

Quantum Cosmology and the Laws of Nature

Scientific Perspectives on Divine Action

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A CASE AGAINST TEMPORAL CRITICAL REALISM? CONSEQUENCES OF QUANTUM COSMOLOGY FOR THEOLOGY

Willem B. Drees

1 Introduction

This paper intends to explore the consequences of contemporary physical cosmology for theology. It will be argued that quantum cosmologies, and the underlying ideas about quantum gravity, pose major challenges to our understanding of time and knowledge. Though *explorative* in intent, the paper is *polemical* in structure. The most widely held positions in contemporary Anglo-Saxon discussion of science-and-religion combine a "critical realistic" appreciation of science and religion with an evolutionary understanding of the world and temporality as an essential element in our understanding of God. This combined view I shall call *temporal critical realism*. The polemical thesis is that these positions are unable to cope with quantum cosmologies, and hence unable to fulfil their own promise of taking science seriously. They need to change either their ontology or their epistemology.

Central to the epistemology of critical realism is the idea that science aims at depicting the world. The approximations become ontologically more accurate as science develops better theories. The discussion will focus on varieties of critical realism which assume that the most well-established theories provide a view of the world which is reliable for metaphysical purposes, or which combine emphasis on the unity of the sciences with a hierarchical structuring of these sciences.¹ I will argue that such assumptions make it

¹ There are various versions of "critical realism." J. Leplin lists in the "Introduction" to *Scientific Realism* (Berkeley: University of California Press, 1984) ten characteristic realist theses, about which actual realists happen to disagree. However, "what realists do share in common are the convictions that scientific change is, on balance, progressive and that science makes possible knowledge of the world beyond its accessible, empirical manifestations." 2. Among the defenders of critical realism in the context of science-and-religion, mostly in combination with an emphasis on temporality, are Barbour, *Myths, Models and Paradigms*; E. McMullin, "A Case for Scientific Realism," in *Scientific Realism*, ed. J. Leplin (Berkeley: University of California Press, 1984); A. R. Peacocke, emphasizing the hierarchical structuring, especially *Intimations of Reality* (Notre Dame: University of Notre Dame Press, 1984); T. Peters, "On Creating the Cosmos," in *Physics*; J. Polkinghorne, *One World* (Princeton: Princeton University Press, 1986); J. M. Soskice, *Metaphor and Religious Language* (Oxford: Clarendon Press, 1985) and various process theologians in the Whiteheadian tradition. These authors may be taken to exemplify what has been referred to as "temporal critical realism" in the present article.

difficult to avoid the challenges from quantum gravity and quantum cosmology (section 5).

Big Bang cosmology appears to be in line with temporal critical realism: the expanding universe seems to line up well with evolutionary worldviews developed in dialogue with biology. Various temporal critical realists have pleaded caution with respect to the beginning, claiming at most a form of consonance. However, they have often appealed to the Big Bang theory as describing a dynamical universe. But analysis of the limitations of the Big Bang theory shows that one should be equally cautious with statements regarding the fundamental nature of time in Big Bang cosmology (section 2). Quantum cosmology modifies the concept of time rather than extending time beyond the initial singularity of the Big Bang theory. Quantum gravity and quantum cosmology thus result in challenges for temporal critical realism (section 3).

An alternative to temporal critical realism might be a more positive appraisal of timelessness. This may give a platonistic flavor to the theological schemes considered (section 4). If one is not prepared to grant timelessness such a place, one might consider deviating from realism with respect to the status of cosmology itself. However, if this is done in a rather *ad hoc* fashion, the claim that critical realists take science seriously, even though not literally, loses its force and thus its apologetic significance. Moreover, dismissing cosmology brings in other questions regarding the status and the unity of the sciences (section 5). Playing down cosmology might be acceptable if one were to give up on the unity of the sciences, seeing them as different partial constructs which need not fit into a neat whole. Such a theology would be less inclined towards ontological statements, as is illustrated by Mary Hesse's work (section 6).

One final introductory remark. Physicists, such as Isham, engaged in quantum cosmology stress the tentative character of contemporary quantum cosmology, noting that there are in fact no real theories here. I agree that that is reason for caution, but I disagree when that is taken to free the philosopher and the theologian from reflecting upon these theories. The arguments below focus on general characteristics of quantum cosmology, rather than on specific schemes. These developments affect our understanding of time, primarily in a negative way, as research in quantum cosmology deviates for good reasons from our previous ideas about time. Research in this area thus invites us to rethink ideas based upon the concept of time as developed in relation to experience at our own, classical level of reality.

2 Big Bang Cosmology and Theology

Some authors, such as the astronomers Robert Jastrow and Gerald Schroeder, have claimed remarkable parallels between the creation narrative of

Genesis and Big Bang cosmology.² Other authors have taken the discoveries to show the reality of a sudden beginning of the universe, which could serve as a premise in a cosmological argument for the existence of God.³ Both arguments are wanting as they pay insufficient care to the nature of the scientific and religious statements at hand.⁴ Temporal critical realists have pleaded for caution with respect to such claims. A major argument for them has been the possibility that "t=0" represents a kind of epistemological limit rather than an absolute beginning. The harmony they envisage is not related to "t=0," but rather to the basic role of time, i.e. the dynamic rather than static nature of the universe (2.1). It will be argued that both the spacetime theory underlying Big Bang models (2.2) and the limitations of such models (2.3) make it possible to challenge not merely the absoluteness of the apparent beginning, but the dynamic nature of the universe as well.

2.1 Critical Realists: Cautious Consonance, But Temporality

Temporal critical realists have not been lured into arguments based on the initial singularity of the Big Bang theory. Even less have they been tempted by naive claims with respect to parallels between inflation—a brief period of extremely rapid expansion of the early universe—and "the wind of God moving over the waters" of the second verse of Genesis.⁵ They are generally open to the possibility that Big Bang theory might describe only a cosmic epoch, perhaps in the context of an oscillating universe. *Creatio ex nihilo* is taken as an ontological claim of dependence, rather than as a historical claim about a beginning. For example, Ian Barbour writes:

The contingency of existence corresponds to the central religious meaning of creation ex nihilo. On both sides the basic assertions can be detached from the assumption of an absolute beginning. On the scientific side, it now appears likely that the Big Bang was indeed an absolute beginning, a singular event, but we cannot rule out the possibility of a cyclic universe or infinite time. . . . With respect to the central meaning of creation ex nihilo (though not with respect to continuing creation) I agree with the neo-orthodox and

² R. Jastrow, *God and the Astronomers* (New York: Warner Books, 1980); G. L. Schroeder, *Genesis and the Big Bang: The Discovery of Harmony Between Modern Science and the Bible* (New York: Bantam, 1990).

³ W. L. Craig, *The Kalām Cosmological Argument* (London: Macmillan, 1979).

⁴ For more developed criticisms, see Drees, *Beyond the Big Bang*, especially ch. 1; and "Potential Tensions Between Cosmology and Theology" in *Interpreting the Universe as Creation*, ed. V. Brümmer (Kampen, NL: Kok Pharos, 1991), 71-75.

⁵ Schroeder, *Genesis and the Big Bang*, 93f. Schroeder also correlates the decoupling of matter and photons with God's injunction "Let there be light," 88. The six days of the biblical narrative and Big Bang theory deal with "identical realities . . . described in vastly different terms," 26.

existentialist authors who say that it is the sheer *existence* of the universe that is the datum of theology and that the details of scientific cosmology are irrelevant here.⁶

There is no support from cosmology for theology, or vice versa, though there may be something less stringent, "consonance." These authors generally consider as alternatives the Steady State Theory and an oscillating universe, as well as the possibility of redefining time, with the effect that the singularity is located in an infinitely distant past. And if a theory of quantum gravity could be found, "we would move the frontier of knowledge further back" (note the temporality of this expression).⁷ The cautious attitude with respect to an appeal to Big Bang theory has to do with the possibility that time might be extended, rather than with the possibility that *the concept of time itself* might be of limited validity.

Whereas the apparent beginning of the universe is not taken as important,⁸ authors such as Barbour, Peacocke and Peters have claimed that Big Bang theory is significant in that it shows us the dynamical nature of the universe, the essential role of time. As Barbour expresses it:

astrophysics adds its testimony to that of evolutionary biology and other fields of science. Time is irreversible and genuine novelty appears in cosmic history. It is a dynamic world with a long story of change and development. On the theological side, continuing creation expresses the theme of God's *immanence* and *participation* in the ongoing world.⁹

These authors all avoid simplistic identification of the initial singularity with the theological concept of creation, although they feel at home with, consonant

⁶ Barbour, "Creation and Cosmology," in *Cosmos as Creation*, 141f. Similarly Arthur Peacocke, *Creation and the World of Science*, 79; and "Theology and Science Today," in *Cosmos as Creation*, 33f; and McMullin, "How Should Cosmology Relate to Theology?" in *The Sciences and Theology*, 38.

⁷ Peters, "Cosmos as Creation," in *Cosmos as Creation*, 107.

⁸ Except, to some extent, by Peters, who believes that there is "surprising and salutary consonance" between the theological idea of *creatio ex nihilo* "formulated in terms of an original beginning of time and space" and contemporary astrophysics (T. Peters, "On Creating the Cosmos," 276). However, he makes a distinction between the abstract *creatio ex nihilo* as ontological dependence and the assertion that there was a beginning as a concrete form of explicating *creatio ex nihilo*. "It is, of course, possible for a theologian to speak metaphysically about the utter dependence of the creation on its creator without reference to a temporal beginning" (ibid., 274). He acknowledges that "oscillationism" is still an alternative type of theory and that the Big Bang (i.e. the Planck Time) is "a methodological frontier and not the full ontological affirmation made by Christian theology" (T. Peters, "Cosmos as Creation," 107).

⁹ Barbour, "Creation and Cosmology," 143.

with, the Big Bang cosmology. They intend to restrict themselves to the more general, apparently more safe, features of the model. The alternatives that are considered are, basically, alternatives with an infinite past—a longer extension of the dimension time. This would *not* affect the claim that we live in a dynamic world.

There is no doubt that we have indeed come to realize that darkness at night implies that we are not living in a static universe (Olbers' paradox). Stars age. The average distances in the universe are increasing; we live in an "expanding universe." The abundances of chemical elements have been traced back to nuclear processes in stars or to processes during "the first three minutes." We do live in a dynamic universe, as seen from the inside.

