

# Interpreting the Universe as Creation

## A Dialogue of Science and Religion

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## 4

# Potential Tensions between Cosmology and Theology

Willem B. Drees (Amsterdam)

The paper starts with a brief recapitulation of some scientific insights (section 1). I will then discuss the *beginning* and the *explanation of the Universe* (sections 2 and 3). I will come to two other areas where the potential tension between theology and cosmology seems to me to be of more importance though less often considered. Firstly, *time* appears to be a concept of limited significance in contemporary cosmology. This might bear upon our understanding of God's relation to temporality, and hence on views regarding *divine eternity* and *divine activity*. Theological positions developed in the context of the dialogue with an evolutionary understanding of the world may be useless in the context of a dialogue with cosmology (section 4). Secondly, the *platonistic character* of theoretical cosmology has significant potential implications for theology (section 5).

In the preceding paper, Chris Isham pointed out many limitations of contemporary cosmological theories. He thus warns against taking cosmology too seriously. The present paper may seem to neglect that warning. As I see it, it may be a good social custom to plead for modesty with respect to one's own business, and especially so in cosmology. And theologians should pay very serious attention to the limitations of cosmology when they intend to use its results as support for their own position (see, for example, the 'beginning', as discussed in section 2). It is there that they may prone to 'smothering the differences', as warned against by Brümmer in his introductory essay in this volume. However,

when theologians and evolutionary theists attempt to do, they may rightly be challenged with regards to the applicability of a concept like 'time' throughout their whole scheme. And playing down the quantum cosmological approach, because our world is one in which breakfast is before lunch, as Brümmer quotes approvingly from G.E. Moore, doesn't do justice to the expansionism which is characteristic of science. Playing down cosmology in order to avoid confrontation seems an unfair and unproductive escapist strategy. I prefer rather to take cosmology serious in order to find out where the issues may be. Like Isham, I have tried to focus on the more general features of such cosmological theories.

Secondly, there is no such thing as *the* doctrine of creation<sup>1</sup>. The issue is rather which doctrine of creation one can take seriously against the background knowledge produced by the sciences. Or, understanding theology more dynamically, how revisionistic one is willing to be.

Thirdly, it seems unnecessarily limited to think of the dialogue between theology and science as one regarding exclusively the locus of creation; it touches on our understanding of God in all its various aspects.

Fourthly, a logical conflict may be avoided by adding appropriate additional hypotheses - as Philip Henry Gosse did in 1857 in his book *Omphalos* when he integrated evolutionary theory with belief in a recent creation by holding that the world has been created with all the evidence of a longer past - Adam with a navel and trees with rings. However, I haven't entered into this line of thought, as it seems to result in *ad hoc* solutions and escapes.

### 1. Time and Matter

What is the universe that we are considering, the ontology suggested by contemporary cosmology? In this section some ideas regarding time and matter will be recapitulated.

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1. D.A.Knight, "Cosmogony and order in the Hebrew tradition", in R.W. Lovin, F.E. Reynolds (eds.), *Cosmogony and Ethical Order* (Chicago 1985), 151, distinguishes between six different views of creation within Yahwism. "They give voice to the viewpoints and values prevalent in diverse settings: priestly, agrarian, sapiential, prophetic, cultic, apocalyptic". And J.Reuman, "Creatio, continua and nova", in V.Vajta (ed.), *The Gospel as History* (Philadelphia 1975), 96, finds "three or four pictures in ancient Israel, three more after the exile, plus half a dozen or more strata in the New Testament". The diversity within systematic theology is at least as wide as in the Biblical texts to which these authors refer.

## 1.1. Time

*Time without flow in classical cosmology:* The language of physics is, at least at the present moment, unable to deal adequately with the notion of a flow of time<sup>2</sup>. In their study of physical reality, physicists eliminate those aspects that make phenomena unique, including the unique 'here' and 'now'. A theory of the flow of time would do precisely the opposite, as it would single out a unique moment of time as the present.

One could compare a universe to a *film* - each single picture representing a three dimensional universe at a certain moment. One can either adopt the perspective of the viewer, who sees all the pictures subsequently in time, and hence sees action, movement, 'evolution', or the perspective of the manufacturer, who handles the whole film as a single entity, for instance in selling or storing it. The film still has a 'story', but there is no movement, no action or 'evolution'. The same holds for books.

In relativity theories space-time as a whole is the fundamental four dimensional entity. The philosopher J.J.C. Smart has consequently argued that all objects should be regarded as four dimensional. "If you want to say that you do not really see a tomato (an object extending into the past and the future) but only an instantaneous 'time-slice' of it, then in consistency you should say that you never see tomatoes but only their facing surfaces. ... if you go one way about the tomato and its back and interior then you should go the same way with the past and the future of the tomato"<sup>3</sup>. Other branches of physics take time as a whole as well. One could think of the formulation of physical theories in phase space, with trajectories representing whole histories, and least action approaches. This holistic treatment of temporal extension need not imply determinism - which seems to be the case in the example of a film<sup>4</sup>.

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2. See P.Kroes. *Time: Its Structure and Role in Physical Theories* (Dordrecht 1985). Questions about the flow of time have often been mixed up with a linear order relation and with asymmetry between the past direction and the future direction. However: (i) an order relation seems necessary for flow, but isn't sufficient - we do not perceive any flow along the line representing the real numbers, and (ii) time asymmetry is neither sufficient nor necessary for flow.
  3. J.J.C.Smart, *Our Place in the Universe* (Oxford 1989), 20.
  4. One can only sell complete films once they are complete. However, selling is an action in time, and hence leads to the temporal type of description. The timeless approach, without claiming to have the final perspective of one's world at a certain moment of time, need not imply determinism, see W.B. Drees, *Beyond the Big*

*Time's ontological status in quantum cosmologies:* If a theory deals with space-times or complete histories, there still is time as an order parameter from one side of history, its beginning, to the other side, the end. However, even such a status for time is disputed in quantum cosmologies. In general terms, once space and time become subject of description in terms of quantum physics they lose the property of definite location in space and time. What would a moment in time be if it would not have a definite location in time? Time is a phenomenological construct, and, as Isham explains in his contribution, many 'internal' properties can be used to define different notions of 'time'. One might well see this phenomenological nature of time as a modern day equivalent of Augustine's view of *creatio cum tempore*, time being part of the created order. The loss of status goes even further: time isn't an applicable notion at the most fundamental level, at least in some interesting realms in quantum cosmological descriptions.

