

Arguing for the Existence of God in the Age of Quantum Indeterminacy by Cockshaw

Introduction

In this project I will explore the question of how we might engage in apologetic discussion of arguments for the existence of God in this age of quantum indeterminacy and closed non-bounded universes. While these last two phrases may not be familiar they are implicit in many conversations between believer and non-believer regarding the existence of God.

Popular Science has given the lay-person a wide range of fantastic ideas about our universe. These ideas provide enough food for thought and enough confidence to perpetuate and encourage debate about arguments for the existence of God. In these days of falling church numbers and falling belief in God of any sort in the Western world, one of the most commonly heard reasons for this trend is the impact of science on our society. Science, it seems, provides *proofs* against the existence of God. I would ask, “Does science point *away* from God?”

To engage with this question meaningfully I will survey the traditional arguments for the existence of God, looking especially at Aquinas (with reference to his philosophical forebears) and those who have followed his definitive work. Following this survey I will look at Immanuel Kant’s critique of these arguments. As a hook into our biblical traditions I will briefly survey Paul’s theology relating to God’s existence. After completing this groundwork I will engage with Kant’s refutation of the traditional ‘theistic proofs’ and then the theistic proofs themselves in the light of the New Physics. Overall this project may be seen to have a chiasmic structure.

While evolution and creation are frequent duellists in this debate they form a completely different field and so will not feature here.

In conclusion I will sum up my findings from a personal view, since a personal judgement is all anyone in this field can ever hope for. I am not trying to prove that God exists, and if at any point I try to do that I have failed in this project. It will be evident that I do not believe science or theology can prove God’s existence. Coherent systems of thought may be attained, but always starting from theistic or atheistic presuppositions.

One last note is that the assumption (made with Worthing¹) must first be made that natural theology is a valid form of theological enquiry. While this may be a question to be explored in more detail, I will not explore it here.

Pre-Thomist Philosophy

Aquinas did not invent theistic philosophy. There is a long tradition of philosophy and theology with philosophical shape almost as long as recorded history. Some key figures warrant our attention here though.

Augustine

St. Augustine (b.354AD d.430AD) reformed the philosophy of his time and that predating him to fit the orthodox faith of Christianity.² He settled on the ultimate attribute of God as that of *being*. God's eternal existence is fundamental to all of Augustine's teaching, and in that respect, along with the equality of persons of the Trinity, Augustine lays the foundations for all further Christian thought. In Augustine's reforming of the philosophical concept of *Ideas* we see an axiom for all metaphysics.³ It is to be noted though that Augustine never set out to write a book on metaphysics.⁴

Augustine's favourite⁵ theistic proof was via consideration of the process of thought. He said that truth is immutable. To *think* immutable truths with our mutable minds means "our mind is so to speak in contact with something that is immutable and eternal"⁶ which is God, the ground of all truth.⁷

While Augustine developed other means of theistic proof, they may be seen as stages in one proof, leading to this climax of proof from thought.⁸

Anselm

St. Anselm (b.1033AD d. 1109AD), Abbot of Bec in Normandy, followed the Augustinian teaching. He regarded there to be two sources of knowledge: faith and reason. The Christian starts always with *faith*, then through *reason* understands that which by faith they believe.⁹ In this way Anselm ought not be classed a natural theologian. We will look at an aspect of Anselm's theistic proofs in more detail later. It is important for now to realise that Augustine primarily, and then Anselm laid the foundations upon which Aquinas built.

Aquinas' Five Ways

St Thomas Aquinas (b.1225AD, d. 1274AD), Christian, metaphysician and theologian wrote the massive *Summa Theologiae* between 1267 and 1273 as a

"systematic and summary exposition of theology for 'novices'...".¹⁰

Seven hundred and more years on it is still fundamental to many of the philosophical questions of today, yet it is not purely and simply philosophical in nature.

The part of the sixty volume *Summa Theologiae* important to us here is the second volume *Existence and Nature of God*. Particularly from this volume¹¹ *Question 2: whether there is a God*. In this question, Aquinas produces three articles for discussion:

1. Is it self-evident that there is a God?
2. Can it be made self-evident?
3. Is there a God?

Within article 3. he lists his famous Five Ways:

- i. Change
- ii. Causation
- iii. What *need* and *need not* be
- iv. Gradation
- v. Guidedness of Nature

These are

"five ways in which one can prove that there is a God."¹²

While he did not assume that most, or even many, Christians came to faith through metaphysical argument,¹³ he did ...

"...think that reflection on quite familiar features of the world affords ample evidence of God's existence."¹⁴

In this context then he developed the arguments.¹⁵ I shall now explore his five ways in more detail.

The First Way: Change or Kinetological Argument

This way has three steps.¹⁶

1. Change is a *realisation* of potential. The realisation in a thing is *caused* by something else.
2. The something else which causes the change must already have that property which it changes in the other.
3. The chain of cause and effect can not be traced back *infinitely*. There must ultimately be a *source* of change: that which changes without being changed by something else. This ultimate unchangeable is called God.

The first two steps appear as common sense made explicit in order that the third step may be taken. The third step needs further elaboration though.

The concept of regress of a causal chain is important to Aquinas' arguments and as such ought to be looked at carefully. While it also may seem self-evident that such chains must end somewhere, this idea will be taken apart by modern physics and mathematics, "Which sees no *a priori* impossibility in the idea of a temporally as well as a spatially unbounded universe."¹⁷

Classically it also may need justification. Hick argues for a *simultaneous* chain of causal conditions, rather than a temporal chain which is to be excluded by this argument. He gives the example of a train pulling coaches.¹⁸ Each coach moves at the same time even though they pull or push one another, with the original force coming from the engine. Perhaps a more accurate example would be that of flow of electrical current or fluid pressure and flow through a pipe.¹⁹ Here there is a clear regression of cause yet it is instantaneous in its effect. Though the elements of the causal chain move simultaneously the original phenomenon of movement is still not explained, and adding more trucks to Hick's train will not help. Ultimately in such a system we must ask why the system moves at all. In the train truck example it is the engine which explains the phenomenon, yet nothing explains the movement of the engine.

In summary the first way looks to the passive object being changed by another. This observation of passive change is sufficient reason for the existence of God, since no change could ever happen to anything without him as the first cause of change.²⁰

The Second Way: Causation or Aetioloical Argument

This argument, strongly related to the first, is more holistic in its approach. Whereas the first looked at the individual event and its immediately prior/associated cause, this way looks at the collection of cause and effect together and argues for all or nothing.

Aquinas sees the connection between the first cause and the last,

"...an earlier member causes an intermediate and the intermediate a last (whether the intermediate be one or many)."²¹

To remove any cause in the chain, he argues, would bring the whole chain down. Working back through the series, one may never reach a first point since to stop at any cause would be to bring the whole system down. This works backwards as well as forwards. So you can have no first cause and no last cause. This is nonsense, says Aquinas so he postulates God as the solution.

In summary the second way looks to the active changer. That which causes another to be changed is the observation which lends sufficient reason for the existence of God, since no cause could ever exist without God as the first cause holding the whole chain together.²²

The Third Way: Contingency

Aquinas, again starting from the everyday, noticed that some things need not exist. To be more exact he observes that since there are times when some things are not, those things obviously do not *always* need to exist. A flower for instance comes into being and dies again. Its existence is short lived and therefore not always necessary. He proceeds then to say that not everything can be like this since if everything need not be then once there would have been nothing. If there was once nothing, in an absolute sense, then there could never have been anything (back to the First Way), since you need at least one thing to cause another.