But is this the most fundamental view of reality? Is it a fair "approximation" to "the way it really is," to use a critical realistic phrase? It is essential to be aware that this is a view "from inside." What is the significance of this perspective? It may not be the final perspective, "the view from nowhere," as Thomas Nagel puts it.¹⁰ It is rather a view from "nowhere." Are there any reasons to believe that a wider, more fundamental, perspective will seriously affect our understanding of the dynamical nature of the universe? First, we will consider the spacetime view of relativity theory and its implications for the emphasis on time (2.2). Second, we will consider some limits of the Big Bang theory and options for future theories (2.3).

2.2 The Challenge of "Spacetime"

One way to challenge the emphasis on time would be to invoke the special and general theories of relativity. In the special theory of relativity the notion of simultaneity as having a universal meaning with respect to a "now" is lost. This in turn raises serious issues for statements about God having time, being related in a special way to "the past" or acting as to influence "the future." "Past" and "future" can be used as concepts relative to an observer located at some position on a specific worldline in spacetime. The problem arises when a definite article is used, speaking about "the past" and "the future," as if these are global concepts. Thus, problems arise in theologies which insist that "God's future" is open, or make other claims which assume the existence of a universal notion of time.¹¹ As long as God lacks a specific location and state of motion, it is difficult to understand the meaning of God knowing "the past" or influencing "the future." At least three ways to get around the theological consequences of this loss of a single universal time have been proposed. One is to allow for the co-existence of more than one time in God. Another, defended by Polkinghorne, is to invoke God's omnipresence.

¹⁰ T. Nagel, *The View from Nowhere* (New York: Oxford University Press, 1986).

¹¹ The description of the problem as one with the definite article has been taken from an unpublished note from C. J. Isham; see also the article by Isham and Polkinghorne in this volume. The problem is discussed theologically, but not solved, in C. Hartshorne, *A Natural Theology for our Time* (La Salle: Open Court, 1967), 93f.

A third option is to argue that there is a physical basis for a universal time by taking into account the cosmological background radiation. We will consider these options in turn:

(1) Some have argued that one might consider the co-existence of our time with other time series. However, if they are taken to be unrelated except for their co-existence in God,¹² "multiple time sequences" are of no help with the relativity problem. They refer to different spacetimes and therefore they don't solve the real problem of coordinating multiple observers existing in *one* spacetime. If one were to apply the idea of "multiple times" to the various times arising for different observers in one spacetime, these time sequences are strongly correlated. One might say that God is related to all those times. However, that would not introduce a universal notion of simultaneity which would allow for statements about God's relation to "the future" or "the present." To say that God is related to a multitude of times which are correlated as the various times of a single spacetime are, is equivalent to saying that God is related—in some non-temporal way—to the whole of spacetime.

(2) Polkinghorne suggests that omnipresence provides a way out. He argues that an omnipresent God is spatially coincident with every spacetime point, and thus has no need to use signalling to tell him what is happening and so he has instant access to every event as and when it occurs. That totality of experience is presumably the most important thing to be able to say about God's relation to world history.¹³

But Polkinghorne's description is ambivalent. "When it occurs" may be read as a reference to a hidden background of universal time, making possible a reading of "the totality of experience" as a three dimensional present. This seems to be Peacocke's reading when he states that "the future does not yet exist in any sense, not even for God," where "God is conceived as holding in being in physical time all-that-is at each instant and relating his own succession of divine states (the divine "temporality") to the succession of created instants."¹⁴ Such a reading of Polkinghorne's solution is not in line with relativity theory, as it introduces a universal sense of now, correlated with that three-dimensional "totality of experience."

Another, perhaps better, reading of Polkinghorne's proposal takes it that "when it occurs" means that God has equal access to events at all spacetime points—whether deemed future, past or present from any spacetime point. But then God's temporality is lost; the "totality of experience" covers four-dimensional spacetime as a whole.

¹² Suggested by K. Ward, *Rational Theology and the Creativity of God* (Oxford: Basil Blackwell, 1982), 166; discussed by B. Leftow, *Time and Eternity* (Ithaca: Cornell University Press, 1991), 29.

¹³ Polkinghorne, *Science and Providence*, 82; see also the opponent of the block universe in the article by Isham and Polkinghorne in this volume, especially his point (8).

¹⁴ Peacocke, *Theology for a Scientific Age*, 131.

(3) One might suggest that classical Big Bang cosmology solves some problems with respect to God's time, as there might well be a way to define a global time in an expanding universe. For example, one might use as the frame of reference that frame in which the background radiation is homogeneous. However, it is not clear that there is such a universal time outside the simplified homogeneity and isotropy of the Friedman-Robertson-Walker models. Besides, general relativity, on which the Big Bang theory is based, seems to make problems worse. Time may be a locally applicable concept, but still there may be no definition of time that covers the whole spacetime manifold.

Similar "block" views of time arise in other physical theories which deal with whole possible histories at once as trajectories in phase space. Temporal crucial realists have not dealt satisfactorily with such "block" views. However, the following will not develop the consequences of classical spacetime views; rather we will ask whether the problem changes once we turn towards quantum cosmology. It might be the case that a notion of a single, flowing, universal time is possible, once general relativity as the framework for cosmology is succeeded by a quantum theory which integrates space and time as well as matter. Running ahead of the argument, the conclusion of the reflections on quantum cosmology will be that such a hope for a recovery of time will *not* be fulfilled. Rather, things will become worse. Before turning to quantum cosmology, however, it is important to see why such a further scientific development beyond the Big Bang theory is needed.

2.3 *Limits of the Big Bang Theory*

The Big Bang theory is the accepted theory about the evolution of the universe over billions of years. It relies upon two types of theories: general relativity describing spacetime and quantum theories describing matter. Both theories have their limitations; furthermore, they are hard to combine.

From our perspective, the theories of matter are the first to present problems near to $t=0$. Current theories about matter are valid only up to a finite temperature, and hence only valid *after* the first fraction of a second following the Singularity at $t=0$, the initial moment entailed by general relativity. This implies an epistemological boundary to the domain where the Big Bang theory can be trusted. Further speculations have to deal with circumstances (temperatures and densities) for which the relevant particle physics is not yet well established.

Closer to the Singularity comes a moment, presumably the "Planck Time" (a number constructed from fundamental constants of quantum theory and gravity, about 10^{-43} seconds after the initial Singularity), where general relativity must be replaced by a quantum theory of gravity. Such theories do not exist yet, but some current ideas will be discussed below (section 3). The meaningfulness of "time" will turn out to be uncertain. This is a troublesome conclusion; once "time" is no longer unambiguous, it becomes unclear what can be meant by "before" or by "the Planck Time."

If one were to continue backwards in time, the initial Singularity itself would be a third limit, where the theory of general relativity, the theory about spacetime, breaks down. However, as this limit lies beyond the Planck Time, and thus in a realm where general relativity has to be abandoned anyhow, it is not clear in what sense this limit might be relevant. This cannot be decided a priori, without considering the actual theories of quantum gravity that have been proposed. Whereas the first and second limits are limits to our present knowledge, the third seems to be an edge, an ontological discontinuity—but it is hidden behind the other two.

Temporal critical realists seem to hold that the major uncertainty regards the third limit. Has there really been an absolute beginning, or is there continuity—for example in an oscillating universe, extending our "past time" indefinitely or even infinitely. That was also the issue between the Big Bang and Steady State theories. If the alternative is seen this way, we might well trust the Big Bang theory in its proper domain, and leave the speculations of quantum cosmologist aside as not relevant to our understanding of the dynamical nature of our cosmic epoch. For instance, Peacocke discusses the Hartle-Hawking concept of imaginary time, but dismisses it as irrelevant, since "by the point at which biological organisms appeared on the Earth, the postulated imaginary component in Hartle and Hawking's physical time would have diminished to insignificance in their theory. So, with this cosmology, we are still free to employ the concept of the personal to interpret God's relation to the universe which goes on being created by God."¹⁵

If the problem is formulated as a problem about the absoluteness of the initial singularity, there is an implicit assumption of a fixed background time which could be extended beyond $t=0$. The problems with such an approach are the problems facing creation *in* spacetime, as discussed by Isham in this volume and previously.

An alternative possibility, however, is that it is the conceptuality which is at stake, as a consequence of the breakdown of general relativity, and hence of its notions of time and space. In that case, we are not merely stumbling upon a possible ontological discontinuity, but rather the ontology—the basic conceptuality in terms of which we think of our world—has to change radically. As the successor to classical cosmology, quantum cosmology would imply a reinterpretation of the meaning of the Big Bang theory as well. Rather than considering creation *in* spacetime, this is the approach that considers creation *of* spacetime.

Changes in conceptuality have been typical of fundamental transitions in physics, such as those from classical physics to quantum physics and from Newtonian conceptions of space and time to those of the special and general theories of relativity. Knowledge was not merely extended to the very small or the very fast, but rather restructured. These from a realist perspective, new theories led to a reinterpretation of the world. In an instrumentalistic vein,

¹⁵ Peacocke, *Theology for a Scientific Age*, 133f.

focusing on predictive power the old theory is a continuous limit of the new one; but conceptually or ontologically it is radically different. Although the empirical or observational consequences of previous theories, as far as corroborated by experiments, are reproduced by the new theory, even if the new theory is cast in radically different conceptions. Such a transition is at stake with respect to quantum cosmology as well: it leads to a reinterpretation of our concepts regarding the world—especially the concept of "time." And that change is not restricted to cosmology, as the theory at stake is quantum gravity, intended to be a universal replacement of Newtonian and Einsteinian views of space and time. *If such a radical change in our ontological conceptuality is possible, due to the second limit of the Big Bang theory, the fundamental dynamical nature of the universe is open for reinterpretation, and not merely the absoluteness of the apparent beginning.*

3 Consequences of Quantum Cosmology and Quantum Gravity

Time in the context of relativistic spacetime theories is a phenomenological, "internal" construct. One might well see this as a modern day equivalent of Augustine's view of *creatio cum tempore*, time being part of the created order. The discovery of "internal" time, as characteristic of the theory of general relativity, has paved the way for a second discovery, the discovery of the limited applicability of the concept of time, as is typified in of quantum cosmologies and quantum gravity. We will consider these two developments in turn.