*The limited significance of evolutionary insights:* Arthur Peacocke, in his contribution to this volume, emphasises 'the *dynamic* character of the history of nature'. Evolution, in a general sense, 'can be said to occur cosmologically, inorganically, geologically, biologically, socially and culturally'. This emphasis on the temporal nature of reality at all levels, and as seen from all scientific perspectives, is typical of almost all contributors to the science and religion dialogue. Ian Barbour wrote in his Gifford lectures about the metaphysical implications of contemporary physics: "In relativity, time is inseparable from space. There are no purely spatial relationships, only spatiotemporal ones. All of this is radically different from the Newtonian world of absolute space and time, in which change consisted of the rearrangement of particles that are themselves unchanging. We will find a similar emphasis on change and the emergence of genuine novelty in astronomy and evolutionary biology. The historicity of nature is evident in all the sciences."<sup>5</sup> I agree about the departure from Newtonian absolute space and time. However, that doesn't lead us in cosmology to an all-embracing temporality, but to a much more limited significance of 'time', and hence a more limited significance of processes, historicity and the like. Cosmology is not in line with evolutionary biology as dealing with a dynamic and evolving Universe. Hence, theological insights developed in the dialogue with the evolutionary understanding of the natural world are not directly extendable

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Bang: *Quantum Cosmologies and God* (La Salle 1990), 283.

5. I.G.Barbour, *Religion in an Age of Science* (San Francisco 1990), 123.

to the dialogue with cosmology. That would 'smother the differences', to take up the phrase used by Brümmer in his introductory essay to this volume, not just between theology and science, but between different sciences. Just because these authors claim a universal role for an evolutionary, temporal outlook, they are challenged to explicate how they could deal with the, still speculative, ideas at the frontier of cosmological research, and even the standard theory of space-time (General Relativity), which suggest that the evolutionary presentation is one of limited validity, and not the most fundamental one.

If the temporal perspective is considered to be essential to Christianity, 'the doctrine of creation' conflicts with cosmology. However, in my opinion, it might be 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 space-time framework) may be found. Depending on one's view about the relation between free will and indeterminacy, that might be dependent upon further considerations regarding determinism.

### 1.2 Matter and vacuum

Contemporary cosmology also seems to challenge our common sense ideas about the substantiality of the Universe. As Isham pointed out when considering quantum creation in a fixed spacetime, the Universe might be equivalent to a vacuum<sup>6</sup>. Take, for example, *electric charges*. Negative charges, of electrons, are matched by positive charges, of protons. Thus, atoms are electrically neutral, as is a vacuum. The Earth as a whole seems to be electrically neutral, and so does the observable Universe.

Even if the negative and the 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, as far as physics is concerned, mass isn't a fundamental concept; it is one of the positive forms of energy ( $E = m.c^2$ ). The observable Universe contains a huge amount of energy. However, we need to take negative energy into account. It takes fuel to launch a rocket; it has negative energy before. Such binding energy is considered negative. The Earth is gravitationally bound to the Sun: without sufficient energy the rocket will be

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6. E.P. Tryon, "Is the Universe a Vacuum Fluctuation?" in *Nature* 246 (1973), 396-397; repr. in J.Leslie (ed.), *Physical Cosmology and Philosophy* (London 1990).

unable to leave the Solar system. And the Solar system is gravitationally bound to our Galaxy, the Galaxy to the Local group of galaxies, and so on. Could one launch a rocket, in principle, with so much energy that it escapes all the gravitational forces of the Universe? Calculations suggest that that is impossible: it takes as much energy as the mass of the rocket (and fuel) is worth. Its negative (binding) energy just equals its positive (mass) energy. The total energy may well be zero. 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 aren't conserved. The Universe may have arisen 'out of nothing', without a source of material.

The equivalence of the Universe to 'nothing' only holds net. It is like someone borrowing a million guilders and buying shares for that amount. That person would be as wealthy, fiscally speaking, as someone without debts and without properties, but he would be more important to the financial market. Such a strategy also assumes quite a lot: the financial system is taken for granted. Similarly, a Universe with positive and negative energy, with mass and gravitational binding, may be equivalent to a vacuum as far as the conserved quantities go, but it nonetheless assumes that there are such quantities, that it is possible to separate zero charge into + and -.

In the preceding section it was argued that the common sense notion of time isn't applicable to the Universe as a whole. Hence, for a 'creation' theory which includes the origination of time, it isn't clear whether the question as to what caused the Universe is meaningful, if the notion *cause* is understood as bearing temporal connotations. If creation in a fixed space-time is considered, as was the framework for the discussion in this section, the Universe might be equivalent to a vacuum. Does one need a cause for 'nothing'?

## 2. *In the beginning?*

Two kinds of arguments have been employed quite often to make the big-bang theory support theological positions: 1. the theory would provide the material premise for an argument for the existence of a Creator, and 2. there are significant parallels with the Biblical narrative. We will begin with the cosmological argument, arguing that it neglects the limitations of the scientific theories it claims for support.



