most fundamental category is substance, as Aristotle notes, in *Metaphysics*, XII.1, 1069a19–20: “If the universe is of the nature of a whole, substance is its first part.” The fundamentality of substance as first in an order of categorizable beings thus characterizes the unity of the universe. It is not the unity of a being in any one category, but a transcategorical unity of order among existing realities ordered into various categories.

⁹⁸ Stanley Jaki argues that “By achieving a contradiction-free account of the totality of gravitationally interacting things, modern scientific cosmology implicitly discredits the very heart of Kantian agnosticism.” (“Thomas and the Universe,” 571) While there are at present various incompletely understood and even paradoxical elements of the standard model, Jaki is surely right insofar as current models avoid the gravitational paradoxes that plagued Newtonian cosmology.

⁹⁹ See Eileen C. Sweeney, “Three Notions of *Resolutio* and the Structure of Reasoning in Aquinas,” *The Thomist: A Speculative Quarterly Review* 58.2 (1994): 197–243; also, Gaston G. LeNotre, “Thomas Aquinas and the Method of Predication in Metaphysics,” Ph.D. Dissertation, The Catholic University of America, 2017.

¹⁰⁰ An example of these modes is found in Charles De Koninck in *The Cosmos; The Writings of Charles De Koninck: Volume One*, 314–21. There, De Koninck discusses the different modes of unity of the cosmos. Its subjective coordination arises through the sort of unity we have been discussing, the unity possible given only mobile being, or material subjects. However, the cosmos also includes the existence of kinds and particularly intellectual kinds. This gives rise to a unity of objective coordination, which is more perfect and which is treated in metaphysics. This more complete mode of consideration is also exemplified by St. Thomas, in *Summa contra Gentiles*, II.46, when he argues that the perfection of the universe requires intellectual creatures.

¹⁰¹ Aristotle, *Metaphysics*, II.1, 993b5–7.

¹⁰² De Koninck, *The Cosmos*, 314.