“One is therefore forced to suppose some first cause, to which everyone gives the name ‘God’.”²³

In summary then the third way looks to the temporality of existence, seeing that nothing has to be and therefore ought not to be. That there is anything is attributed to God.

The Fourth Way: Gradation

An object may contain a property to a greater or lesser degree. For instance, a pot may be cold or hot, or any temperature between these points. In terms of moral characteristics this principle also applies. Aquinas uses the terms, good, noble, true, and finally *being*. As much as a thing may possess these characteristics they may only change in terms of their perfection in one of these characteristics by way of another more perfect object. Only that which is very good may cause a less good thing to become ‘more good’. In terms of being then we leap to the fundamentals of existence. In the Summa Aquinas makes this leap from following Aristotle²⁴ and equating truth with being. Thus Aquinas says,

“Something therefore is the truest and the best and the most noble of things, and hence the most fully in being;”²⁵

God then is that which is most fully in being, and following Aristotelian philosophy the source not only of being, but also goodness, truth and nobility, etc. Nothing has its being without God. God is therefore necessary for all being.

In summary the very existence of things gives sufficient evidence for God.

The Fifth Way: Design or Teleological Argument

It is noticed that physical law guides things toward a goal. Why this guidedness? Aquinas thought there must be an explanation for this intrinsic trait of nature. This Fifth way is more commonly known as the teleological or design argument. *Teleology* being perhaps the most helpful in describing what it is that is seen, i.e. the heading for a certain goal rather than a haphazard working out of chaos. *Design* being more helpful in describing the next logical step after having seen the teleology at work, and saying “there must be a conscious designer behind this.”

In summary Aquinas saw the empirical evidence of order as sufficient for God’s existence. As we shall see later this is a point strongly challenged by modern science and philosophy.

The Classical Statements Of God’s Existence

It is not usual to refer directly to Aquinas’ five ways, since although they are superb for their day, they have been built upon, and indeed new areas of thought have created entirely new approaches to theistic proof. However arguments for the existence of God

have after many centuries of philosophical thought always come back to four main categories of argument. They are:

- i) Teleological or Design
- ii) Cosmological
- iii) Ontological
- iv) Moral

For the purposes of this project I will not consider the moral argument since the New Physics does not properly deal with it. While physicists have spoken on this issue when doing so they are stepping beyond their authority.²⁶ Until science has unified all thought schools into one, including psychology, ethics, religion, etc. physicists have nothing as *physicists* to say about the moral argument.

The other three then, in order:

Teleological Argument

This argument, made famous by William Paley and his mysteriously formed watch,²⁷ is also known as the argument from design. Given that there is design and order in the universe, instead of *total* chaos, we must postulate a creative and ordered being as the reason for it. This argument is seen clearly in Aquinas' fifth way as stated above.

Polkinghorne, the self confessed bottom-up thinker²⁸ says,

“...this one world is the way it is because it is the creation of the will of a Creator who purposes that it should be so.”²⁹

The argument from design relies on the hypothesis of *order* being an intrinsic part of creation.³⁰ Fundamental particles and the formative cosmological processes both display this order in fantastic ways, certainly supporting Aquinas. However, in the realm of the everyday, the macroscopic level of human existence, we can also see much disorder. Entropy increases without check.³¹ As Polkinghorne says, a natural theology which does not speak to this would not prove very persuasive.³²

Excursus: Was Paul a Bottom-up Thinker?

In Romans 1:19-20 we have the source of much debate. At first glance it appears that Paul did indeed hold fast to natural theology. Barth however strongly contests this proposition. Perhaps the foremost revelationist says:

“...what Paul says in these places and no matter what their meaning may be, he certainly did not intend the Gospel of his Roman Epistle to be gathered from what the heathen too can know about God. On the contrary, he grounded it exclusively on what the first chapter of this Epistle calls God's a)poka/luyij.”³³

While Barth agrees that Paul recognised the ability to see God in creation, it is only ever after first having accepted revealed truths, and then knowing that it is only shadows of the image of God that we see.³⁴ Top-down, then bottom-up!

Emil Brunner agrees with Barth here saying,

“...God does not only reveal Himself through His Word in History, but also through His work in creation, hence He leaves no man without a witness...yet...sinful man is not capable of grasping what God shows him in His work in Creation without turning it into something else.”³⁵

However, it becomes evident that whereas Barth sees the revelation of God through nature as accidental and shadowy, Brunner reckons it to be more deliberate and exacting:

“God has given the world its “orders”, and it is precisely in these orders that He constantly reveals His Creator-Spirit, and His Power as Creator.”³⁶

The limits of the revelation through nature, says Brunner, are simply that since the laws of nature are impersonal

“...they cannot show us His inmost meaning.”³⁷

Whereas Barth says nature cannot point to God, Brunner says man is responsible for his own sin precisely *because* he ought to have known God through the general revelation given to all through nature.³⁸

So two great theologians have directed their thought down two contrary avenues from this one passage of Paul. What did Paul think? Dunn outlines the problem,

“...God is the fundamental presupposition of Paul’s theology...The problem for us however, is that Paul’s convictions about God are all too axiomatic. Because they were axioms, Paul never made much effort to expound them.”³⁹

As Dunn goes on to say Paul did not need to expound his convictions about God because his intended audience shared the same convictions. What were these convictions or beliefs?

“These shared beliefs were Jewish through and through.”⁴⁰

Given this the thought behind Paul’s writing’s were surely motivated by a teleological understanding of creation, but with the proviso of prior revelation and the interpreting context of faith.⁴¹

Cosmological Argument

Any argument which professes to start with the reality⁴² of our world/universe, and work to a proof of the reality of God, can be called a cosmological argument.⁴³ In the strictest sense then the teleological argument is also a subset of the cosmological argument. However these are two distinct trains of logic and should not be merged. Distinctively the arguments which are properly called cosmological are those which see in God a self-explanatory nature not shared by the world or universe. The world then is contingent upon God.

Aquinas’ first, second and third ways are all statements of the cosmological argument. The cosmological argument is necessarily *a posteriori* since it appeals first to our senses of observation and experience, and not to the concept of God.⁴⁴

The existence of the universe can be considered as either temporally or non-temporally caused. That is it either does or does not have a beginning *in time*. While this may seem absurd, when we discuss cosmology it will be seen that a temporal beginning to the universe can be very unhelpful. Whether Aquinas’ second way refers to temporal causation or logical causation is a relevant question to ask in the light of Cosmology (see below).⁴⁵

Ontological Argument

Here the *being* of God is the starting point of the argument not the end point. It is an hypotheses waiting to be proven or disproven by the ensuing logic. As such it derives its name.

The ontological argument is necessarily *a priori* in that it is based solely on concept and not on our experience. There are however two forms to this argument, which were coined by Anselm. His two forms were called *Proslogion 2* and *3* respectively.

First Form (Proslogion 2)

If God is defined as *that than which no greater can be thought* then God must exist. This is based on the assumption that to exist in thought alone is less than to exist in both thought and being.⁴⁶

Second Form (Proslogion 3)

This is similar to the first form except *exists* is replaced with *necessary existence*:

“it is greater to have necessary existence than not to have it; and that which no greater can be conceived accordingly has necessary existence and therefore necessarily exists”⁴⁷

As such it is probably more proper to say (as Barth does),

“Anselm is offering a single argument which divides into two phases. In the first phase he seeks to prove that God exists in the sense in which other things exist...And...in the second phase he seeks to show that the reasoning which proves God’s existence also, at a deeper level, proves his unique nature as self-existent reality...”⁴⁸

From Aquinas to Kant

A single step from Aquinas to Kant, a time-span of 500 years, may seem rather implausible. Yet Aquinas deals with these three categories of argument and so does Kant. Kant does not concern himself with addressing Aquinas’ *Five Ways* specifically, yet he does deal very thoroughly with the three categories of argument. Therefore I step next into the realm of Kantian criticism, inviting the reader to hold onto the work of Aquinas within these three categories.