### 2.1. A cosmological argument

A typical example of the cosmological argument which we are considering here runs as follows:

1. Everything that begins to exist has a cause of its existence.
2. The universe began to exist.
3. Therefore the universe has a cause of its existence".<sup>7</sup>

The first premise "is so intuitively obvious that no one in his right mind *really* believes it to be false".<sup>8</sup> 'Nothing from nothing' understood as the requirement of previous material appears similar to the *conservation laws* in science. Therefore, this rule seems to be supported by scientific evidence for the conservation of energy, momentum, charge and the like. However, those conservation laws that are believed to be valid for the Universe as a whole conserve a total quantity which is zero, as for the total charge (see above, 1.2). Other conservation laws, like conservation of mass and energy, are not applicable to the Universe as a whole or total to zero as well. As far as the scientific conservation laws are concerned, the Universe might come from a 'nothing'. If one objects to this on the basis of *ex nihilo nihil fit*, one is using a metaphysical principle, something like 'conservation of actuality', which is not equivalent with or justified by the scientific conservation laws. 'Nothing from nothing' as a requirement of a preceding cause seems also similar to the *methodological* principle of sufficient reason which seems to be at the heart of science: one should always seek reasons. However, this methodological rule should be distinguished from the *metaphysical* principle of sufficient reason, which states that there must be such reasons, whether we can find them or not<sup>9</sup>. This latter principle is outside science.

The second premise has been defended by Craig through an appeal to the big-bang theory and to thermodynamics. The big-bang theory is claimed to show that there was a 'beginning'. The Steady State theory is observationally ruled out, while the oscillating model is incorrect since our Universe is ever expanding. And the entropy (disorder) of the Universe is increasing, because "by definition the universe is a closed system, since it is all there is"<sup>10</sup>. An eternal universe would have reached its state of maximal entropy. Hence, our Universe must have had

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7. W.L. Craig, *The Kalām Cosmological Argument* (London 1979), 63.

8. Craig, 141.

9. M.K. Munitz, *The Mystery of Existence* (New York 1974).

10. Craig, 131.

a beginning. The idea, that a universe at low entropy might be a gigantic fluctuation in a universe in equilibrium, is rejected since the fluctuation would have to be extremely big, and hence improbable.

Both these claims are dubious once quantum theories are taken into account. Firstly, although there were in 1979 nearly no results in quantum cosmology, there was consensus among cosmologists that a complete theory needed a quantum theory of gravity. A philosopher could (and should) have known that there was a limit to the validity of the big-bang theory. In current cosmological research there are various ideas about the period before the standard model, and these different approaches have different implications for the cosmological argument. Some are eternal, others suggest an understanding of time which makes the notion of a beginning problematic.

Secondly, the appeal to the Second Law of Thermodynamics needs a more careful consideration as well. There are three meanings of 'open' involved: (a) open as forever expanding with diminishing density; (b) open as having interaction with an environment; and (c) open as regarding the applicability of the Second Law of Thermodynamics. These meanings are confused when it is claimed that the Second Law is applicable (meaning c) since the Universe is by definition closed (having no environment, meaning b). In an expanding universe, the expansion works as if there is an environment, although there is none. More precisely, the maximal entropy increases in an expanding universe, and this increase goes faster than entropy production during most phases. Thus, the universe does not approach a maximal entropy<sup>11</sup>. Rather, the non-equilibrium becomes more pronounced. Besides, the absence of a clear concept of entropy in relation to gravity makes the application of the concept of entropy to the whole Universe disputable. And the statistical character of the Second Law might allow for the occasional occurrence of states of low entropy in an otherwise eternal universe in equilibrium. In combination with the inflationary scenario the fluctuation does not need to be big, nor is it obvious that a much smaller universe with observers like ourselves would be more probable.

It is thus clear that a cosmological argument for the existence of God which is based on the 'beginning' of the Universe has no support from contemporary cosmology, and certainly not on the basis of the big-bang theory - which has a limited domain of validity. It must be a philosophical argument, without appeal to empirical evidence for a beginning of the Universe or for *ex nihilo nihil fit*.

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11. S. Frautschi, "Entropy in an expanding Universe", in *Science* 217 (1982), 593-599, esp. 595.

## 2.2. *Parallels with Genesis 1?*

Cosmogonic legends serve a variety of functions. Besides explaining the actual world with its tragic elements like death and decay, they legitimize social or religious structures and traditions, present an ideal against which actual practices are measured, and provide a background to the ethics of a culture.

In the Bible, the world is seen as created. But it does not present just one view of 'how'. Dominant is the emphasis on 'who', the one God related to Israel. Monotheism is not primarily a philosophical statement. It expresses an existential interest: one God implies that enemies don't have a God as powerful as Israel's God. Important is that the same God who is present in the life and history of Israel is also the One who was at the beginning, and who has the power to create or change whatever is necessary to his people. The world itself is not divine; there is a qualitative difference between God and his creatures. By the way, the concept of 'creature' may well serve to exemplify difficulties that arise when ideas are transferred from one context, the Biblical stories, to another one, our current understanding of the world of living organisms. For example, Labuschagne, in his contribution to this volume, speaks of humans as being created on the same day as 'the rest of living creatures on earth', according to the creation story of Genesis one. The 'living creatures' have been given to humans for food only after the flood. Implicitly, plants seem to be excluded from Labuschagne's category of 'living creatures', and thus from 'inherent (c.q. intrinsic) value of every living creature'. Labuschagne seems to smother the differences, to use again Brümmer's phrase from the introductory essay in this volume, between life as it functions in the context of the Biblical narratives and life as it is understood in the context of contemporary biology or environmental ethics, which certainly include plants among the living beings (even among the breathing ones).

Genesis 1, the well-known story of the creation in seven days, is *not* the major, and certainly not the only, text where reflections on God as the Creator can be found. The first few chapters of Genesis have been overemphasized as *the* story about creation and fall, the sources for cosmogony and anthropology. Such an emphasis neglects the variety of Biblical images concerning creation. Besides, it tends to misinterpret Genesis as if it were an answer to our cosmological questions. From the second verse on, the story of Genesis 1 concentrates on 'the earth' as the context of life. This includes a vision of social life, especially through its emphasis on the Sabbath, the seventh day, which is a major element in the identity of the people of Israel.