3.1 External and Internal Time

Isham, in his contribution for this volume, explains why origination of the material universe in a *fixed background spacetime* is problematic. One of the major problems is the problem of choice: "within an infinite, pre-existent, and homogeneous timeline, there is simply no way whereby the mathematics can select one particular time at which creation occurs."¹⁶ Quantum theories which work with probabilities (e.g., instances per unit time) tend to introduce a plurality of origination points. This would lead to interacting "universes," contrary to the available empirical evidence.

Hence, physicists have turned to the development of theories which describe creation *of* time rather than creation *in* time. General relativity theory offers a fundamental hint in that direction. Whereas in a fixed background, time may be seen as external with respect to the system, the situation in general relativity is different. Here time is understood as an "internal" variable. For

¹⁶ This objection to creation *in* time is not a new insight; for example, it was considered by Augustine (*Confessiones* 11, XII, 14) and, centuries earlier, by an epicurean, as told by Cicero in his *De natura deorum* I, 9, 21.

example, one might attempt to define time in relation to the average distance between "test-particles" such as galaxies, or one might use the temperature of the background radiation or features of other material phenomena. The evolution of properties of the universe in time is thus transferred to statements about the correlation between, for example, the temperature and other properties of the universe.

In traditional quantum theory, the fundamental equations (like the Schrödinger equation) describe the evolution of the wave function (or state vector) in time. This means that the properties of the system are given by a time dependent entity. "Thus 'time' is arguably part of the classical background which plays such a crucial role in the 'Copenhagen' interpretation of the theory."¹⁷ In some approaches to quantum gravity there might be a background structure which is sufficiently rich as to include some concept similar to classical time. However, those approaches have the same problem as described above for creation in a fixed background spacetime.

Quantum gravity and quantum cosmology have really taken a different approach.¹⁸ The background structure is not a four-dimensional spacetime, but rather a three-dimensional space. On this three-dimensional a wave function is defined which specifies curvature and matter. The "notion of time (and therefore spacetime) has to be *extracted* in some way from these variables."¹⁹ Thus, the dynamical evolution might be recovered by defining a time variable on the basis of a suitable variable constructed either out of the curvature or out of the matter fields (hence either like average distance, or volume, or like background temperature). Though the external time has disappeared, the quantum scenario could be seen as open to two equivalent representations: an evolutionary one and a frozen one. However, the evolutionary representation is slightly odd, compared with evolutionary equations which arise in conventional quantum theory. This deviation is an advantage in the context of the program of quantum cosmology, the attempt to construct a genuine theory of origination of the universe. It leads us to the idea of "imaginary time."

¹⁷ C. J. Isham, "Conceptual and Geometrical Problems in Quantum Gravity. Lectures presented at the Schlading Winter School," (Preprint Imperial/TP/90-91/14), 74.

¹⁸ Beginning at least with B. S. DeWitt, "Quantum Theory of Gravity: I, II," *Physical Review* 160 (1967), 1113-1148, 162 (1967), 1195-1239.

¹⁹ C. J. Isham, "Conceptual and Geometrical Problems in Quantum Gravity," 75. In his contribution to this volume, Isham discusses the problem of selecting a unique wave function for the universe. A genuine "creation" theory would have to predict all features of the universe, but assumptions are always fed into such theories. For instance, in the scheme he discusses here, part of the (contingent) background is the assumption of a three dimensional manifold of fixed topology. Issues of uniqueness and background might be very relevant entrances to philosophical and theological reflection, closely related to questions of contingency and necessity. However, these issues are beyond the scope of the present article, which focuses on time.

3.2 *The Limited Applicability of Time*

Superspace is the collection of all possible configurations of curvature and matter on a given three-dimensional manifold. As Isham explains, a series of such possible configurations—a possible history of a universe—corresponds to a path in that superspace. However, quantum theory is such that it does not result in a single history, as if there were only a single path in superspace with non-zero probability. Just as in conventional quantum theory, each classical history will be slightly fuzzy, as slightly deviating histories have lower, but still non-zero, probability amplitudes. Besides, the wave function turns out to have a number of paths around which it is peaked, and thus to describe a whole set of (approximately) classical histories. The spacetime picture would not be unique, even if the wave function were unique.

Isham distinguishes two regions in superspace. In one region the spacetime picture corresponding to a path is fairly well in accord with the general relativistic view (and thus, aside of the spacetime problem discussed in 2.2, with our common sense understanding of time). But other regions of superspace do not lend themselves to such an interpretation. These regions are part of the theoretical structure and cannot be omitted, unless in an unsatisfactory *ad hoc* fashion. For trajectories in this realm of superspace, space and time do not correspond to the relativistic case (recognizable by the Lorentz distance formula $x^2 + y^2 + z^2 - c^2t^2$). For trajectories from this realm, time and space variables appear in the equivalent formula completely on a par, as there appears a plus sign rather than a minus sign in all four terms of the distance formula. It is in relation to this realm that some have spoken of "imaginary time." Taking time to be imaginary, one might retain the minus sign in the formula. However, it seems as accurate to say that another formula is applicable. The corresponding four-dimensional space is highly quantum mechanical. It is far more fuzzy than the spacetimes corresponding to paths in the other region of superspace, as the solutions peak less around certain paths in superspace in this second region. Isham calls this quantum mechanical four-dimensional realm "imaginary spacetime." Whether one wants to say that the concept of time has become meaningless or that time has become imaginary may be a matter of taste. However, it certainly is not the kind of time which allows for clear successions of events.

By way of summary, two features of the canonical approach to quantum gravity may be emphasized. First, the fundamental ontology (background structure) assumes a three-dimensional manifold, rather than a four-dimensional spacetime. The ontology contains as well a whole collection of possible configurations of geometrical and material configurations on this manifold: superspace. "Time" is a derivative notion, well defined only for certain subsets of, or certain paths in, this superspace.

Second, wave functions arising in this theory may be interpreted as describing a realm where the concept of time is meaningless and a realm where a relativistic concept of spacetime is meaningful. Even this more classical reality is, however, fuzzy for two reasons. A wavefunction corresponds to a

plurality of paths describing pure classical space times, and each path has the fuzziness which is typical of conventional quantum theories.

It is important to note that the relevance of these ideas cannot be restricted to considerations regarding the quantum theory of the origination of the universe. Rather, it purports to be the quantum view of the universe or, even more significantly, the quantum theory of time (and space, but less so as some features of space are still assumed as part of the background structure). As the quantum theory of matter or radiation is different from classical theories of matter or radiation, so is the quantum theory of space and time different from classical theories of space and time.

3.3 *Challenges for Temporal Critical Realism*

"Temporal critical realism" was taken to combine an epistemological and an ontological position: science has to be taken seriously, but not literally, and reality is best described in dynamical terms, including its relation to God. Quantum cosmology and quantum gravity seem to challenge these positions. Let me begin with a remark about the epistemological issue.

Critical realists tend to see science as a more or less continuous series of successive approximations of increasing accuracy in depicting reality. However, the concept of approximation ties in with instrumentalistic approaches to the mathematics, whereas quantum cosmologists tend to be more platonistic, for example, with respect to the reality of mathematics. If mathematics is seen as a tool, it may be more or less adequate in describing properties of entities. For example, in stating that an object has a mass of 4.3 kilograms, one means that it has that mass with the required precision, say, give or take at most 50 grams. Physical reality is modelled mathematically, but the model is considered to be an approximation. If, on the other hand, reality itself is assumed to be mathematical, one does not deal with approximations. For example, it is not clear in what sense the fundamental symmetry group underlying the particle world could be *approximately* group X —it is group X or it is not. This may need some qualifications in relation to spontaneous broken symmetries. However, it remains the case that the alternatives seem to be much more discrete than in an instrumentalistic approach to the mathematics. "One of the most fascinating features of mathematical structures as models of the world is their apparent ability to justify themselves. These structures are so strictly connected with each other that they seem to be necessary and to be in no way open to arbitrary, speculative alterations."²⁰

In addition, the theories developed successively in cosmology, from Newton through Einstein to quantum cosmology, tend to be continuous with respect to the numerical outcome of certain calculations, but to differ radically

²⁰ Michael Heller, "The Experience of Limits: New Physics and New Theology," quoted from the abstract in *Science and Religion*, eds. J. Fennema and I. Paul, (Dordrecht: Kluwer Academic Publishers, 1990), 207.

in their fundamental conceptualities. Hence, it is hard to make clear in what sense these models depict reality approximately, and thus how they refer. Dismissing quantum cosmology for this reason as too speculative seems an unfair, *ad hoc*, move, which would be a betrayal of the intent to take science seriously.

The epistemological consequences from cosmology, as well as from other significant discontinuities in fundamental physics, may be at odds with "critical realism." However, the main targets of the defenders of "critical realism" seem to be sociological, psychological and idealistic reductions of physical and religious reality to ideas produced by humans. The platonic realism under consideration here does not suffer from such a reductionism. It might therefore be possible for critical realists to change their epistemological position by accepting a kind of platonic realism (as quite a number of mathematicians tend to do). We will return to epistemological issues below (section 5).

The temporal critical realists take time to be fundamental; reality is dynamic. This position has been developed for a variety of reasons; prominent among them is the desire to accommodate insights from the evolutionary sciences. Reality is, of course, dynamic and evolving, if considered on an intermediate scale from a point of view within an almost Newtonian epoch. However, questions arise already when one considers larger scales and has to take account of the conceptuality of general relativity. The dynamic picture may be extendable to the quantum level, the finer detail of photons and electrons. However, further down in scale, to the quantum gravity level, the conceptuality of dynamism breaks down. "Deep down" the ontology is different. It is not limited to quantum cosmology, as it has to do with quantum gravity a theory with universal applicability. And it is not just a detail at some irrelevant scale, because it affects, or should affect, the concepts of space and time as they are used at *all* levels. At the Newtonian level of description, space and time are taken to be universal, infinitely extendable continua. The special theory of relativity has raised problems with the universal simultaneity of time. General relativity calls into question the extendability of time, as singularities arise. And quantum gravity takes away the fundamental states of time. The still speculative ideas at the frontier of cosmological research, and even the standard theory of spacetime (General Relativity), thus suggest that the evolutionary presentation is one of limited validity, and not the most fundamental one. Hence, theological insights developed in the dialogue with the evolutionary understanding of the natural world are *not* directly extendable to the dialogue with cosmology.