Immanuel Kant’s Critique

Immanuel Kant (b.1724AD d.1804AD), German idealist philosopher and pietist, followed Hume and others in developing a series of critiques of philosophy and science. His work has been called

“...a devastating critique of the traditional arguments for the existence of God.”⁴⁹

I will look chiefly at Kant’s *Critique of Pure Reason*, and in it the sections 4, 5, and 6 in chapter three of that work:

- i) The impossibility of an Ontological Proof of the Existence of God.⁵⁰
- ii) The impossibility of a Cosmological Proof of the Existence of God.⁵¹
- iii) The impossibility of a Physico-theological Proof.⁵²

Taking these out of Kant’s order but more in line with Aquinas’ I shall start with a review of Kant’s critique of the Teleological argument for the existence of God.

Teleological Argument

Kant calls this the *physico-theological proof*.

In describing the

‘immeasurable...stage of variety, order, purposiveness and beauty...’⁵³

he observes a

‘chain of effects and causes’⁵⁴

and says

“The whole universe must thus sink into the abyss of nothingness, unless, over and above this infinite chain of contingencies, we assume something to support it – something which is original and independently self-subsistent.”⁵⁵

While this may be Kant’s summary of the teleological argument he does appear to be rather taken with its natural force, if not its logical method. He continues saying it ought to be treated with respect and that it would,

“...not only be uncomfortable but utterly vain to attempt to diminish in any way the authority of this argument.”⁵⁶

As much as he likes it he claims it brings one to ‘apodeictic certainty’⁵⁷ and therefore he says,

“the physico-theological proof can never by itself establish the existence of a supreme being, but must always fall back upon the ontological argument to make good its deficiency.”⁵⁸

Kant summarises the teleological argument in four steps:

- i) There is order in the universe.
- ii) Order is alien to things of this world and is therefore contingent.
- iii) There exists at least one causative mind⁵⁹ behind the universe.
- iv) The unity of nature infers the unity of the causative mind.

Kant pinpoints the crux of the argument as the second step. Is matter ordered against its nature? Without the divine being beyond it, would it stumble into uncontrolled chaos? To undermine the validity of this second point, says Kant, would be to undermine the argument altogether:

“To prove the contingency of matter itself, we should have to resort to a transcendental argument, and this is precisely what we have here set out to avoid.”⁶⁰

Cosmological Arguments

Aquinas’ first three ways were all members of the Cosmological argument. Aquinas was not the only philosopher to argue along these lines,⁶¹ and so Kant is not simply critiquing a part of Aquinas’ *Summa* but a major part of Western philosophy covering many centuries and many great minds.

Kant views the cosmological argument as the ‘most convincing’⁶² of all. He also points out that it is the cosmological argument which came first and which will always be used.

Kant summarises the proof as being

‘not wholly *a priori*’⁶³

rather

‘dealing with the objects of experience...’⁶⁴

Swinburne goes further than this in his summary but probably encapsulates what Kant means:

“Let us say, more precisely, that it [the cosmological argument] is one which starts from the existence of a finite object, i.e. any object other than God.”⁶⁵

so then the direction starts from reality, at least what we perceive to be reality. If we can not even extend confidence of reality onto the world around us, then Kant says, we can have confidence in our own existence -

“Now I, at least, exist.”⁶⁶

Kant accepting this as the starting point, and seeing it wholly rational and proper to start from here, goes on to critique the logical steps which bring you to the conclusion of God’s existence.

Kant argues that the premise of *experience* is only used for the first step, and then only...

“...to conclude the existence of a necessary being. What properties this being may have, the empirical premiss cannot tell us. Reason therefore abandons experience altogether...”⁶⁷

So Kant suggests the cosmological argument can not do what it sets out to do, i.e. work from experience to concept. In doing this, says Kant, the cosmological argument adopts the assumption of the ontological argument which it says it is trying not to do. Since the cosmological argument is based upon the fallacy of the ontological argument the cosmological argument fails.

Let us turn now to see why the ontological argument and, because of it, the cosmological argument fails, in Kant's critique.

Ontological Arguments

Kant summarises his view of the Ontological Argument by saying:

“To attempt to extract from a purely arbitrary idea the existence of an object corresponding to it is a quite unnatural procedure and a mere innovation of scholastic subtlety.”⁶⁸

The ontological argument is a purely *a priori* argument. It is for this reason alone that Kant criticises it and ultimately judges it to be false.

Kant says it is not the definition of an absolutely necessary being which is the problem here, but the

“conditions which make it necessary to regard the non-existence of a thing as absolutely unthinkable.”⁶⁹

He goes on to cite the example of a triangle. He says,

“...that a triangle has three angles, is absolutely necessary,...” but *only when the triangle actually exists*. The necessity of the three angles does not force the triangle into existence, only it holds when the triangle already exists.

In saying this he highlights the fallacy of the ontological argument. The ontological argument proceeds by supposing a characteristic which is necessary to God. That is, God is a necessary being. What it has not stated is that, *if God exists*, then he exists necessarily. This is back to Aquinas' third way in part, only it takes from God the status of non-contingent and appends to him the status of contingent, which totally contradicts Aquinas.

On the fallacy of the ontological method Kant says,

“So great, indeed is the deluding influence exercised by this logical necessity that, by the simple device of forming an *a priori* concept of a thing in such a manner as to include existence within the scope of its meaning, we have supposed ourselves to have justified the conclusion...”⁷⁰

The conclusion being that according to our arbitrarily chosen concept of a God who exists necessarily, then God exists necessarily.

He goes on to say that if we wish to argue for the *possibility* of God's existence then we are not permitted to infer from the possibility actual existence. To do so would be,

“nothing but a miserable tautology.”⁷¹

Kant continues with his dissemination of the ontological argument,

“Being is obviously not a real predicate; that is, it is not a concept of something which could be added to the concept of a thing.”⁷²

In other words, a concept with all its attributes may or may not exist. A concept cannot also have the predicate “it exists” in the same way as it may have the predicate “it is red.” He says,

“By whatever and by however many predicates we may think a thing – even if we completely determine it – we do not make the least addition to the thing when we further declare that this thing *is*. Otherwise it would not be exactly the same thing that exists, but something more than we had thought in the concept; and we could not, therefore, say that the exact object of my concept exists.”⁷³

Continuing on Kant says that we can never know any pure concept *a posteriori*. Concepts are necessarily *a priori* and therefore we can never justly say we have experienced them, or that they definitely exist. This is the last nail in the coffin for the ontological argument. Either the ontological argument is, as it claims to be, completely *a priori* and we can never deduce from it the existence of God, or it is not completely *a priori* and so requires more than simply rationalisation for its proof.. Either way it fails as a proof.

Kant is well aware of human nature and keeps coming back to the ‘natural’ tendencies of human thought. Yet he says these tendencies produce ‘mere illusion’.⁷⁴ In this he is talking about the ‘irresistible’ tendency to ‘transgress’ the limits of *a priori* thought and cross over into *a posteriori* conclusions, or vice versa.⁷⁵

For Kant then, all knowledge (as opposed to mere conjecture of the possible)...