Both the big-bang idea and the biblical narratives evoke the image of a sudden appearance of the world. A similarity of such a *general nature* is not very surprising; there are at that level only two possibilities: either the Universe had a sudden beginning or it had not such a beginning. In many cultures there have been narratives expressing such a beginning of the world. Parallels with a more informative content fail upon closer inspection. Claiming more specific parallels seems only possible if the text or idea is taken out of its context. The content is read - in a certain way -, but its function is neglected. Adapting the analysis by Sal Restivo of claims on 'parallels' between physics and Eastern mysticism<sup>12</sup>, I suggest the following problems about parallels.

1. Translations: Parallels can only be established if there is something to be compared, namely statements in a common language. These statements are translations, both in the linguistic sense (from Hebrew and from mathematics) and in the cultural sense (a culture of a far past and the scientific, theoretical culture).

2. Representativity: If two statements are used to argue for a parallel between two conceptual structures (say, a scientific and a biblical world view), the question arises whether the statements are representative for the whole. A parallel between Genesis 1 and the big-bang idea would not imply that the big-bang theory confirmed a religion based on the Hebrew Bible, since the most important aspect from the biblical point of view, God's presence throughout history, is missing. Similarly for the scientific perspective, since the big-bang theory describes the evolution of the Universe after 'the first fraction of a second', and not the 'beginning', which is beyond the limits of its applicability.

3. The different functions of language: In science the main function is the communication among scientists about observations, experiments and theories. Conceptual clarity and logical consistency are important for such a purpose. Religious language serves other functions, like reassuring and comforting people and evoking moral attitudes. Whether there is some common aspect of language is to be discussed later, but there is surely much difference in this respect. Claiming parallels without paying attention to the function of language is not satisfactory.

4. The languages of science and religion influence each other. Words used in one context get used - with another meaning - in a different context. Parallels based on the use of the same word might be a consequence of such 'corruption of languages'. Notoriously risky are words like 'energy', 'order', 'nothing', and

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12. S. Restivo, *The Social Relations of Physics, Mysticism and Mathematics* (Dordrecht 1984).

also 'creation'. The use of the *creatio ex nihilo* formula in articles treating the beginning of the Universe as a quantum event might be of such a nature.

Clearly, the validity of claims concerning parallels between contemporary science and traditional texts is doubtful.

### 3. Explaining the universe

#### 3.1. Does science explain 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. We can track down the infinitely lazy creator totally free of any labour of creation, by resolving apparent complexities into simplicities."<sup>13</sup> Is there any need for introducing a creator beyond the Universe? Isn't the Universe fully explained by science? Peter Atkins is an eloquent defender of this latter position. The first half of his argument is reduction to simplicity: 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 space-time; particles being specific configurations, like knots, of space-time points. The other half of his argument is chance: through chance fluctuations nothingness separates into +1 and -1. With dualities like -1 and +1, time and space come into existence. The +1 and -1 may merge again back into nothingness. By chance a stable configuration may come into existence - say our space-time with three spatial dimensions and one temporal dimension. Atkins idea is based on a notion of 'pregeometry' considered over a decade ago. However, the fundamental issue hasn't changed significantly. For example, Hartle and Hawking wrote in their first article on the 'no-boundary' cosmology that the wavefunction gave "the probability for the universe to appear from Nothing"<sup>14</sup>. I would like to put forward three issues for further discussion.

1. *Testability*: There is a plurality of fundamental research programs in cosmology. Experimental tests and observations may well be insufficient to decide among the stronger contenders. Aesthetic judgements are, at least partly, decisive in opting for a specific scheme. However, what one considers elegant,

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13. P.W. Atkins, *The Creation* (Oxford 1981), 17.

14. J.B. Hartle & S.W. Hawking, "The Wavefunction of the Universe", in *Physical Review D* 28 (1983), 2961.

another may reject. John Barrow formulates this at the end of his book *The World Within the World* as follows: "Confronted with an emotionally satisfying mathematical scheme which is 'simple' enough to command universal assent, but esoteric enough to admit no means of experimental test and grandiose enough to provoke no new questions then, closeted within our world within the world, we might simply have to believe it. Whereof we cannot speak thereof we must be silent: this is the final sentence of the laws of Nature".

2. *Exhaustiveness*: Consider the following dialogue from Lewis Carroll:

"We actually made a map of the country on the scale of *a mile to the mile!*"

"Have you used it much?", I enquired.

"It has never been spread out, yet," said Mein Herr: "the farmers objected: they said it would cover the whole country and shut out the sunlight! So now we use the country itself, as its own map, and I assure you it does nearly as well."<sup>15</sup>

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"<sup>16</sup>. In the present volume, Isham too raises the question whether simple boundary conditions could lead to the complex universe we see today.

3. *A vacuum isn't nothing*: Though the Universe may be equivalent to a vacuum, as far as conserved quantities go, such a vacuum isn't equivalent to nothing. A common sense example: an empty room still has three dimensions, just as the apparent millionaire only can get started once there is a concept of money, of borrowing, and the like. Zero is still a number, with properties, unlike 'nothingness'. Thus, Atkins account of a universe which wouldn't be in need of further explanation might still need some explanation for its laws. The creation theories described by Isham, which avoid assuming a background space-time, seem to be better off in this respect. However, even such theories feed certain assumptions into the scheme, say about the structure of the Universe being

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15. Lewis Carroll, *Sylvie and Bruno Concluded*, ch.11, as quoted in this context by J.D. Barrow, *The World Within the World* (Oxford 1988).