It seems as if the temporal critical realists have not been considering such a shift in conceptuality as a reason for caution. They pleaded caution with respect to the $t=0$ in Big Bang theory, because of the possibility of an extension of past time. However, as Isham makes clear in his contribution, a cyclic view seems incompatible with the spacetime picture in contemporary theories of quantum cosmology and quantum gravity. The alternative is not an extension to earlier times, but a reinterpretation of time, and hence a reinterpretation of the meaning of the Big Bang model itself.

If the temporal perspective is considered to be essential to Christianity, there is a conflict with cosmology. However, it might be that it is possible to accept the cosmological view of time, embedding the common sense temporal view in a wider timeless view *sub specie aeternitatis*, provided a meaningful formulation for human responsibility in relation to human actions (within the spacetime framework) could be found. We thus will turn from theologies which emphasize temporality to theologies which grant timelessness a more prominent place.

4 Platonizing Theology

A metaphysical view of reality as timeless and as of a self-justifying mathematical nature seems at odds with the emphasis which many theologians place on contingency and time as major aspects of the Christian doctrine of creation.²¹ A defensive approach would thus be to emphasize all the contingency that is left. However, might it not be that the contingency and temporality under consideration are not necessary to a proper view of God? One may be able to defend such a claim if one does not presuppose a voluntaristic understanding of God as creator, but rather supposes that God creates according to certain "internal necessities." For instance, God might not have been able to create something logically contradictory; the fundamental rules of logic would reflect God's rationality. Similarly, perhaps God could not have created something wicked or ugly, as goodness as well as aesthetic elements are intrinsic to the divine.²² Michael Heller proposes to interpret the rationality displayed by the universe as an ultimate rationality, which is God's. Platonic and neoplatonic philosophies, and theologies inspired by them, have always been inclined to regard the world as a reflection of "eternal objects" (for which one may read "mathematical objects") that dwell in God's mind. Thus, he points out that the metaphor of "God thinking the Universe" is well rooted in the history of theology.²³ Platonistic tendencies in cosmology may well be developed into a philosophy which extends the issues from mathematical intelligibility to wider concepts of rationality, and from there into values. Another further development of such a platonistic philosophy might extend the discussion on mathematical intelligibility so as to introduce the notion of spirit

²¹ In addition to the temporal critical realists mentioned above, one could also refer to T. F. Torrance, *Divine and Contingent Order* (Oxford: Oxford University Press, 1981); W. Pannenberg, "The Doctrine of Creation and Modern Science," *Zygon: Journal of Religion & Science* 23 (1988), 3-21; and the discussion of his work by R. J. Russell, "Contingency in Physics and Cosmology: a Critique of the Theology of W. Pannenberg," *Zygon: Journal of Religion & Science* 23 (1988), 23-43.

²² H. G. Hubbeling, *Principles of the Philosophy of Religion* (Assen, NL: Van Gorcum, 1987), 148.

²³ Heller, "The Experience of Limits," 207.

or mind. "From the theological perspective, there is an intimate relationship between the spirit of rationality and the Christian idea of the Logos."²⁴

In suggesting that quantum gravity might correlate well with a platonizing theology, I do not intend to make a historical claim. The concept of "platonism" certainly needs to be defined with greater precision. For the moment I intend only to draw attention to a number of different features which seem to apply to almost all fundamental scientific cosmologies, and which may transfer to the way ideas about God are formulated.

The following sections will give a limited survey of discussions regarding elements of such an understanding of God, considering divine eternity, divine action, and the way in which God may be conceived of as explanation of the universe. It is not an exhaustive presentation of such theologies, but an initial exploration of contemporary discussions. Is it possible to think theologically along such lines? Some hesitations will be expressed (4.4). Whereas this section explores the possibility of changing the ontological assumption underlying temporal critical realism, further sections will explore possible changes in epistemology.

4.1 *Divine Eternity*

Recent philosophers and theologians tend to think that anything that could count as *God*—as the living, loving person whom the Old and New Testaments depict as in dialogue with the creatures of history—must be in time. Their message is that the deity of the atemporalists is too remote and impersonal to be God. Yet medieval philosophers and theologians tended to think that anything that could count as *God*—as the transcendent, perfect source of all that is other than Himself—could not be in time. The medievals would say that the deity of the temporalists is too small or too creaturelike to be God.²⁵

"God is eternal" may be understood in two ways, either as everlastingness (through time) or as timelessness, without extension or location in time.²⁶ Early defenders of timelessness have been Augustine, Boethius and Anselm. Leftow has analyzed in detail their different ways of conceiving timelessness, arguing that divine timelessness is a consistent option. If one is able to think consistently about divine timelessness rather than everlastingness, one may ask whether that is an appropriate view of God. Opinions diverge on this issue.

Nelson Pike has analyzed the logical relations between the classical understanding of divine eternity as divine timelessness and other doctrines, such

²⁴ M. Heller, "Scientific Rationality and Christian Logos," in *Physics*, 141.

²⁵ Brian Leftow, *Time and Eternity* (Ithaca: Cornell University Press, 1991), 3.

²⁶ Nelson Pike, *God and Timelessness* (London: Routledge & Kegan Paul, 1970).

as immutability, omnipresence and omniscience. Timelessness has consequences for the interpretation of those other attributes; consequences which he finds objectionable. Pike sees timelessness as a Platonic influence with hardly any scriptural basis, and points to the devastating consequences for other doctrines, ending with the question: "What reason is there for thinking that the doctrine of God's timelessness should have a place in a system of Christian theology?"²⁷

The case for divine timelessness has been defended in the contemporary Anglo-Saxon philosophy of religion by Paul Helm and Brian Leftow. Timelessness is not understood as a separate attribute, but rather as God's way of possessing certain attributes. For God's timelessness "justification can be found in the need to draw a proper distinction between the creator and the creature." Thus, "properties which the creator and his creatures have in common are distinguished by their mode of possession."²⁸ Though the biblical narratives describe God as speaking, and performing other temporal acts, Helm understands timelessness as offering a metaphysical underpinning for God's functioning as the biblical God. The question is not whether timelessness is a Greek notion or not, but "whether the thought that God is timeless is a necessary truth-condition of all else that Christians want to say of God."²⁹ It has consequences at the spiritual level: "The idea of God as timeless, as the changeless ground of all that changes, has profound implications for the focusing of faith, hope, and love in what is unseen and eternal rather than what is invisible and transient."³⁰ Leftow acknowledges that we tend to speak about God in temporal terms. However, existing timelessly may be treated as existing at some "date" called "eternity"—a date which is, however, not part of the time series, and hence does not stand in a relation of "before," "after" or "simultaneous."

The contemporary discussion regarding the viability of the concept of divine timelessness, framed in "possible worlds" semantics and the like, is subtle. It is beyond the scope of the present paper to take sides with respect to the outcome in the debate between philosophers such as Pike and John Lucas³¹ on the one hand and Helm and Leftow on the other. Leaving the possible worlds of analytic philosophers of religion, we will now consider reasons provided by the given world—as described by quantum cosmology and quantum gravity—for taking seriously the option of timelessness. Against Pike's "I see no reason," there are three reasons arising from the encounter with cosmology as to why timelessness rather than everlastingness might have a place:

²⁷ Pike, *God and Eternity*, 189f.

²⁸ Paul Helm, *Eternal God* (Oxford: Clarendon Press, 1989), 17, 19; similarly Leftow, *Time and Eternity*, 66.

²⁹ Helm, *Eternal God*, 22.

³⁰ *Ibid.*, xiv.

³¹ Lucas, *The Future*.

- (1) Time is part of the created order. This is Augustine's view of *creatio cum tempore*, but it also seems also a reasonable interpretation of most contemporary cosmologies, with their "internal" understanding of time (see above, 3.1). Hence, it is not meaningful to talk about God as if there was time before the creation—God as everlasting. Everlastingness would fit in the context of creation *in* time, rather than in theories which attempt to understand the creation *of* time.
- (2) "Time" is not universally applicable in quantum cosmologies; classical spacetime is recovered only as an approximate, fuzzy, notion and does not correspond to the whole of reality as described by the wavefunction, as it excludes, for example, the "imaginary time" realm (see above, 3.2). Hence, time is unlike traditional time at the most fundamental level of description, that of quantum gravity.
- (3) The presence in physics of timeless descriptions, for example in terms of trajectories in phase space or of spacetimes, where the whole is a unit including all moments, suggests that it is possible to talk about the relation of God to this whole—and not only of the relation between God at one moment to the universe at that moment, differentiating moments in God.

I therefore maintain that it may be useful to attempt to understand, at least partly, God's transcendence with respect to spacetime as timelessness. This emphasizes God's unity with respect to the world. This leaves us with at least two possibilities.

If God is understood as a *being*—more or less the common sense theistic understanding, an assumption shared by Pike and Helm—there still might be an order, and perhaps even a flow, within God which could be labelled God's time. As my teacher in philosophy of religion, Huib Hubbeling, liked to ask: how could God otherwise enjoy music? If music is not enjoyable when all notes are played at the same moment, God's perfection, also with respect to aesthetical appreciation, requires that God has God's time. Karl Barth seems to have defended a similar distinction between ordinary time and God's time when he understood Jesus as the lord of time and distinguished between an uncreated time which is one of the perfections of the divine being and created time, with its succession of past, present, and future.³² However, such a notion of "God's time," which would even be a universal time, is hard to fit in once time is thoroughly physicalized. One is not free to add one spatial dimension in contemporary superstring theories; adding another temporal dimension is at least as problematic.

³² K. Barth, *Kirchliche Dogmatik III/2* (Zürich: Theologischer Verlag, 1948), par. 47.

An alternative would be to deny that God should be understood as a being, a single individual with attributes. God might, perhaps, be understood differently, say as "being itself," "the Good," or—as might perhaps be appropriate in the context of the natural sciences—"Intelligibility," hence more as an abstract entity.

4.2 Divine Action

Many theologians emphasize that time is a necessary component of a meaningful concept of divine action. There has been considerable discussion of divine action in recent philosophy of religion.³³ Some of these theologians and philosophers have defended the notion of specific acts of God in time. Others, such as Gordon Kaufman and Maurice Wiles, have opted for a more revisionistic position, seeing the whole universe as a single *master-act* of God. Leaving aside the many issues which arise from the dispute about science and specific acts, I will briefly summarize the "single act" position as it seems congenial to a cosmological point of view.