“...starts with the senses, proceeds from thence to understanding, and ends with reason...”⁷⁶

Hence Kant preferred the cosmological argument as being the most plausible.⁷⁷

If there is any defence of the ontological, and with it the cosmological and teleological argument, then it is in the *naturalness* of the method of reasoning which they employ.⁷⁸

So we have seen Kant’s reasoning as to why the Ontological argument is fallacious. One can not start with pure concept, e.g. God, and move smoothly into empiricism. At some point in the argument one is forced to make a critical jump, a discontinuous step of illusory ‘logic’ which is founded not in rational judgement but in human senses. Hick argued summarily that when the ontological fails so too do the other two traditional arguments.^{78b}

Our religious experiences of God then are not enough to confirm our conceptual theologising about God. Kant says we may only ever have pure concepts of God and divorce them from our experience, so never prove that the concept is true, or we may simply enjoy the experience and not know what it is we experience.

“...neither the proof nor the disproof of God’s existence is possible by the ordinary processes of human knowledge.”⁷⁹

God and the New Physics

Aquinas and Kant both precede modern science by many centuries. What then do they have to do with modern discussions of philosophy and theology? Very much I would argue. Their work is still fundamental to any discussion today regarding God’s existence and other subjects. I will look first at Kant’s critique and ask if it holds up in the light of modern physics. If not, is there then renewed hope for Aquinas’ work, or does Aquinas similarly fail in this new light?

A further note on the basis of Kant's work is appropriate at this stage. Namely that his initial motivation was toward the study of physics. Kant's contemporary situation was a world of thought in which metaphysics and physics were closely related. This was due largely to the work of Isaac Newton who died when Kant was three years old.

“The success of Newton's mechanistic worldview led to a significant religious development...”⁸⁰

Because of this Kant's

“underlying concern was to discover how far physics rested upon metaphysical foundations and what these metaphysical foundations were.”⁸¹

In this manner Kant proceeded with his Critique of Pure Reason as the first stage in a wider study to answer this question.⁸² Kant seeks, as this project in some small way does, to understand the relationship between the empirical and the rational.⁸³

Kantian Criticism In The Light Of The New Physics

The most obvious question to ask of the Kantian criticism, is whether it is truly a problem for *a priori* reasoning creating *a posteriori* conclusions.⁸⁴

Hilbert Space

In classical physics the real world was always there waiting to be discovered. The near spherical nature of Earth is not to us an *a priori* concept at all. It is now utterly based on empiricism. To Copernicus though it may well have been initially an *a priori* concept. Here the judgement of the Kantian critique is difficult because the examples are not too clear.

The method of contemporary science seems much more explicitly *a priori* with *a posteriori* conclusions being drawn. Indeed Hilbert space⁸⁵ is often considered so conceptual that it has been described as,

“...terrifyingly abstract and inhuman...”⁸⁶

The field of quantum mechanics for example uses mathematics to model the expected outcome of experiments, as do all areas of physics. The mathematics of quantum mechanics however is conducted quite often in a Hilbert space. Hilbert spaces are not only multi-dimensional as per our empirical neighbourhood, but can be infinitely dimensional. Indeed the quantum physics often requires the dimensions of Hilbert space to be infinite.⁸⁷ This may seem crazy, to base theoretical work on infinite dimensions. The only possible outcome would be more theory and no provable connection with the real world. Yet the outcome is very successful in predicting experimental results which later agree very accurately with the theory.⁸⁸ This is a very real and oft repeated exercise in *a priori* reasoning leading to *a posteriori* conclusions, the very thing Kant critiques the ontological argument for.⁸⁹ The space considered is a vector space, and so is divorced from space of everyday experience. It is a mathematical construct used to explore the theory which governs the fundamental modes of physical existence.

Since pondering on the trouble posed to Kant by my experience of Hilbert spaces, I have discovered that Kant also worried about this aspect of his work. In his day though the trouble was with classical geometry rather than the higher geometry of Hilbert spaces. The same is true of both though. To Kant

“Geometry...is a body of a priori truths about space...”⁹⁰

but this begs the question

“...if space is a thing in the world independent of us how can we have a priori knowledge about it?”⁹¹

This argument may need investigation outside the scope of this project. Let me say here though that some believe all mathematics to be rooted, at least in distant origins, on empiricism, no matter how abstract it seems.⁹² This view is in fact the context from which the above quote about Hilbert space comes. Others though may wish to argue that Hilbert space only provides a model or framework within which we may approximate the quantum system under investigation. This does not then equate to Kant’s theory at all in that it is not pure concept nor pure empiricism, rather an analogical bridge between the two camps.⁹³

In summary it is perfectly reasonable to use concept to ‘discover’ empirical truth, contrary to Kant’s critique. If this is not so then modern physics relies mainly on coincidence! A priori reasoning is the launching pad for empirical study.

Heisenberg’s Uncertainty Principle

When we speak of experience we think of hard fact, or at least hard reality. When we talk about Heisenberg though these concepts turn rather fuzzy! Werner Heisenberg (*b.*1901AD *d.*1976AD), a German professor of theoretical physics and winner of the Nobel prize for physics in 1932,⁹⁴ developed his uncertainty relation which affects all energy and matter.⁹⁵ He single handedly brought us from a scientific view of fixed quantities and measurable values to a view of no absolute certainty about anything physical. Even empiricism then is, given the best technology available, always going to be restricted in its *portrayal* of the ontological nature of the universe. Kant’s view of empiricism being the only source of knowledge,⁹⁶ is philosophically but also physically undermined by the work of Heisenberg. Knowledge is limited. Depending on your interpretation of quantum mechanics, truth, if it exists, exists beyond the reach of empiricism. We may only ever know the past, never the present, and certainly not the future. With Heisenberg’s uncertainty the observation of a system changes that system unpredictably. We will know how it was at the moment of observation, but not how it is now.

Einstein’s View Of The World

Einstein’s theories of Special and General Relativity⁹⁷ are what concern us here even though Einstein thought,

“Relativity is a purely scientific matter and has nothing to do with religion.”⁹⁸

Just as in the case of Heisenberg’s uncertainty principle, so the principle of relativity and the principle of equivalence have drastic effects on our concept of *knowledge*. They also have drastic effects on the way we understand ontologically the created order, and the way that created order is in relation to itself and to God.

As a result of time-dilation, we now know that God has to deal effectively with people living and operating in different time frames. According to the principle of equivalence, black holes and wormholes are possible, and there is mounting evidence of their existence.⁹⁹ The whole topology of space-time is altered beyond recognition and, in many cases, comprehension. Black-holes can not be experienced because light can not escape them. Their existence must be inferred. Furthermore, since light travels at a finite speed no distance is small enough for anything to be known in the present. It always

takes a finite time for light to travel from an object to the observer. The present is never knowable, except within the mind. We only ever know history.

We are back to the idea of a concept being used to explain the empirical nature of the universe. The concept of special relativity waited many years before it found firm empirical basis. The precession of the orbit of mercury was the greatest test of the theory and it was found to be superbly accurate. It is still being tested.¹⁰⁰ The method of development of the New Physics is to conceive first and find later. Indeed Einstein's work required the abstract mathematical work of Reimann.¹⁰¹ In this case the totally pure mathematics of Reimann ultimately becomes the foundation for our understanding of the ontological nature of space and time! It is true that empirical study was required to prove it satisfactorily but I think Kant may well have been turning in his grave as Einstein worked at his desk finalising his relativity theories.

God: The Immanent Concept?

Kant's refutation of the traditional arguments for proving the existence of God, and indeed the traditional arguments themselves (thus leading to Kant's view) treat God as pure concept. Is this a correct line to take?