16. Mary Hesse, "Physics, Philosophy and Myth", in R.J. Russell, W.R. Stoeger & G.V. Coyne (eds.), *Physics, Philosophy and Theology* (Vatican City 1988), 197.

mathematical and describable in a quantum formalism. To summarize, science does explain a lot, but it doesn't offer a full explanation for the Universe. Science seems to remain unable to explain the existence of something with properties, rather than a complete nothing. And it also seems unable to explain the lawfulness of the Universe, or similar assumptions fed into the scientific theories.

### 3.2. *Religious explanations of the universe*

Accepting that the scientific explanation covers an enormous amount of data, could the remainder, perhaps 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? Richard Swinburne argues that if the most fundamental law and its effectiveness is scientifically inexplicable, one has to face two possibilities: either the law is completely inexplicable or it has an explanation of another kind. Swinburne makes the distinction between causal and personal explanations. A personal explanation should take its startingpoint from a person with intentions and certain capacities. These together determine the basic acts open to that person, say 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 brainstates are linked to intentions, the correlations aren't logically necessary.

Using this notion of 'personal explanation' the fundamental law of the Universe might have such a personal explanation: that is the way God intended it to be. "The choice is between the universe as stopping-point and God as stopping-point"<sup>17</sup>. 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 which 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"<sup>18</sup>. 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

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17. R.Swinburne, *The Existence of God* (Oxford 1979), 127.

18. Swinburne, 130.

support from science<sup>19</sup>. However, if the choice between accepting the Universe as a brute fact or as needing 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 undermine Swinburne's argument based on simplicity. The notion of 'basic acts', without causal or physical mediation, seems at odds with our experience of persons, who are actually always embodied. Some theologians have thus introduced embodiment into the concept of God<sup>20</sup>; we will return to spatiality below (4.2).

Swinburne's argument based on simplicity fails. The more general idea of using a person as explanation for the Universe isn't helpful: it introduces the problematic concept of a non-embodied person and leads to the next question: If the personal God explains the Universe, who or what explains that person? According to our experience, a person is also an entity that can either be or not be. That seems to be the advantage of the emphasis on values, to which we will now turn.

Values seem to have something absolute about them. They might therefore be better candidates as stopping-point for questions for further explanations than either causal or personal explanations seem to offer. However, a value lacks effectivity. 'Honesty' may be a value, even though it isn't realized automatically. In general, values don't bring about the corresponding states of affairs. However, the Canadian philosopher John Leslie has recently argued that one might think of creative values<sup>21</sup>. He thereby places himself in a long philosophical tradition which places the Good as the origin of all existence and knowledge. Plato used the analogy of the light of the Sun, which allows for growth (existence) and seeing (knowledge). The Good upon which existence and knowledge are

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19. For criticisms, see J.L.Mackie, *The Miracle of Theism* (Oxford 1982), 95-101, and J.Hick, *An Interpretation of Religion* (London 1989), 104-109.

20. L.J. van den Brom, *God Alomtegenwoordig* (Kampen 1982), and "God's omnipresent agency" in *Religious Studies* 20 (1984) 637-655, and Grace Jantzen, *God's World, God's Body* (London 1984).

21. J.Leslie, *Value and Existence* (Oxford 1979).



dependent, surpasses all existents in dignity and power<sup>22</sup>. Assuming the axiarchic principle that value tends to come into existence, it may be not too difficult to argue for the necessity of consciousness, and hence for characteristics which our environment happens to have. Holding such a philosophical position, it isn't surprising that Leslie has developed a strong interest in the argument from design in its contemporary form, the anthropic coincidences<sup>23</sup>. Swinburne's position seems more voluntaristic, the emphasis being on the will. Something would be good because God wills it; all existence is due to the will of God. Leslie's position is different. Not the human will is extrapolated to the divine, but the qualitative dimension of the good is seen as absolute: God may will something, if 'will' is an adequate concept at all, because it is good.

The idea that values could be creative is rather speculative. Our experience is different: all too easily the good is neglected. Besides, according to our experiences, values find their expression in human decisions. In his criticism of Leslie's position, J.L.Mackie has thus stressed that the concept of 'creative values' may well be a projection of our desire for things judged to be good in themselves, an objectivisation of human desires and judgements<sup>24</sup>. Do values have a platonic existence of their own, apart from of the things in which they are realized? Or are non-embodied values as problematic as non-embodied persons? I wonder whether such a view does sufficient justice to the vulnerability of the good, the discrepancies between reality and ideal.

Clearly then, religious explanations of the Universe, its existence and laws, seem to need assumptions about non-embodied persons or values which are at least as problematic, qua explanations, as the unexplained existence of the Universe or its laws. In the light of the limitations of scientific and religious explanations of the Universe, it may well be wise to join the physicist Charles Misner's view who formulated his view as follows: "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."<sup>25</sup>

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22. Plato, *Republic* book VI (nr. 509).

23. J.Leslie, *Universes* (London 1990).

24. For another friendly critic of Leslie's position, see Smart, *Our Place in the Universe*.

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

#### 4. God

The limited significance of the notion *time* in contemporary cosmology has consequences for ways God might be understood.

##### 4.1. *Divine acts and the universe*

Underlying the interest in 'the beginning' is the idea that that would be the supreme case of a divine act, bringing something into existence from non-existence, without the use of any mediation, say through human agents. This section introduces some alternatives from contemporary theology, to the emphasis on the initial event as the supreme case of a divine act. First, we will briefly refer to process theologians who argue that there is no beginning nor a *creatio ex nihilo* in the temporal sense, but rather a co-existence of God and the world. We then will consider some philosophers of religion who have defended that the whole Universe should be regarded as a single master-act of God.