Kaufman regards activity proceeding from a single agent which is ordered toward a single end "one act," regardless of the complexity of the act or its end. Hence, "this whole complicated and intricate teleological movement of all nature and history should be regarded as a single all-encompassing act of God, providing the context and meaning of all that occurs."³⁴ Taking the whole as a single divine act might avoid problems linked with a more interventionistic account of divine acts in nature. God's master-act is understood to be the source of the overarching order itself. However, Kaufman insists on temporal order.

It is meaningful to regard the fundamental structures of nature and history as grounded in an *act* (of God), however, only if we are able to see them as developing in time. An act is intrinsically temporal: it is the ordering of a succession of events towards an end. If we could not think of the universe as somehow developing in

³³ See W. Alston, *Divine Nature and Human Action* (Ithaca: Cornell University Press, 1989); G. K. Kaufman, *God the Problem* (Cambridge, MA: Harvard University Press, 1972); H. Kessler, "Der Begriff des Handelns Gottes: Überlegungen zu einer unverzichtbaren theologischen Kategorie," in *Kommunikation und Solidarität* (Freiburg, Schw./Münster: Exodus/édit. liberation, 1985); *Marburger Jahrbuch Theologie I*, hrsg. W. Härle, R. Preul (Marburg: Elwert, 1987; art. by R. Preul, W. Härle, H. Deuser and C. Schwöbel); *The Concept of God*, ed. T. V. Morris (Oxford: Oxford University Press, 1987) and *Divine and Human Action* (Ithaca: Cornell University Press, 1988); T. F. Tracy, *God, Action, and Embodiment* (Grand Rapids: Eerdmans, 1984); K. Ward, *Divine Action* (London: Collins, 1990); M. Wiles, *God's Action in the World* (London: SCM, 1986).

³⁴ Kaufman, *God the Problem*, 137.

unidirectional fashion in and through temporal processes, it would be mere poetry to speak of God's act.³⁵

Kaufman then continues with the claim that modern science, the Big Bang theory explicitly included, makes such an understanding of the universe possible, even though the teleological end is not well discernable to humans.

I have serious doubts about the possibility of defending a teleological end, in a temporal sense, to the universe, though some physicists have speculated about life in an indefinite future.³⁶ Besides, it is not clear whether Kaufman would be satisfied with the partial ordering of most spacetimes, the "block" view of relativity theories, or whether he insists on a flow of time and a universal notion of simultaneity. Such problems have already been raised above. Here, I want to pay some attention to the notion of temporality as used by Kaufman.

The notion of temporality seems to be used at two levels. Kaufman ascribes temporality to God because he ascribes intentions to God. Time does function, for him, both within the universe, the created order, and beyond it—as a concept applicable to God (acts, intentions) as well. Is such an understanding of time as a universal background not challenged by the idea of the creation of time, which links time intimately with the whole created order rather than making it a universal category applicable both to God and to the created order? Would it not be possible to take more distance from the language of "acts," "causes" and the like in considering the relation between the physical universe and the divine? If the whole of spacetime is understood as a single act of God, could one not drop the notion of time (and causal action) at the meta-level? Might the concept of explanation in discussing the relation between God and the whole universe be more appropriate at that level than the concept of causation? This brings us to the next section.

4.3 *Divine Creation: God as Explanation of the Universe?*

The only way of explaining the creation is to show that the creator had absolutely no job at all to do, and so might as well not have existed.³⁷

Is there any need for introducing a creator of the universe? I will first point out some weaknesses in the claim that science provides a complete explanation

³⁵ Ibid., 128.

³⁶ F. J. Dyson, "Time without End: Physics and Biology in an Open Universe," *Reviews of Modern Physics* 51 (1979), 447-460; Dyson, *Infinite in All Directions* (New York: Harper & Row, 1988); F. J. Tipler, "The Omega-Point Theory: A Model of an Evolving God," in *Physics*; Tipler, "The Omega Point as Eschaton: Answers to Pannenberg's Questions to Scientists," *Zygon: Journal of Religion & Science*, 24 (1989), 217-253; see Drees, *Beyond the Big Bang*, 117-141.

³⁷ P. W. Atkins, *The Creation* (Oxford & San Francisco: Freeman, 1981), 17.

of the universe. Next, I will consider two proposals for religious explanations of the universe (Swinburne, Leslie).

4.3.1 *Science as Explanation of the Universe?* Atkins, an eloquent defender of the view that science leaves nothing to be explained, puts great weight on reduction to simplicity. Beings such as elephants and humans arise through an evolutionary process given sufficient time and atoms; atoms arise given even more simple constituents. Perhaps the ultimate unit to be explained is, as Atkins suggests, only spacetime; particles being specific configurations, knots of spacetime points. The second major component in his argument is chance: through fluctuations, nothingness separates into +1 and -1. With such dualities, time and space come into existence. The +1 and -1 may merge again into nothingness. However, by chance a stable configuration may come into existence—for instance, our spacetime with three spatial dimensions and one temporal dimension.

Atkin's idea is based on a notion considered over a decade ago, "pregeometry," promoted by John A. Wheeler. However, the fundamental issue has not changed significantly. For example, Hartle and Hawking wrote in their first article on the "no-boundary" cosmology that the wave function gives "the probability for the universe to appear from Nothing."³⁸ I would like to suggest that such claims face at least three kinds of problems.

(i) *Testability*. There is a plurality of fundamental research programs in cosmology. Experimental tests and observations may well be insufficient to decide among the more able contenders. Aesthetic judgments are, at least partly, decisive in opting for a specific scheme. However, what one considers elegant, another may reject.³⁹

(ii) *Exhaustiveness*. Could a single and relatively simple complete theory be fair to the complexity of the world? Or, as Mary Hesse suggests, is it the case that for "the explanation of *everything* there must in a sense be a conservation of complexity, in other words a trade-off between the simplicity and unity of the theory, and the multiplicity of interpretations of a few general theoretical concepts into many particular objects, properties and relations."⁴⁰ We will return to this question, as it suggests a significant objection to a platonizing theology related to cosmology.

(iii) *A vacuum is not "nothing."* The universe might be equivalent to a vacuum as far as conserved quantities go. Those conservation laws that are believed to be valid for the universe as a whole conserve a total quantity which may be zero. Take, for example, electric charge. Negative charges of electrons are matched by positive charges of protons. Atoms are electrically

³⁸ J. B. Hartle, S. W. Hawking, "Wavefunction of the Universe," *Physical Review D* 28 (1983), 2960-2975; 2961.

³⁹ W. R. Stoeger, "Contemporary Cosmology and its Implications for the Science-Religion Dialogue," in *Physics*, 229; J. D. Barrow, *The World Within the World* (Oxford: Clarendon Press, 1988), 373; Drees, *Beyond the Big Bang*, 66.

⁴⁰ Hesse, "Physics, Philosophy, and Myth," in *Physics*, 197.

neutral. And so is, it seems, the observable universe. Even if negative and positive charges match, there still seems to be a lot of mass. The universe is, as far as mass is concerned, far from a vacuum: we encounter stars, planets, and people. However, in physics mass is not a fundamental concept; it is one of the positive forms of energy ($E = mc^2$). We need to take negative energy into account. It takes energy to launch a rocket; hence we say that the rocket has negative energy before being launched. In the universe the negative energy due to gravitational binding might equal the positive energy due to the mass-energy of the universe. Hence, the universe might well be equivalent to a vacuum, as far as energy is concerned. Similar arguments can be made about other properties: either they may total up to zero or they are not conserved. The universe may have arisen "out of nothing," at least without a source of materiality. The universe might be equivalent to a vacuum.⁴¹

The equivalence of the universe to "nothing" only holds net. It is like someone borrowing a million Dutch guilders and buying stock for that amount. That person would be as wealthy, fiscally speaking, as someone without any debts and without properties. However, the first would be of more significance on the financial market than the second. The first strategy also assumes more than the second: the financial system is taken for granted. Hence, as far as the conservation laws are concerned, the universe might come from a "vacuum," but such a vacuum is not nothing. The vacuum discussed here in the context of creation *in* time is a vacuum that behaves according to the (quantum) laws which allow for the fluctuations to happen—just as the apparent millionaire only can get started once there is a concept of money, of borrowing. Similar assumptions, though not about time, are in the background of the schemes regarding the creation of time, as Isham's contribution in this volume explicitly acknowledges. Thus, Atkins' account might still need some explanation for the laws or similar entities which govern the vacuum.

To conclude, perhaps scientific explanations may achieve a lot, but they do not explain without remainder. Could the remainder, such as the existence and the laws of the vacuum, be in need of a religious explanation, or at least support the plausibility of such a view? I will present two examples of the latter argument. The first is based on the theistic conception of a personal God as the preferred explanation for the universe. Another approach does not make the transition from a causal to a personal explanation, but rather from facts to values.

4.3.2 Richard Swinburne: A Personal Explanation? Assume that the most fundamental law, and its effectiveness, is scientifically (causally) inexplicable. In that case, Swinburne has argued, one has to face two possibilities: either

⁴¹ See E. P. Tryon, "Is the Universe a Vacuum Fluctuation?" *Nature* 246 (1973), 396f., which has been reprinted in *Physical Cosmology and Philosophy*, ed. J. Leslie (New York: Macmillan, 1990). See also the discussion of creation in a background spacetime by Chris Isham in this volume.

that law is completely inexplicable or it has an explanation of another kind. Swinburne distinguishes between causal and personal explanations. A personal explanation should take its starting point from a person with intentions and certain capacities. These together determine the basic acts open to that person, such as raising one's hand. According to Swinburne a personal explanation cannot be reduced to a causal explanation. Even though physical concepts (such as muscle strength) are relevant to one's capacities, and brain states are linked to intentions, the correlations are not logically necessary.

Using this notion of "personal explanation" the most fundamental law of the universe might have such a personal explanation: that is the way God intended the universe to be. "The choice is between the universe as stopping-point and God as stopping-point."⁴² According to Swinburne, a universe is much more complex than God. The supposition that there is a God is an extremely simple supposition. A God of infinite power, knowledge, and freedom is the simplest kind of person there could be, since the idea has no limitations in need of explanation. The universe, on the other hand, has a complexity, particularity, and finitude which cries out for explanation. Hence, the religious option is to be preferred over its alternative.