It seems wholly reasonable to treat God, in any discussion of his existence, as pure concept. After all, there is no tangible thing which we may call *God*. In what sense though is the concept of God different to the concept of a quark, or the concept of a photon? God is only known through inference, analogous to the way we 'know' quarks.¹⁰² The person claiming a religious experience has indeed experienced something, yet must take a step of faith in order to make that something God. They may, as may Murray Gell-Mann,¹⁰³ be right in their inference. The problem is that there is no physically obvious knowledge of God, but there is neither any physically obvious knowledge of quarks. The two remain conceptual, although inferred from empirical observation. On the one hand the physical properties of the hadron family leading to further conceptualising, and on the other, the religious experience leading to a belief and further conceptual/spiritual work.

For these reasons I believe Kant's critique is fundamentally flawed, or at least out of date. Therefore I now return to the theistic arguments which Aquinas first systematised, and explore their relation to the New Physics.

The God Of The Quantum Physicist

What does the existence of anything mean to a quantum physicist? This is perhaps a more difficult question to answer than the existence of God itself. It is a difficult question because there are various theories about ontology within quantum mechanics, and all of them are counter-intuitive. However all quantum physicists would argue that their field discusses the nature of fundamental modes of being. To them is ascribed the task of discussing the constituents of all matter and forces. They span the structure of the most elementary (quarks and leptons) to the most comprehensive and holistic (the universe/s). What they discuss has very great bearing on the concept of existence because they are the people who, at the physical level at least, are in the best position to describe what *to exist* actually means.

“Quantum theories are successful, but their interpretation is still subject to discussion.”¹⁰⁴

What are the implications for God's existence in the light of the two major interpretations?¹⁰⁵

The Copenhagen Interpretation (CI)

Perhaps it could be argued that God must be 'observed' in order to exist. Then the existence of God is purely subjective and great leaps forward may be taken in inter-faith dialogue! Yet this is very uncertain ground. What does it mean to *observe* God? He is not a quantum system subject to interaction via the fundamental forces. Herein lies the danger of employing a scientific hypotheses in the wrong domain.¹⁰⁶

The Many Worlds Interpretation (MWI)

"...one might find it easier to believe in an infinite array of universes than in an infinite Deity, but such a belief must rest on faith rather than observation."¹⁰⁷

Here God would end up having to relate to many different versions of the same person. I may be a Christian in one 'world' and an atheist in another. Which of the many *me*'s is saved? Perhaps ontologically we are differentiated by occupying different worlds, rendering us in essence different persons in God's view.

In terms of God's existence though we must envisage a God who transcends multiple universes. Or perhaps there are multiple Gods. Is it necessary in terms of Christian theology to postulate a single deity over all the universes, or may we postulate one deity per universe. Further still, may some universes have a deity and others none?

Surely this leads us into pantheism. God must be separate from the laws which govern the multiple splitting of the universe.

Summary

The classical world view of physics supposed that given enough information about a present or past state of a physical system, such as the orbit of a planet, we may predict precisely how that system will develop. We may say exactly where the planet will be at any given time in the future. The system is independent of the observer. This led many to compose a deistic image of God, Aquinas' first mover now motionless, maybe dead!

With the emergence of quantum theory came the breakdown of this view. No longer can physics...

"...be conceived as a body of equations which will yield a description of the events of the world once appropriate initial conditions have been ascertained."¹⁰⁸

Furthermore the physical system is now dependent on observation and in some interpretations the consciousness of the observer¹⁰⁹ for its development.

"Physical science has found that it cannot be omniscient with respect to individual events but must be content to record them as they occur."¹¹⁰

In this way then, at the very least we can agree with Polkinghorne,

"The old image of the divine Clockmaker presiding over a steadily ticking universe has been replaced by One responsible for a world at once more open to innovation in its process and more dangerously precarious in its possible outcome."¹¹¹

Given our usual tendency to posit God with human attributes or at least those we would *ideally* have, is it still fair to say that God is omniscient? Since there is no longer any

possible ideal of omniscience for us, can God interact with nature in a way which allows him to be omniscient?¹¹² Perhaps the MWI allows God to know everything in all those different worlds.

If we started from a quantum mechanical perspective rather than a Newtonian one would the cosmological argument ever have come about. Considering a particle coming into existence via Heisenberg's uncertainty relation, the philosopher could not reasonably conclude that all existence is caused – some things just happen! No first mover for Aquinas, just random motion and random existence.

Here also Aquinas' ways must be challenged. The concept of a first cause or a first mover, does not hold in Newtonian physics, and even less in the New. In Newtonian physics things may move without being moved (Newton's first law). In the New Physics particles may flick in and out of existence simply because statistically they can, and eventually will. Nothing *causes* their emergence into our world, nor the velocity with which they subsequently travel at through our space-time continuum.

The God Of The Cosmologist

“If we confess a God who is beyond all space and time yet created space and time, can we neglect to listen to what contemporary physicists are saying about the nature of space and time?”¹¹³

“Scientists working in the field of cosmology seem to be irresistibly drawn by the lure of philosophy.”¹¹⁴

The beginning, structure and end of the universe constitute the main areas of cosmological study. It is in the first two areas that we find the greatest impact on our discussion.

Creation Ex Nihilo?

“...the scientific models of an *ex nihilo* beginning of our universe can and have been used as arguments against the existence of God.”¹¹⁵

“The limits of the Big Bang theory are very relevant to its use in cosmological arguments for the existence of God.”¹¹⁶

There are various models for creation out of nothing offered by modern cosmology. It seems to the cosmologists that to succeed in formulating a water-tight model would be to leave no room for a creator. The universe becomes self-explanatory from $t=0$ to the present day. However this is not the case.

In terms of the structure of the universe, we have already seen how the teleological argument cries for people to see the existence of God from the order therein. Indeed *order* is a fundamental axiom for the study of cosmology.¹¹⁷ What we infer philosophically from this order is a matter of contention.¹¹⁸ Yet it is not denied.¹¹⁹ Even with the law of ever increasing entropy¹²⁰ order throughout the universe is axiomatic. We could argue that modern cosmology ascribes weight to the teleological arguments, even if it only does so for the first step.

The beginning of the universe is where the most interesting discussion about the existence of God may be had. As Hawking asks:

“Why does the universe go to all the bother of existing? Is the unified theory so compelling that it brings about its own existence? Or does it need a creator, and, if so, does he have any other effect on the universe? And who created him?”¹²¹

Hawking here has taken an odd tangent away from the usual line of cosmologists. He sees beyond the usual inferences of his theory. Hawking has proposed a universe which is self-consistent: closed and unbounded. His universe has no beginning and no end. It requires no creation physically. It is allowed, according to his physics, to produce itself.

Most cosmologists at this point say to theists, “We do not need God for this universe! Therefore God does not exist!”¹²² The exact opposite of the cosmological argument. In this way they stand against Aquinas’:

“...any effect of a cause demonstrates that that cause exists...”¹²³

However, they have missed the point. The model only ever answers the question of what was produced and how it developed. Hawking sees that there is also the question ‘why?’