Process philosophers and theologians defend a view for which the word *pan-en-theism* has been coined as a middle position between theism (God transcending the world) and pantheism (God totally immanent in the world). According to process theologians, God is not the unchanging and passionless absolute, nor the controlling power. "Process theology rejects the notion of *creatio ex nihilo*, if that means creation out of *absolute* nothingness. That doctrine is part and parcel of the doctrine of God as absolute controller. Process theology affirms instead a doctrine of creation out of chaos"<sup>26</sup>. The Universe is coeternal to God, but there are no enduring things within that Universe, thus preserving God's uniqueness. Process theologians think that only an eternal Universe is compatible with their ideas. They defend an analogy between divine and human activity, both using other entities.

In recent philosophy of religion there have been many substantial discussions of 'divine action'<sup>27</sup>. Some have defended, with the process

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26. J.B. Cobb & D.R. Griffin, *Process Theology: An Introductory Exposition* (Manchester 1976), 65.

27. G.K. Kaufman, *God the Problem* (Harvard, 1972); H.Kessler, "Der Begriffs des Handeln Gottes: Überlegungen zu einer unverzichtbaren theologischen Kategorie", in *Kommunikation und Solidarität* (Freiburg (Schw.)/Münster 1985); W. Härle, R. Preul (eds.), *Marburger Jahrbuch Theologie I* (Marburg 1987); T.V. Morris (ed.), *The Concept of God* (Oxford 1987), and *Divine and Human Action* (Ithaca 1988);

theologians, the notion of specific acts of God, in time. Others, like Gordon Kaufman and Maurice Wiles, have opted for a more revisionistic position, seeing the whole as a single master-act of God. I will briefly summarize this 'single act' position as it seems most congenial to a cosmological point of view.

According to Kaufman, "activity proceeding from a single agent and ordered toward a single end, no matter how complex, is properly to be regarded as *one act*". 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"<sup>28</sup>. Such a concept of God's act avoids the problems which are linked with the interventionistic account of divine acts in nature which would set up the order that recognizable experience has. "God's act is viewed as the source of precisely that overarching order itself"<sup>29</sup>. 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 unidirectional fashion in and through temporal processes, it would be mere poetry to speak of God's act"<sup>30</sup>. Kaufman subsequently claims that modern science, the big-bang theory explicitly included, makes such an understanding of the Universe possible, even though the teleological end isn't well discernable to humans.

The notion of temporality is used at two levels here. The temporality of the 'structures of nature and history', the temporality of the created order, correlates to the question in cosmology whether time is a meaningful notion in a space-time view of the Universe (or in a wavefunction of the Universe). The other issue is whether it is necessary to ascribe temporality to God in creating that entity. Kaufman does so 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 not challenged by the physical view of time, which links time intimately with the whole 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

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T.F. Tracy, *God, Action, and Embodiment* (Grand Rapids 1984); K. Ward, *Divine Action* (London 1990); M. Wiles, *God's Action in the World* (London 1986).

28. Kaufman, 137.

29. Kaufman, 138.

30. Kaufman, 138.

physical Universe and the divine? If the whole of space-time (or the whole wave function of the universe) is understood as a single act of God, the notion of time applied to God (act, intentions) should be explicitly distinguished from the notion of time as it pertains to the created order; could one not drop the notion of time (and causal action) at the meta-level?

#### 4.2. Divine eternity

'God's eternity may be understood in two ways<sup>31</sup>: Either God is everlasting and has an unending duration, or God is timeless and without duration. Many major theologians have defended that God is timeless as well as spaceless. As Augustine has it (*Confessiones*, Book XI, Ch.13):

"Thy years do not come and go; while these years of ours do come and go, in order that they all may come. All Thy years stand together, for they stand still, nor are those going away cut off by those coming, for they do not pass away".

Or, with Anselm of Canterbury (*Proslogium*, Ch. XIX):

"Thou wast not, then, yesterday, nor wilt thou be tomorrow; but yesterday and today and tomorrow thou art; or rather, neither yesterday, nor today nor tomorrow thou art; but simply, thou art, outside all time. For yesterday and today and tomorrow have no existence, except in time; but thou, although nothing exists without thee, nevertheless does not exist in space or time, but all things exist in thee".

Timelessness may be understood with Boethius (*Consolation*):

"Eternity, then, is the complete possession of all at once of illimitable life. ... Therefore, whatever includes and possesses the whole fullness of illimitable life at once and is such that nothing future is absent from it and nothing past has flowed away"

Nelson Pike has analyzed the logical relations of this classical understanding of divine eternity as timelessness with other doctrines, like *immutability*, *omnipresence* and *omniscience*. Timelessness has consequences for the interpretation of those other attributes; consequences which he does not like. Eternity as timelessness is a Platonic influence with hardly any scriptural basis.

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31. N.Pike, *God and Timelessness* (London 1970), ix.

"What reason is there for thinking that a doctrine of God's timelessness should have a place in a system of Christian theology?"<sup>32</sup>

Within the context of philosophy of religion, explicitly seeking to stand in the Biblical tradition, Paul Helm has opposed Pike in arguing strongly that divine eternity should be understood as timelessness. He understands timelessness not 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". Though the Biblical narratives speak about God as speaking, etc., etc., the "introduction of timelessness offers a metaphysical underpinning for God's functioning as the biblical God"<sup>33</sup>. A problem concerning the conception of a timeless God might be personality; as Hume has said: "A mind, whose acts and sentiments and ideas are not distinct and successive; one, that is wholly simple, and wholly immutable; is a mind, which has no thought, no reason, no will, no sentiment, no love, no hatred; or in a word, is no mind at all"<sup>34</sup>. As the concept of person or mind may be anthropocentric, it might well be that one might be willing to concede that God is not a person in that sense, though the unattainability and non-manipulability might be reason to use 'person'- rather than 'thing'-language in talking about God.