There is no explicit use of science in this argument. It might be rational and valid, but that is to be debated at the level of philosophical reasoning without support from science.⁴³ The scientific contribution lies in the description of the universe. However, if the choice between accepting the universe as a brute fact or as in need of an explanation of a different kind is justified by comparing the simplicity of the two hypotheses (as Swinburne does), it is a matter of the utmost importance to understand how complex or simple the two alternatives are. Many cosmologists believe that their theories are of an impressive simplicity and elegance in structure and assumptions, even if the mathematics is difficult. Whether this makes it more or less reasonable to regard the universe as a "creation" is not clear (why could one not believe that God made a universe with a simple structure?) but it does tend to undermine Swinburne's argument based on simplicity. And the more general idea of using a person as explanation for the universe introduces the problematic concept of a disembodied person and suggests another question: why does that person exist. In addition, it seems to suffer from the problems surrounding the use of a single notion of "time" on two levels, as discussed above in relation to Kaufman.

4.3.3 *John Leslie: Creative Values?* Swinburne's approach does not offer an answer to the obvious question: why does that person exist? If the person

⁴² R. Swinburne, *The Existence of God* (Oxford: Oxford University Press, 1978), 127.

⁴³ For philosophical criticisms of Swinburne's argument, see J. L. Mackie, *The Miracle of Theism* (Oxford: Clarendon Press, 1982), 95-101, and J. Hick, *An Interpretation of Religion* (Basingstoke: Macmillan Press, 1989), 104-109.

(God) explains the universe, who or what explains that person? A person is, according to our experience, an entity that can be or not be. However, values seem to be different. They seem to have something absolute about them. They might therefore be better candidates for a stopping-point in the quest for explanation than either causal or personal explanations. However, a value lacks effectiveness. Honesty may be a value, even though it is not realized automatically. In general, values do not bring about the corresponding states of affairs. John Leslie, however, has defended the concept of creative values. He thereby places himself in a long philosophical tradition, which places the Good at the origin of all things. Plato seems to have held that knowledge and existence are both dependent upon the Good, the Good surpassing all existents in dignity and power.⁴⁴ Assuming Leslie's axiarchic principle that what is of value tends to come into existence, it may not be too difficult to argue for the necessity of consciousness, and hence for the necessity of characteristics like those our environment happens to have. Holding such a philosophical position, it is not surprising that Leslie has developed a strong interest in the argument from design in its contemporary cosmological form, based on the anthropic coincidences. Swinburne's position seems voluntaristic, the emphasis being on the will. Something would be good because God wills it. Leslie takes another stand: God may will something, if "will" is an adequate concept at all, because it is good.

The idea that values could be creative is highly speculative. Our experience is different: all too easily the good is neglected. Furthermore, according to our experiences, values find their expression in human decisions. Thus, in his criticism of Leslie's position J. L. Mackie has stressed that the concept of "creative values" may well be a projection of our desire for things judged good on these things themselves, an objectifying of human desires and judgements.⁴⁵ Do values have a platonic existence of their own, a priori of the things in which they are expressed? Or are dis-embodied values as problematic as dis-embodied persons? I wonder too whether such a view as Leslie's does sufficient justice to the problem of evil: the vulnerability of the good, the discrepancies between the real and the ideal.

Religious explanations of the universe, its existence and laws, seem to need assumptions about dis-embodied persons or values which are at least as problematic as the unexplained existence of the universe or its laws. Not being able to accept the finality of a scientific or a religious explanation, I think one does best in joining Charles Misner:

⁴⁴ Plato, *Republic*, book VI (nr. 509). On creative values, see J. Leslie, *Value and Existence* (Oxford: Basil Blackwell, 1979). On the anthropic principles in this context, see J. Leslie, *Universes* (London: Routledge, 1990).

⁴⁵ Mackie, *The Miracle of Theism*, 230-239, especially 239; see for another friendly critic of Leslie's position J. J. C. Smart, *Our Place in the Universe* (Oxford: Basil Blackwell, 1990), 176, 180.

To say that God created the Universe does not explain either God or the Universe, but it keeps our consciousness alive to mysteries of awesome majesty that we might otherwise ignore.⁴⁶

4.4 *Some Theological Objections to Platonizing Theology*

Is a "platonic" view of reality, which seems to correlate well with quantum cosmology and quantum gravity, a problem for Christian theology? Is there in this respect a genuine conflict between contemporary science and a Christian understanding of existence?

A platonizing theology is certainly different in its understanding of God and the relations between God and the world from another view which would put more emphasis on temporality both in God and in the world. Some of those differences, with respect to divine eternity and divine action, have already been explored briefly above. There seem to be possibilities, however, for reconciling the changes in our understanding of time (and similar changes with respect to contingency, and the like) with a concept of God which is not totally discontinuous with the Christian tradition.

Temporal critical realists might object to the understanding of cosmology and its consequences for theology as presented here. As an epistemological position, it seems to be at odds with critical realism's view of the world as consisting of substantial entities and of science as continuously approximating the true ontology. Developments in cosmology exhibit significant discontinuities with respect to the ontologies suggested (see above, 2.3). However important this objection may be, it concerns a philosophical issue, or perhaps even an empirical one,⁴⁷ rather than a religious issue.

There may be another objection, closer to the existential core of Christian belief. A platonic view of reality seems to depict an abstract world such as it might exist in the mind of God or, perhaps, of a finite knowing subject, rather than the reality of matter and history. A platonic view tends to emphasize the unity and coherence of the universe. Everything fits into an encompassing mathematical structure. Primacy of unity tends to go with a top-down approach. Reality, with its diversity, seems an illusion, since deep down there would be no diversity nor individuality. As far as there is diversity, it would not be good. The Good and the One are together on the divine side of being. In contrast, "nominalism" may be the symbol for the emphasis on diversity, and thus for a bottom-up approach. The diversity of things is the reality we encounter. Unity is our contribution in the process of description. Christian theology has its platonizing trends, but it is also interested in

⁴⁶ C. W. Misner, "Cosmology and Theology," in *Cosmology, History and Theology*, eds. W. Yourgrau, A. D. Breck, (New York: Plenum Press, 1977), 95.

⁴⁷ That critical realism might be empirically testable is suggested by E. McMullin, "A Case for Scientific Realism," in *Scientific Realism*, 29.

particulars, especially in relation to our own being. The theologian Langdon Gilkey is thus wary of demands for total coherence:

... the incoherent and the paradoxical, the intellectually baffling and morally frustrating character of our experience, reflect not merely our lack of systematic thinking but also the real nature of creaturehood, especially "fallen creaturehood."⁴⁸

Any comprehensive theological scheme is as much an attempt to think about diversity within unity as a complete scientific theory would be. They both remain open to a further consideration of their unity, and of the way that unity deals with the diversity. Gilkey's statement should not be misconstrued as to suggest that theology has no interest in the unity of an encompassing view. But Christian theologies should remain open to the diversity of experiences, even to the confusing and contradictory aspects of existence, such as evil. As I see it, the danger of too much emphasis on a timeless overall view of the universe might be that it enforces values which overemphasize unity and neglect diversity. Both unity and diversity should be part of a satisfactory view of the world. One might distinguish in the Christian tradition between strands that have more affinity with "mysticism," with a sense of unity or harmony with the divine, and strands that emphasize more the distance between the actual world or the actual behavior and the way it is intended by God, a "prophetic" stance. A platonizing philosophy of nature might accommodate more easily a mystical strand in the Christian tradition than the prophetic strand, with its critical stance towards the existing order.

Is this an important conflict between a platonizing interpretation of the universe and a Christian, existentially shaped, attitude in life? Is this conflict, if real, due to the limitations of such an understanding of the universe, or even a limitation to any understanding based on the natural sciences with their abstraction from particulars and from the present?

If the abstract, platonizing character of cosmology is deemed a problem, one might opt for a "bottom-up" approach with respect to our knowledge, and thus make a turn to the subject who develops such platonic views. However, before turning to more constructivistic approaches with respect to religion and science, I still need to rebut one possible objection against my argument so far: why can temporal critical realists not dismiss quantum cosmology and quantum gravity as too speculative to be relevant?

5 *Why Critical Realists Cannot Dismiss Quantum Cosmology*

One might argue that a logical conflict may always be avoided. For instance, Philip Henry Gosse integrated evolution with belief in a recent

⁴⁸ Gilkey, *Maker of Heaven and Earth*, 37.

creation by holding that the world has been created with all the evidence of a longer history—Adam with a navel and trees with rings.⁴⁹ Almost any conflict may be avoided by choosing appropriate additional hypotheses. However, I have not entered into this line of thought, as it tends to result in *ad hoc* solutions and escapes. And certainly, such *ad hoc* moves are not in line with the serious work done in science and religion.

An apparently more credible way for temporal critical realists to escape the challenges posed by quantum cosmology and quantum gravity would be to dismiss quantum cosmology as too speculative. Ian Barbour, for example, has suggested that "we should consider only the broadest and most well-established features of the world disclosed by science, not its narrower or more speculative theories."⁵⁰ I will argue below that such a restriction to the scientific consensus is ineffective. This way of dismissing quantum gravity is not open to critical realists.

Another way to attempt to escape taking account of quantum cosmology would be to emphasize the intermediate, "human" or organic level of reality as the most relevant, and thus to defend passing over quantum cosmology, for example with respect to the non-applicability of time at "early times," such is the substance of Peacocke's remarks on the Hartle-Hawking imaginary time, referred to above (section 2.3). With respect to conventional quantum theory, Polkinghorne once played down its significance as it "only manifests its idiosyncratic character in processes of a smaller scale than normally concerns us."⁵¹ Believing instead that quantum R. J. Russell humorously replied that "atoms may be small, but they're everywhere." He went on to show that quantum physics is relevant to all sorts of, everyday phenomena, including visual perception, the stability of matter and a host of other phenomena.⁵² There is, of course, some relevance to Polkinghorne's position. One can still apply Newton's law of gravity for calculating orbits, and chemistry can be done without paying much attention to the quark structure of the atomic nuclei. I will nonetheless argue below (5.2) that in their quest for theologies with a credible ontology it is impossible to escape reflection on quantum gravity. This is because of the way the authors discussed here have emphasized the unity of the sciences and of reality: both are structured in hierarchical manners.