It is the principle of equivalence which has been developed by Hawking and others (departing strongly from Einstein’s own beliefs about the Universe but using his mathematical legacy) to come to their unbounded universe which some say leaves no need for a creator at all:

“...the quantum theory of gravity has opened up a new possibility, in which there would be no boundary to space-time and so there would be no need to specify the behaviour at the boundary. There would be no singularities at which the laws of science broke down and no edge of space-time at which one would have to appeal to God or some new law to set the boundary conditions for space-time.”¹²⁴

So then the potential impact on theology is very great indeed:

“The idea that space and time may form a closed surface without boundary also has profound implications for the role of God in the affairs of the universe.”¹²⁵

Perhaps the most famous physicist of our times, and one of the most the accomplished, Stephen Hawking, is pressing for an explanation of the universe which does not need God, yet retains all the elements of the traditional arguments for the existence of God, namely ontology and design. To be fair to Hawking he does not rule out God. He points out that science has only asked *what*, not *why*.¹²⁶ His cosmology is no more proscriptive of a deity than the Copernican revolution.

The trouble with all cosmologies, including Hawking’s, is the *why?* question. Given a perfectly consistent cosmology, with exact relation to observation and excellent predictive qualities about what else we ought to observe, there still remains the problem of why there exists anything rather than nothing. Further to this there is the apparent failing of all cosmologies to tackle to the philosophical question of on what basis physical law *exists* and *acts*. It is very well to show consistency with current laws and their effects, but if no laws exist because no universe exists what good is it to say

“...the universe is spontaneously created from *literally* nothing...”¹²⁷

when you carry on to say

“We know that in quantum mechanics particles can tunnel through potential barriers. This suggests that the birth of the universe might be a quantum tunnelling effect.”¹²⁸

‘Nothing’ must mean *nothing*. In my understanding the laws of physics are a *something*. What that something *is* is a question for the philosophers of science, but there is something intrinsic to the fabric of space-time which we call the *laws of physics*.¹²⁹

“...the theory of relativity implies that space and time are part of physics, rather than an arena in which physics takes place.”¹³⁰

Hence physical law is not pre-existence apart from space-time!

In our universe we do indeed observe quantum tunnelling phenomena,¹³¹ however this is in our post-creation universe. In the *ante*-creation ‘universe’ there is no way we can know that these same laws existed and were active. What use is it to say the universe came into being *by* the law of quantum-tunnelling?¹³²

“...what we know about quantum fluctuations occurs in our space-time framework. How could they occur in a situation where space and time did not exist?”¹³³

We must assume the necessity of the space-time continuum as the stage on which the laws of physics play. However Hawking uses imaginary time¹³⁴ and proposes physical law beyond ‘normal’ space-time. Worthing notes this but says it may

“...not have a physical correlate...”¹³⁵

This may be true but is not helpful as an argument since much of cosmology may not have a ‘physical correlate’.

In short it is my belief that cosmologies may not explain the existence of the universe in terms of ‘why’ or even ‘how’ at the most fundamental level before the Planck time. They may however be superbly accurate after this time. It is exactly at this point that the cosmologist must draw his line. Worthing presses this point more firmly than I saying,

“The moment one claims to have a theory explaining *how* the universe could have originated out of nothing, one enters into an unavoidable contradiction.”¹³⁶

Yet he seems correct in his damnation of cosmological metanarratives. While I do not wish to propose any God-of-the-gaps arguments,¹³⁷ philosophically it must be recognised that cosmology is limited and can never answer everything. It is perfectly reasonable to say that God created a universe which is closed and unbounded for example, it is not reasonable to say that because the universe is closed and unbounded God does not exist. My final words on this come from the first words of Torrance’s *God and Rationality*,

“Today natural science is at work penetrating deep into the heart of the ultimate questions of the universe that carry it to the very frontier of created being, which it can approach but cannot cross by means of the methods it has developed.”¹³⁸

The Anthropic Principle

The Strong Anthropic Principle (SAP) and the Weak Anthropic Principle (WAP) both recognise the almost miraculous coincidence that not one, but *all* the fundamental constants written into the fabric of nature, unchanged since time immemorial, are not just roughly in the region needed for life to exist in this universe, but to within a few percent of the values necessary for life.¹³⁹ The SAP proponents say this is clear evidence of a cosmic mind, or God if they are theists, the WAP proponents say, ‘well what do you expect, we could not ask the question if it were not so.’

The WAP proponents have been shown to be incorrect in their logic.¹⁴⁰ McGrath makes it quite clear that it is unlikely and that we ought to side with the SAPists, or at the very least recognise the validity of their argument. However,

“This does not mean that the factors noted above constitute irrefutable evidence for the existence or character of a creator God... What would be affirmed, however, is that they are consistent with a theistic worldview... and that they offer apologetic possibilities for those who do not yet hold a theistic position.”¹⁴¹

An All Seeing Eye?

Hawking’s model of the universe ‘starts’¹⁴² with a wave-function, as do the other quantum cosmologies.¹⁴³ The philosophical interpretation of this is interesting to us here. As with all quantum objects the interpretation of this wave-function is a point of contention.

“...Hawking’s wave-functional analysis of the universe requires the Many Worlds Interpretation of quantum physics...”¹⁴⁴

Otherwise he relies on the CI which would result in the question,

“Who or what collapses the wave function of the universe?” – some Ultimate Observer outside of space and time?”¹⁴⁵

Clearly physicists are unwilling to provide grounds for the existence of God as a direct consequence of their theories. In no other place is MWI preferred by the majority over Copenhagen interpretation. But the cosmologists think to use Copenhagen interpretation on a universal wave-function implies God. I am not convinced that this implication is necessary. I said earlier that we do not observe God as we do quantum mechanical systems. The converse is also true: we are not observed quantum mechanically by God. God does not interact with the universe in a way which causes the wave-function to collapse into one of the possible states which the wave-function establishes the probability of.

So Hawking’s model, and quantum cosmology generally, does not produce a critical choice for physics in terms of the method of interpretation which it should employ.¹⁴⁶ Neither does it allow an inference (or stronger) to God’s existence via the CI. The question does remain however: “How does the wave-function collapse?” With MWI it need not collapse and God becomes God of an infinite array of universes. With Copenhagen however there has to be something which collapses the wave-function. This is more a reflection on the limits of physics rather than a warrant for theistic belief. The CI allows for useful conversation within QM systems after the plank-time. When we speak of the creation of the universe we must recognise that the terminology of collapsing wave-functions begs a question which can not be answered by either theist or atheist.

Cosmology and the Cosmological Argument

If, as Kant denies, the cosmological argument has any currency left then it is not in the temporal form.¹⁴⁷ That is, we may not work back through a series of cause and effect *in time* and stop at God. This is due to Hawking’s (and others) proposal that the universe does not *begin to exist* in any meaningful sense.

“...the boundary conditions [of the Universe] are that it has no boundary.”¹⁴⁸

Given this can we concur with Sagan that there was

“...nothing for a Creator to do.”?¹⁴⁹

However,

“...this rests on a view of God and God’s role in creation which is not the view of most developed theologies.”¹⁵⁰

Certainly true but in terms of the *traditional* arguments for the existence of God, it may provide a strong criticism. Is this so?

“...it is false that there is no place for God in Hawking’s system or that God is absent.”¹⁵¹

There is still much for a creator to do, meaning there is still reason for a Creator to exist.

I said earlier that the question of Aquinas’ temporal or logical sequence was a relevant question. It is so because of this point. If Aquinas meant a temporal sequence, then in light of Hawking’s Cosmology Aquinas’ first three ways are false. There can be no temporal sequence requiring a first cause according to Hawking. However, there may still be room for a *logical* first cause. Perhaps therein lies the answer to Hawking’s *Why?* question.

As we have seen earlier there is still the problem of the laws of physics. How do they come about to allow for an unbounded universe in the first place? Temporal causation is not the only method of causation though. Swinburne says,

“...whether the universe is of finite or infinite age,...G[od] is a full cause of the existence of the universe throughout its history...The choice is between the universe as stopping-point and God as stopping point.”¹⁵²

However Aquinas may not have intended logical causation to be inferred from his work.¹⁵³ If not then his first three ways at least are undermined.