Returning to the dialogue with cosmology, there are a couple of reasons as to why timelessness might have a place, against Pike's "I see no reason":

(1) Time is part of the created order. This is Augustine's view of *creatio cum tempore*, and seems a reasonable interpretation of most contemporary cosmologies, the phenomenological understanding of time. Hence, it is not meaningful to talk about God as if there was time *before* the creation - God as everlasting. (2) Time isn't even an applicable notion 'at all times'. Hence, if temporality is essential to God, how could God then be conceived of as being related to, or even the creator of, those quantum cosmological realms where time isn't applicable? (3) The presence of a timeless description, 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 God at one moment to the Universe at that moment, differentiating moments in God. I therefore maintain that it is useful to

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32. Pike, 189f.

33. P.Helm, *Eternal God* (Oxford 1989), 17, 19, 21. See also Brian Leftow, *Time and Eternity* (Ithaca 1991).

34. Hume, *Dialogues Concerning Natural Religion*, as quoted by Helm, 57.

understand, at least in this context, God's transcendence with respect to space and time as timelessness. This emphasizes God's unity with respect to the world.

That leaves us with, at least, two possibilities. If God is understood as *a being* - more or less the mainline 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, 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 aesthetic 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<sup>35</sup>. If this notion of 'God's time' is only metaphorically using the concept of 'time', there will not be a problem with science but one with language: what does it mean to speak about time, then? Why not use another word? If a certain similarity with the physical understanding of time is intended, such a notion of 'God's time' is hard to fit in in the cosmological context once time is thoroughly physicalized - just like one isn't free to add one spatial dimension in contemporary superstring theories, another temporal dimension is problematic as well.

An alternative would be to deny that God should be understood as "*a being* - a single individual possessing negative as well as positive attributes"<sup>36</sup>. 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'. That would be a way to avoid the difficulties which arise upon attempting to locate God in spatial and temporal terms.

#### 4.3. *Divine transcendence*

As was noted in an earlier remark about divine action and embodiment (3.2), Van den Brom has proposed a model in which God is understood as having additional dimensions over and above the regular physical dimensions. As in the well known story about *Flatland*, the higher dimensional reality encompasses the

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35. Karl Barth, *Kirchliche Dogmatik* III/2, par.47.

36. Pike, 1.

reality of lower dimensionality. The higher dimensionality should have at least two additional dimensions in order to avoid dissection by the lower dimensional reality. This model makes it possible to imagine God as intimately close to all events without confining God to physical reality.

Mathematically, additional dimensions can be realized easily. Curvature may be included as well in order to accommodate some aspects of cosmology. Physically, the concept of additional dimensions would have fitted well into the Newtonian cosmology. It has become more problematic in the light of the scientific theories of the twentieth century. The special theory of relativity states that there is an upper limit to velocities, the velocity of light. However, the unity of God's actions can be maintained only if there wouldn't be a finite velocity as the upper-limit to communication. Besides, in order to avoid a differentiation of places in God, a measure of distance shouldn't be possible in God's higher dimensional space.

In the context of contemporary cosmology, the model seems to run into additional difficulties. The dimensionality isn't arbitrary. The requirement that the theory describing the fields (matter, interactions) of the Universe should be finite in all its possible observable outcomes seems to restrict the number of potential theories drastically. The consistent theories turn out to require specific dimensionalities - a theory of nine dimensions is essentially different from one of ten dimensions; whereas the first may be inconsistent, the latter may be a live option today. Hence, within the context of physical cosmology it is much harder to render intelligible the concept of additional dimensions than in the context of more traditional views of space and time, such as the Newtonian view.

Transcendence in a space-time sense, either as *before*, *after*, *aside*, or *above* seems hard to sustain in the context of contemporary cosmology. Hence, it may be worthwhile to develop an alternative interpretation of transcendence, which might be more like the transcendence of the laws of nature, or, if one accepts the notion of objective values, like the transcendence of values over facts. Sutherland gives good reasons why such a notion of transcendence might be important even if it isn't taken as localizable. As Sutherland argues, the idea of a transcendent point of view, a view *sub specie aeternitatis* can be a notion, which expresses the intention to aim at an understanding of human affairs which goes beyond any limited outlook, whether of an individual, of a community or even of humanity. The idea functions like the transcendental regulative ideas of reason, as directing the understanding towards a certain goal. The unattainability, the transcendence, is essential. It is sane to allow self-questioning in relation to a perspective other than one's own. If this 'other perspective' is accessible, like a list of eternal values, it might result in fanaticism without self-questioning. The idea of the

eternal as referring to something transcending even one's most cherished views keeps faith open.<sup>37</sup>

## 5. *Platonistic tendencies in cosmology*

### 5.1. *A mathematical universe*

In calling cosmology 'platonistic' I do not intend to make an historical claim. The concept is certainly in need of further precision. For the moment I merely intend to draw attention to a number of different features which seem to apply to almost all fundamental scientific cosmologies. A major aspect is the absence of 'time' at the most fundamental level of description. Cosmology seems to deal with a timeless reality, either because it encompasses the whole of space-time or because the notion of time is one of limited applicability with respect to the wavefunction of the Universe.

Reality seems less and less to be described as substantial. We already discussed the possibility that the Universe could be equivalent to a vacuum (in a background space-time). The variety of entities may be traceable to a single abstract field. From the atom as a Solar System in miniature we have moved to abstract formalisms in abstract spaces. Mathematics, since long a valuable tool in science, seems to have become dominant. Reality seems to be mathematical, rather than substantial. This should not be understood as that there is no reality; my impression is that cosmologists tend to be realists about mathematical entities; they have a mode of existence of their own. Mathematical truths aren't invented; they are discovered. However, they are truths of a formal nature; mathematics may be seen as form without content. Could then the content of reality be mathematical?<sup>38</sup>

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37. S.R. Sutherland, *God, Jesus and Belief: The Legacy of Theism* (Oxford 1984), 110. See also T.Nagel, *The View from Nowhere* (Oxford 1986).