5.1 Consensus and Speculation

Restriction to the most soundly established features is typical of critical realism as defined by McMullin, for instance:

⁴⁹ P. H. Gosse, *Omphalos* (1857); see Edmund Gosse, *Father and Son* (London: Heineman, 1907; Harmondsworth: Penguin Classics, 1986), ch. 5.

⁵⁰ Barbour, "Creation and Cosmology," 143; similarly Peacocke, *Intimations of Reality*, 1984, 60f.

⁵¹ Polkinghorne, "The Quantum World," 334.

⁵² Russell, "Quantum Physics," in *Physics*, 369.

the longterm success of a scientific theory gives reason to believe that something like the entities and structure postulated by the theory actually exists.⁵³

The length of time during which the theory must be successful is unspecified, but the general requirement is nonetheless defended as reasonable. On this assumption, it seems reasonable to take the description of the universe as of a fraction of a second after the apparent " $t=0$ " as reliable, since it has been accepted as successful for two decades—at least since the discovery of the cosmic background radiation in the mid-sixties. Future developments, as envisaged by the critical realists, may confirm a finite past or suggest an earlier cosmic epoch before the apparent " $t=0$."

The problem with this view is that it only considers one type of future development, an extension back in time. As argued above (2.3), the nature of the epistemological limit—the need to integrate quantum theories and spacetime theories around or before the Planck time—is such that it may well affect the entire interpretation of Big Bang theory. On the view of quantum gravity which we have followed so far, the quantum view of time turns out to be very different. Therefore, one also needs to reinterpret the concept of spacetime view in Big Bang theory, and thus the part upon which there is consensus. Similarly, one could argue that the co-existence of a plurality of serious research programs which all accept the Big Bang theory in its "consensus" domain, shows that the Big Bang theory may well be open to a variety of future developments or interpretations, suggesting different ontologies.⁵⁴

The variety of possible developments and interpretations of cosmology seems to offer temporal critical realists the possibility that there might be a cosmology which would fit their view of time, for example by assuming a Minkowski background spacetime. If a Minkowski background spacetime would not do, they could perhaps even opt for a cosmology with a universal notion of simultaneity so as to allow for a univocal definition of concepts such as "God's past" and "God's future." Among the serious contenders in cosmology the programs of Penrose and Vilenkin might be slightly more attractive to temporalists than Hawking's.⁵⁵ However, Penrose too has expressed the conviction that time and space may be notions of limited significance, and Vilenkin's approach was the one actually used by Isham in his contribution to set forth the features of quantum cosmology and quantum gravity, with "internal" time and "imaginary time."

If one allows theological or metaphysical preferences to be decisive in the choice of theories or in the interpretation of theories, some relief might

⁵³ McMullin, "A Case for Scientific Realism," 26.

⁵⁴ See the comparison of the approaches by Linde, Hawking and Penrose in W. B. Drees, "Quantum Cosmologies and the 'Beginning'" *Zygon: Journal of Religion & Science* 26 (1991), 373-396, and in Drees, *Beyond the Big Bang*, 62-69.

⁵⁵ Peters, "On Creating the Cosmos," 295; Drees, *Beyond the Big Bang*, 68.

be available for temporalists. However, a critical realist has to accept the fact that by the standards of critical realism certain possibilities are no longer open. One would have to accept two major transitions of "longterm success": the transition from Newtonian time to the conceptuality of special relativity, which led to the dismissal of absolute simultaneity, and the transition from the special to the general theory of relativity, which led to the transition from external to internal time. Hence, though some eclecticism might be permissible, but one cannot—by the standard of longterm success—back away from quantum cosmology and gravity where it is in the process of developing such concepts.

In general, there seem to be four possibilities with respect to the way one deals with the consensus, and the lack of consensus, in science.

(i) *Eclecticism*: one takes whatever fits best. This attitude is present in much religious use of more speculative scientific statements, such as those of David Bohm or John Wheeler. Taking one's selection from science in such a manner might be a contribution to the development of an intelligible and coherent view. However, it makes no contribution to the credibility of the position under consideration. It may even be to its disadvantage if the selection is made in a rather arbitrary manner.

(ii) *Cheap dismissal*: theologians need not pay attention to science, since the scientists are not themselves certain of their claims. Thus, theologians might claim to be free to hold whatever position they like. As long as the scientists, in this case the cosmologists, do not reach a consensus, anything goes. Such an approach would neglect the partial consensus among scientists. Though there is some variety of positions, many alternatives have been ruled out. Hence, to dismiss some science because of a lack of consensus is not really warranted.

(iii) *Cautiously wait and see* what will become the consensus. "Viable theologies need not, at the moment, even be consistent with such ideas, since these ideas are speculative at this time."³⁶ There is, I admit, no strict need for consistency with all speculative scientific theories. However, the scientific consensus is not that clear and safe either, as it is open to future developments which may cause significant reinterpretation. As R. J. Russell observed: "In active areas of scientific research, there are always numerous competing theories as well as competing interpretations of theories. If our strategy is to wait for agreement, I fear we will be limited to historical studies."³⁷ Moreover, he stresses that agreement is seldom unambiguous: what guarantees that it really has been reached? what about the eventual replacement of even "accepted" theories?

(iv) *Reverse eclecticism*: take the worst possible case. If one were able to show how it might be incorporated in a certain religious-metaphysical

³⁶ H. L. Shipman, "The Creation of Order from Chaos," in *Creation and the End of Days*, eds. D. Novak and N. Samuelson (Lanham: University Press of America, 1986), 9.

³⁷ Russell, "Quantum Physics," in *Physics*, 370.

scheme, one would really have made progress. Taking science "where it hurts most" offers the greatest challenge, but also the greatest profit with respect to credibility.⁵⁸

5.2 *The Unavoidability of Quantum Gravity*

Arthur Peacocke and other temporal critical realists have pleaded for a hierarchical view of reality, whereby higher levels of reality are constrained by lower levels but not determined by them, nor epistemologically fully reducible to them. A biological description of reality is not reducible to one in physical terms, though it cannot contradict the physical laws involved, such as the conservation of energy. Through this hierarchical structuring of the sciences, they are able to combine interest in the unity of the sciences ("One World") with an anti-reductionistic stance which, among other aims, intends to do justice to the distinct contributions offered by different disciplines. Roughly speaking, the hierarchy extends from the physical sciences through the life sciences up to psychology and cultural sciences, with theology occupying the uppermost level.

One may question the linear structuring of the sciences. It may be that some disciplines do not so much fit at one level as serve to integrate different levels. For example, one might defend the view that genetics in biology serves to integrate evolutionary biology, ecology and ethology as higher levels with physiology, histology, and molecular biology at lower levels.⁵⁹ Similarly, one might claim that theology serves an integrating role rather than that it occupies the uppermost level. It might perhaps be more suitable to consider a network structure than a hierarchy. However, a network would do less justice to the intuition that some sciences are more basic than others, though specific sciences could still be considered as constraints upon other sciences.

Let us assume the hierarchical structuring. A change in the concept of energy in physics would then imply changes in the way the metabolism of living organisms is understood. The discovery of the conservation of energy in the nineteenth century, as well as the proper definition of concepts such as free energy, has had its impact on higher level sciences, for instance those studying the metabolisms of organisms. If "energy" were discovered to be wrongly defined, biology would have to adapt. The constraints imply that

⁵⁸ L. Eaves, "Spirit, Method, and Content in Science and Religion: The Theological Perspective of a Geneticist," *Zygon: Journal of Religion & Science* 24 (1989), 185-215, 203. Eaves deals with the role of genetics, also in a response to the papal message of the 1987 conference: "biologists need to be assured that their science is to be accorded the same sensitivity and respect that His Holiness' message has extended to physics" (L. Eaves, "Autonomy Is Not Enough," in *John Paul II on Science and Religion: Reflections on the New View from Rome*, 22). Similarly, I intend to warn against eclecticism with respect to the treatment of time in quantum cosmology.

⁵⁹ E. T. Juengst, "Response: Carving Nature at Its Joints," *Religion and Intellectual Life* 5 (Spring 1986), 70-78.

changes in our understanding at lower levels of the hierarchy of the sciences have consequences for higher levels insofar as the higher levels use the same concepts and laws.

Now in the case of quantum gravity it is not the concept of energy which is at stake, but rather the concept of time. The changes initiated by the general theory of relativity have affected our understanding of the Newtonian theory. Not that it led to much change at the level of calculations done in a Newtonian framework, but it affected the assessment of the metaphysical adequacy of its view of space and time as absolutes. Similarly, quantum theories affected the assessment of the metaphysical adequacy of the billiard-ball view of material substance. The same should hold for a theory which affects our concepts of space and time: it should rank extremely low in the hierarchy of the sciences, due to the very general and basic concepts involved, and thus affect our view of all the other sciences. If, for example, time and space were shown to have a discrete rather than a continuous character, this would, in principle, affect our understanding of all the laws of physics—formulated as they are in terms of differential equations. If time were shown to be a derivative and not a fundamental concept, it would not be acceptable to treat time as a Newtonian, external absolute at higher levels—at least not for metaphysical purposes. Thus, one cannot dismiss quantum gravity in such a perspective as dealing with distances and durations which are too small to be relevant. The issue is not just quantum cosmology, but quantum gravity—the theory which would be the physical theory below the levels occupied by quantum theories and general relativity theory.

It would seem an unacceptable, *ad hoc* move for critical realists to dismiss quantum cosmology and quantum gravity just because its resultant view of time displeases them. And its understanding of the nature of time carries over to all levels of the sciences, including the life-sciences, the humanities and theology, due to the realist view which unites the sciences into a hierarchy, since quantum gravity would have to be located at the bottom, fundamental level.

An alternative might be to put less emphasis on the unity of the sciences. It might be that different sciences lead to different views of reality, but without allowing for the coherence and unity suggested by the hierarchical view. Rather, in the various sciences different views of reality are constructed, without claiming that they need to be ordered in such a hierarchical fashion. Thus, it might be possible that the concept of time used at different levels can vary. Such an attitude towards the sciences would, of course, be more modest in that it withdraws the metaphysical intention of achieving, or at least approximating, an encompassing view of all aspects of reality.