Cosmology and the Teleological Argument

“...our knowledge of the large-scale universe has been increasing at such a rapid rate during the present century that proponents of teleological arguments have had little difficulty in finding evidence of design in the universe.”¹⁵⁴

As much as the quantum theories from the early part of this century have sparked trouble for the design argument by introducing fundamental randomness into creation, so also have the theories from the same era provided much fuel for the teleologist by introducing large-scale order and ultimately a very delicate balance between order and chaos.

This last point is the most often pounced upon in the argument from design today. The universe is very finely tuned. Both in the initial conditions of energy density distribution¹⁵⁵ and in the particle-antiparticle ratios produced, the incredible accuracy needed to create, not just a universe capable of somewhere supporting life,¹⁵⁶ but also for existing in any meaningful sense, leads many to see not just order, but *miraculous* order in the universe.¹⁵⁷

Anything You Can Do...

The usage of scientific understanding of the universe in the arguments for God’s existence must be made clear. It is not true, not by any means, that a scientific hypothesis may be used *either for or against* the existence of God, dependent only on that hypothesis.

For example, the concept of disorder in the universe is a fundamental, if difficult to define, hypothesis. Disorder, it is supposed, exists. This is seen in the form of entropy in thermodynamics. I said above that the uncertainty of nature in quantum mechanics deals a fatal blow to the concept of a clock-making God. However, it does not write off God completely since there remain other definitions of God and his actions. The hypothesis of disorder however, can be used both for and against these remaining definitions of God.

Hawking, for instance, has said the uncertainty from quantum mechanics could be seen as God’s intervention. However, he continues, if this is so then,

“it would by definition not be random.”¹⁵⁸

Hawking then uses the randomness of nature to outlaw this argument for God’s existence. However Polkinghorne using the same hypothesis of randomness and uncertainty argues for God’s existence.¹⁵⁹ In this way two scientists are seen to apply the same scientific hypothesis to reach opposite conclusions about the existence of God.

The employment of science in this debate then is purely subjective. There is little objective reasoning in the pursuit of arguing for the existence of God using evidence from the natural world. In this way Kant is right, a posteriori reasoning can not of itself help us reach a proof of God. One axiom of our discussion is that God’s existence, true or false, ought to be objectively true or objectively false since it deals with ontology. Only in the realm of quantum physics, and only then in some interpretations, can the objectivity of the argument be replaced successfully with subjectivity.¹⁶⁰

Coherence theory of truth may have something to say here. I have not the space to discuss it properly, suffice it to say however that Polkinghorne’s argument may be seen to be coherent. He starts from a position of theism and using scientific hypotheses arrives at a theistic conclusion. Hawking stands more agnostically, but let us say atheistically. From there he uses scientific hypotheses and arrives at an atheistic conclusion. Their arguments are coherent in themselves but do not transcend the barriers of logic (Gödel’s incompleteness theorem) to prove themselves ontologically or objectively superior to any other coherent theory. Metanarrative may not be proven, only believed!

Conclusion

I hope it has become apparent that the New Physics says nothing of itself regarding the existence of God. However the New Physics does impact on questions of the existence of God, as laid down by Aquinas *et al*, and his nature via the interpretation of those who work with and study it. Hawking prefers to leave the question open. Certainly the success of cosmology in particular has led many in the media and the public to write-off God as an outmoded concept. He is no longer needed, *apparently*.

I hope it has also become clear that this latter view is incorrect. The New Physics can never ask the question *why?* And therefore can never prove the non-existence of God.

As much as God’s non-existence can never be proved so I have found that his existence can never be proved either. Kant’s arguments are very powerful and partly so because of their realistic view of human nature and method. He is aware of our shortcomings in terms of philosophical reasoning and shows how there is a pure reason which we ought to attain but cannot. However, I also hope to have shown reasonably clearly that Kant’s arguments also fail somewhat in the light of the New Physics.

I am left then with this thought. To argue consistently from your own beliefs is the best that one can attain. If I am an atheist or a theist, I may reason clearly why I am so. The other camp may never prove themselves superior. Furthermore neither camp may justly employ the findings of the New Physics to bolster their reasoning to a superior level than the other. The New Physics offers much promise for furthering theological discussion within the theistic camp though. I look forward to engaging with it in the future.

Appendix i: Einstein’s Theories of Relativity

Albert Einstein, (b.1879AD d.1955AD) brought in the second wave of the new physics with his concept of relativity. He was professor of theoretical physics at Zurich, Berlin

and Princeton. In 1921 he received the Nobel Prize for his work on quantum theory rather than relativity since his relativity theory was yet to be proven.¹⁶¹

Einstein developed two theories of relativity, the special (1905) and general theory (1916). The Special theory introduces the concept that *all the laws of physics are the same in all inertial reference frames*.¹⁶² That is, the laws governing the universe are identical to all observers, no matter where they are or how fast they are moving, so long as they are not accelerating. This is known as the **principle of relativity**. This may seem obvious on paper, but a startling consequence of it is that the speed of light is constant in all inertial reference frames. With light comes time and effects on it. From these beginnings Einstein developed his general theory of relativity which incorporated not only all laws of nature, but the very foundations of nature also – the space-time continuum. He did this by examining the nature of gravitation. His second theory of relativity revolved around the **principle of equivalence**, which states that gravity is absent in any inertial reference frame, or in an accelerating reference frame artificial gravity is present. Gravity and acceleration are seen to exhibit the same forces and are interchangeable in terms of the reference frames used.¹⁶³ This changes the concept of the underlying fabric of space and time. Gravity is no longer a force on a flat plane of space-time, but the curvature of space-time itself!¹⁶⁴

First we believed in a flat earth, then that view was changed to a round earth by Copernicus. Then we continued to believe in a flat space-time. That view was changed by Einstein into a curved space-time. The effect of Einstein's work is just as, if not more radical than the work of Copernicus and Galileo.

Time dilation is a consequence of the principle of relativity. A single time frame no longer exists. Although the speed of light in vacuum may remain constant in each inertial reference frame, the rate at which time passes for two separate observers is not constant. The rate at which a clock ticks depends on how fast that clock is moving. Therefore a traveller could find themselves in a time frame in which the clock ticked twice as fast or twice as slowly as another traveller who happened to be on a slower or faster mode of transport respectively. This horrific simplification ought to make obvious the fact that if they both travel for the same length of time relative to an observer who simply stayed at home, these two travellers will have aged at different rates. This is best summed up by the twin-paradox.

Appendix ii: Quantum Mechanics Explained

Max Plank was the first to propose the quantum theory and did so in 1900. In this way we can say that quantum theory was the first wave of the New Physics. However, it was not until almost two decades later that a firmly agreed upon formulation of Quantum Theory was accepted. Therefore I have placed it after the appendix on Relativity.

Heisenberg's Uncertainty Relation

One of the most important principals of the Quantum Theory is that of Werner Heisenberg's Uncertainty Relation.

Mathematically it is stated thus:

$$\Delta x \Delta p \geq \frac{h}{4\pi}$$

x is the position of the object, p is the momentum, and h is Plank's constant.

In English this states that the product of the uncertainty of position and the uncertainty of momentum of an object is always greater than or equal to the finite number $h/4\pi$. This means then that if we know 'exactly' the position of an object, we have no idea what its momentum might be. Conversely, if the momentum is known then the position is not known. As the uncertainty of one goes down, so the other goes up to compensate and make the product of the two maintain the relation to $h/4\pi$.