38. In the context of information science similar questions arise. "The theme 'hardware is software' ... proposes that 'software' is not only that we will ever find, but even that in the same sense it is all there actually is underlying the material world of everyday experience." (C.W.Misner, "The immaterial constituents of physical objects" in C.M.Kinnon, A.N.Kholodilin & J.G.Richardson (eds.), *The Impact of Modern Scientific Ideas on Society* (Dordrecht 1981), 133f.) For a recent example of platonism among cosmologists one could read Roger Penrose's *The Emperor's New Mind* (Oxford 1989).



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, give or take 50 grams. Physical reality is modelled mathematically, but the model is considered to be an approximation. This doesn't hold for all aspects of physical reality; for example, its spatial dimensionality is generally taken to be exactly three. If, on the other hand, reality itself is assumed to be mathematical, one doesn't deal with approximations. It isn't clear in what sense the fundamental symmetry group underlying the particle world could be *approximately* group X - it is group X or it isn't. "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"<sup>39</sup>.

### 5.2. Platonistic cosmology and Christian existence

Rather than being afraid of the apparent self-justificatory nature of mathematics, as if it would mean a revival of the totalitarian tendencies of science, the cosmologist and priest Heller pleads for a more affirmative response: "This type of rationality is an ultimate rationality. In a theological perspective the ultimate rationality is that of God. The fact that it is a mathematical type of rationality is not a new factor in theology. All platonic and neoplatonic philosophies, and all theologies inspired by them, are always inclined to regard the world as a reflection of 'eternal objects' (which might read: of mathematical objects) that dwell on God's mind. The metaphor of 'God thinking the Universe' is well rooted in the history of theology".<sup>40</sup> The platonistic tendencies in cosmology may well be developed into a philosophy which extends the issues from mathematical intelligibility to rationality, and from there into values. (If one wonders whether rationality is a value, consider the emotional resistance to irrationality as being below human dignity.) Another further development of such a platonistic philosophy might extend the discussion on mathematical

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39. M.Heller, "The experience of limits: new physics and new science", abstract in J.Fennema & I.Paul (eds.), *Science and Religion: One World - Changing Perspectives on Reality* (Dordrecht 1990).

40. Quoted from the paper presented at the *Second European Conference on Science and Religion* (Enschede, March 1988).

intelligibility as to introduce the notion of spirit or mind. "From the theological perspective, there is an intimate relationship between the spirit of rationality and the Christian idea of Logos"<sup>41</sup>. However, defending, or developing, a platonistic theology with reference to cosmology is in danger of 'smothering' essential differences between science and theology, as Brümmer rightly warns in his essay in this volume. Thus, one should be far more cautious with respect to constructive approaches, theology building upon, or being claimed to be in harmony with, science, than with regard to the critical use of science as a basis to question claims made, for example by theologians about the historicity of nature being evident in all the sciences (Barbour, as quoted above).

Is this 'platonism' coming out of cosmology, if correctly diagnosed, a problem for christian theology? As I see it, there may be three different areas of tension, depending on one's position with respect to theology and the relation between theology and science.

As an *epistemological* position the platonism might be at odds with the 'critical realism' defended by many leading authors on science and religion, like Ian Barbour, Arthur Peacocke and John Polkinghorne, as their realism seems to rely heavily on a view of the world as consisting of substantial entities and on seeing scientific knowledge as approximate truth. 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 doesn't suffer from such a reductionism.

As a *metaphysical* position, the emphasis on the apparently self-justifying, necessary, nature of the mathematical structures, and hence of reality, is at odds with the common emphasis on contingency as a major aspect of the Christian doctrine of creation<sup>42</sup>. There may be two ways out: either there is still some contingency left, for example as a choice between different consistent mathematical schemes, or the contingency under consideration isn't necessary to a proper view of God. The latter may be defensible if one doesn't presuppose a voluntaristic understanding of God as creator, but rather takes it to be that God

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41. M.Heller, "Scientific rationality and christian logos", in R.J.Russell, W.R. Stoeger & G.V. Coyne (eds.), *Physics, Philosophy and Theology*. See also Heller's *The World and the Word* (Tucson 1986).

42. W.Pannenberg, "The doctrine of creation and modern science", in *Zygon* 23 (1988), 3-21; R.J.Russell, "Contingency in physics and cosmology: a critique of the theology of W. Pannenberg", in *Zygon* 23 (1988), 23-43; T.F.Torrance, *Divine and Contingent Order* (Oxford 1981).

creates according to certain 'internal necessities'<sup>43</sup>. Thus understood, God could not have created something logically contradictory. Rather the fundamental rules of logic reflect God's rationality. Similarly, God could not have created something wicked or ugly, as goodness as well as aesthetic elements are intrinsic to the divine.

3) The objection which is most important to me, questions this platonism for *moral or existential* reasons rather than for epistemological (critical realism) or metaphysical (contingency) reasons. The platonizing tendencies in cosmology tend to emphasize the unity and coherence of the Universe. Everything fits into an encompassing mathematical structure. In contrast, one might recall Langdon Gilkey's expression of a christian view of existence: "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'."<sup>44</sup> A platonizing philosophy of nature might accommodate more easily to a mystical strand in the christian tradition than to 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, from the present and from the flow of events in time? Should one, in order to achieve a satisfactory theology, turn to the subject who has developed the platonic understanding of reality, but also acts and interacts - perhaps guided by that vision of a perfect platonic reality but not experiencing it personally? Turning from understanding to acting may be satisfactory from an existentialistic religious point of view. However, is it adequate with respect to contemporary cosmology, with its suggestion that our reality can be interpreted in mathematical terms?

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43. H.G.Hubbeling, *Principles of the Philosophy of Religion* (Assen 1987), 148.

44. L.Gilkey, *Maker of Heaven and Earth* (Garden City 1959), 37.