6 *Cosmology and Theology as Myths*

It is far beyond the scope of the present paper to attempt to do justice to the various ways in which less "realistic" approaches to theology have been developed. One might think of nominalistic strands in the history of theology,

the various turns to existentialism, ethics, narrative, social struggle, and the rules of discourse in language games. Many of those less realistic approaches lack interest in the dialogue with the natural sciences. However, this is not necessarily the case. In order to show the existence, and to suggest the viability, of a third approach in science and religion, in addition to temporal and platonic realism, some aspects of the work of Mary Hesse on science and theology will be discussed.⁶⁰ The last section (6.2) will suggest some lines along which I think that one might develop such ideas into a substantial theological position.

6.1 Mary Hesse: *The Construction of Reality*

The problem is essentially not one of scientific "realism," but of communicative strategy.⁶¹

Mary Hesse has defended a network model of science. Such a model tends to stress instrumental goals, valuing prediction and control, "at the expense of realism, if realism is interpreted in terms of universalizable theoretical explanation."⁶²

She has called her position on various occasions "realism," but qualifies that significantly. For example, what counts as the primary individuals is theory-relative; they may well be superseded in another theory. There is, taking her view, no reason to deny the existence of something formerly referred to as "phlogiston." However, its "what" is not decided thereby. "What those substances or those atoms actually *are*, is something whose description changes from theory to theory, and will never be finally settled as long as science continues to develop. Theories about essences are neither stable nor cumulative, and are therefore not part of the realistic aspects of science." Thus, theoretical descriptions asserting that space is Euclidean or that it has non-zero curvature are unstable and non-cumulative. This does not exclude accumulations of approximate forms of law. "If such accumulation of approximations is thought insufficient for 'realism', then this account of science may be called instrumentalist, but there are other respects in which it is nearer

⁶⁰ Another example would be the hermeneutical approach advocated in science-and-religion by a group of the University of Neuchâtel (Switzerland). An extensive presentation of the theoretical ideas and various applications, for instance on Artificial Intelligence, came to my knowledge only after concluding this contribution. P. Bühler, P.-L. Dubied, C. Karakash, O. Schäfer-Guigner, G. Theissen, *Science et foi font système: Une approche herménéutique* (Geneva: Labor et Fides, 1992).

⁶¹ Hesse, "Retrospect," in *The Sciences and Theology in the Twentieth Century*, 287.

⁶² M. Hesse, *The Structure of Scientific Inference* (London: Macmillan, 1974), 284. One could also consult her *Revolutions and Reconstructions in the Philosophy of Science* (Brighton: Harvester, 1980), especially 63-110. She acknowledges her debt to W. V. O. Quine for the term "network model."

to realism." It certainly is not the case that anything goes. Science is a learning process, with systematic self-correction. "Natural scientific inference has rational grounds, but these are essentially finite and local in application, and determined by empirical conditions of testability and self-correction."⁶³

In the Gifford lectures delivered by Michael Arbib and Mary Hesse, learning is discussed in a wider context. Taking up a suggestion from Piaget, the concept of a schema becomes central. Schemas may represent objects or actions, with perceptual schemas serving to supply the parameters that afford the action. In the line of Piaget's work on the development of schemas, one might think of them in a dynamic Kantian way; "the categories are no longer a priori, but change over time."⁶⁴ Schemas do not arise as ideas in isolation. They are not closed semantic nets, as dictionaries are—words explaining words. Interaction with the world, in perception and action, is central, and thus is embodiment. It is essential to link the development of knowledge structures in artificial intelligence with "being in the world."

In the context of the network model, Hesse has emphasized the limited scope of theories and the role of the pragmatic, instrumentalistic criterion. This has:

negative implications for the universal ontological and cosmological consequences that have sometimes been held to derive from natural science. There has been a constant tendency for the prestige of instrumental success to flow back into temporary ontologies and analogies, and to infect social and metaphysical thought about the nature and destiny of man and the universe.⁶⁵

Thus, "no truths about the substance of nature which are relevant to metaphysics or theology can be logically derived from physics." "No substantial consequences about the world can be drawn from this game [science] except what were put into it."⁶⁶

The use of science in theology might be apologetic, a matter of communication and status. "It would be a mistake now, as it was then, to build the details of such models of causality too firmly into our doctrine of God. They may provide useful analogies for apologetics and a useful liberation from too constrained a notion of God, but they are not essential to central theological beliefs, nor can they logically disprove such beliefs."⁶⁷ In the context of the present article, it may be of interest that she applies this also to considerations

⁶³ Hesse, *Structure of Scientific Inference*, 299, 300, 302.

⁶⁴ M. A. Arbib, M. B. Hesse, *The Construction of Reality* (Cambridge: Cambridge University Press, 1986), 45.

⁶⁵ Hesse, *Structure of Scientific Inference*, 301.

⁶⁶ Hesse, "Physics, Philosophy and Myth," in *Physics*, 189, 198; compare earlier remarks regarding the technical role of the background in quantum cosmology (e.g., notes 17 and 19).

⁶⁷ Hesse, "Physics, Philosophy and Myth," 191.

regarding the static or dynamic nature of reality, even paying some attention to quantum cosmology.⁶⁸

"In any case, it is unprofitable in an antimetaphysical age to seek to make the world safe for religion by metaphysics. Such a procedure is anachronistic and intellectually barren for believers and unbelievers alike. But there is no need for it. In relation to the Christian religion, at least, there are no intellectual foundations for belief except in the continuing tradition of practice, theology, and changing historical experience, which are all rooted in the Great Schema itself."⁶⁹

Rather than looking for scientific contributions to a metaphysical theology of nature in the traditional sense, it may be more fruitful to regard science as consisting in "debates about an appropriate language for theology, and a source of appropriate models."⁷⁰ Hence, the issue is how theological concepts "may be expressed in a language accessible to those nurtured in the scientific framework." Science and theology "meet on the ground of different but comparable social symbolisms rather than of common subject matter or of method."⁷¹

6.2 The Christophoric Circle

Hesse focuses on epistemology, interpretations of physics and theology, rather than on interpretations of nature. However, some ontological consequences seem to follow. One is the emphasis, especially in the Gifford lectures, on "embodied existence," on the essential role of perception and action in relation to thinking. Another, related one, is the emphasis on the interaction if not interwovenness of truth and value, for example in her understanding of language. If embodiment, perception and action, are taken to be central, the *imago Dei* notion cannot be focused exclusively on human reason or rationality, but should relate to action, as expressed in the phrase *imitatio Christi*. This may well be illustrated with the legend of Christopher.

Christopher—not yet bearing that name—was an impressive figure, strong as a bear. He wanted to serve no one but the highest king. He thus went to serve the greatest human king—until he discovered that the king was afraid of the devil. He then served the devil, but discovered that the devil avoided crossings. Thus, Christopher discovered that Christ must be greater than the devil. He then longed to serve Christ, but could not find him. Advised by a hermit, Christopher took on a humble task that fitted his

⁶⁸ Ibid., 200 n.13.

⁶⁹ Arbib & Hesse, *The Construction of Reality*, 243.

⁷⁰ M. Hesse, "Retrospect," in *The Sciences and Theology in the Twentieth Century*, 287.

⁷¹ Ibid., 287, 282.

capacities—helping people to cross a river. After many years a child called upon him to help him across. But the child turned out to be unexpectedly heavy. It was Christ, who carries the world—depicted in many images as a globe.

There is a circularity in the story which is not fully captured in the common depictions of it: Christopher carries the child while the child carries the world—on which Christopher should be understood to be standing. It seems to me an apt representation of a religious attitude which acknowledges the human, constructive side of faith: images of God are our schemes, they exist in us, individually and socially. But those human images are images that intend to express something that transcends us, both quantitatively (a persistent mystery beyond) and qualitatively (a greater and different love, a higher perfection than we will ever realize and an otherness which confronts us). The child that we carry may be the child that carries the world, including ourselves.

As acting and thinking come together, the relation between values and facts—axiology and cosmology one might say—comes in sight. Some contemporary contributions to "science and religion" seek to relate religious thought to the contemporary world view suggested by the sciences. If that approach is taken in isolation, cosmology may, for example, by analogy and extrapolation, be related to order and design, to a positive view of God as the Maker of Heaven and Earth. The extrapolation might also, due to awareness of epistemological limitations on cosmology, be seen to suggest a mystery beyond knowledge.⁷² Such ways of understanding God may be deemed pale and irrelevant to our individual and social existence.⁷³ An attractive feature of a more self-consciously limited view of scientific knowledge is that it leaves room for a more independently formulated understanding of God. But the advantage may also turn into a disadvantage: too much freedom, as mutual irrelevance, may lead to a loss of credibility.

One way to keep a proper distance from cosmology, of allowing for the correct amount of independence of cosmology from theology, is the turn to axiology, to the ethical and existential decisions that humans have to face, as the primary locus of theology. This may lead to questions about the nature of values in a world of facts. One might consider granting values a platonic kind of existence, or point out how they function in the social world, arguing that science is unable to measure them as values. Elsewhere I have tried to define theology formally as the attempt to think the unity of cosmology and axiology, of "facts" and "values," whether as being in harmony or not.⁷⁴ I prefer to hold that values should interrupt and confront our behavior (facts) with something else, with what might be considered as God's intentions, if we are

⁷² For instance in M. K. Munitz, *Cosmic Understanding* (Princeton: Princeton University Press, 1986).

⁷³ Hesse, "Physics, Philosophy and Myth," 199.

⁷⁴ W. B. Drees, "Theologie en natuurwetenschap: onafhankelijkheid en samenhang," in Hans Kiting *et al.*, *Godsdienst op een keerpunt* (Kampen, NL: Kok, 1990).

to do justice to the prophetic strands in the Christian tradition. This may be neglected when too much emphasis is placed on the coherence of the various sciences and theology, on consonance between our understanding of physical reality and of God, as seems to be the intent of many more realistic theologies, and even more so of so-called "new age" religious philosophies. A lack of interest in the manifold tensions typical of human existence, as seems to characterize most platonizing theologies, may as well endanger the possibility of a confrontive, interruptive style of ethical thinking. On the other hand, religious thinking which restricts itself to ethical issues may fall short in providing a basis for motivation and empowerment, even in the face of failures. As in the image of Christopher and the child, we have to act, to carry the child, but we do so on the assumption that we are carried by something—power, mystery, love?—far beyond us.