Physically this relates to the simple fact that on quantum levels observation requires the emission of a photon, or other particle by which an observer may observe the object in question. At this level though, the emission or absorption of a photon has massive effects on the position or momentum of the object.

Philosophically this relates to the breakdown in certainty. Knowledge of an empirical nature is no longer possible in any absolute sense. It is wrong to suppose that either of the elements on the left hand side of the equation may be known absolutely, leading to the conclusion that knowledge is still preserved. This is an incorrect conclusion because one element of uncertainty in the equation would be zero, and the other would then be forced to infinity to produce a non-zero product.

Heisenberg's principle also implies that given a vacuum there will be ghostlike particles flicking in and out of existence. Classically a perfect vacuum is exactly zero energy. With Heisenberg though this is not allowed, exact measurements, even of zero energy, violate his principle. So energy and matter are continuously created where none ought to exist.¹⁶⁵ This again is true of the post-creation universe and laws.

Wave-functions Large and Small

Wave-functions are more normally used for modelling quantum level objects. They are the probability wave for the various states of the particle under consideration. The peak of the wave represents the state which is most probable for the particle at the time of observation. However, the less probable states are still possible. Hence the wave-function for an electron which is spread out over space allows it to pass through two slits at the same time rather than going exclusively through either the right slit or the left slit as you would expect a single point-like particle to do.

Wave-functions may be calculated for macroscopic objects too. Their peaks are very strong at a particular place, which is the classical measurement of the object. The universe similarly may be modelled as a wave-function.¹⁶⁶ In this case the universe is taken as a unified system with the wave-functions of all quantum and macroscopic objects added together to create one single wave-function covering the entire universe.

Appendix iii: Philosophical Interpretations of Quantum Theory

The Copenhagen Interpretation

The best way to discuss the interpretation of quantum mechanics is to take an object and discuss what it means to observe that object. An electron is the most usual object considered and I will stay with that concept.

In the Copenhagen interpretation (proposed by Neils Bohr) the electron is considered to be in all its possible states at any given moment. There is no objective reality given to this system simultaneous states of being. There is no being at all. The only ontological reality of the electron comes about when it is observed. At the point of observation the

subjective measurement of the observer forces the electron into one of its possible states. Then and only then does any objective reality come about. Most of the time then the electron is in a state of non-being in an objective sense. “Such a picture was abhorrent to Einstein...”¹⁶⁷

Thus the nature of existence, *to be*, means *to be observed*.

The Many Worlds Interpretation

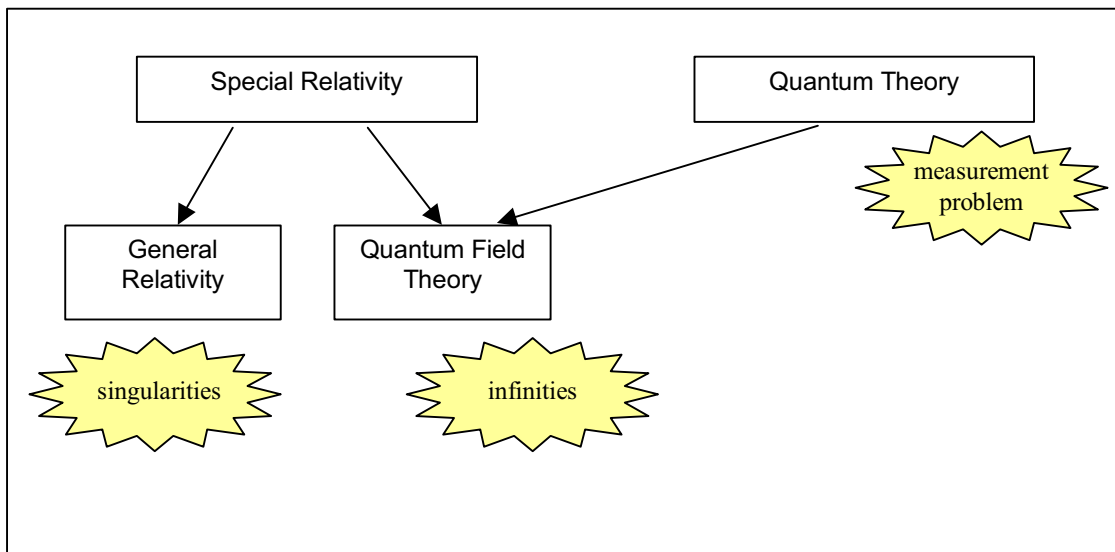
When a quantum system, say an electron, is measured, that quantum system *splits* into its various possible states.¹⁶⁸ The state which is observed remains in this *world*, and the other states vanish into other worlds. The proponents of this view hold that it is not the universe as a whole which splits, only worlds within that universe. Thus there is only one universe, but that universe contains much more than the universe of non-MWI interpretations. It is ontologically enlarged.¹⁶⁹ The objective reality problem of the Copenhagen interpretation is not present here. Instead of too few really existent objects, you have too many existent objects. What we observe classically exists in multiple instances in the MWI.

Hidden Variable Theory

This interpretation postulates the existence of variables which we are unaware of but which determine classically the behaviour of quantum systems. If we were able to measure these hidden variables then we would have a classical system. Einstein himself subscribed to this theory believing

“Bohr’s ideas of paradox and complementarity were a departure from rationality.”¹⁷⁰

Appendix iv: Relation of Scientific Theories



This diagram and text reproduced from Hawking & Penrose, p62

Appendix v: The Quark Structure of Matter

Both God and the quarks are empirically elusive. Neither can currently be proven. The effects of both are often seen, although this is very much open to the interpretation of the observer. In the case of the quark the evidence comes down to the application of the usually abstract discipline of Group theory in interpreting the puzzling results of

hadronic families. The group of particles known as hadrons (the familiar proton and neutron are examples of hadrons) occur in curiousity. The model proposed by Murray Gell-Mann in 1961 (and by Yuval Ne'eman) to explain the hadronic properties and family worked very well. Yet theoretically the model made room for more particles than were observed. Still those missing particles are missing and the proposal is that hadrons are themselves not elementary but made from quarks. The nature of the quark model explains away these missing hadrons.¹⁷¹

Appendix vi: Jewish Creation Tradition

A summary of Paul and the tradition he follows is that

“Paul...makes no attempt to prove the existence of God. He assumes, based on his Jewish ancestral beliefs..., that God exists, that he created humankind and continues to maintain interest in his creation.”¹⁷²

Eichrodt believes the early Jewish concept of God to be a single will independent of creation,¹⁷³ and his work in creation to involve a complete dependence of the earthly order on Yahweh¹⁷⁴ and a subjection of chaos to Yahweh's

“single divine will of incomparable strength”¹⁷⁵

However,

“As to how its God came into being Israel could say nothing whatever. Even when she had not as yet discovered the most precise formula for expressing the eternity of God...yet she never knew a time when, so to speak, Yahweh had not been there.”¹⁷⁶

While God then exists eternally and this is axiomatic, creation is not dualistic¹⁷⁷ but is dependent on Yahweh for existence.¹⁷⁸ This contrasts with Plato and Aristotle.¹⁷⁹

It is clear though that Eichrodt would side with Barth. He says that Israel's creation tradition is

“...essentially an utterance of faith, and which because it is born out of a knowledge of the lovingkindness and faithfulness of the covenant God can say Yea to the actions of that same God in Nature. This principle applies equally to Israel's insights into *the large-scale teleology which permeates the whole creation.*”¹⁸⁰

Teleology observed by the Israelites and Paul was only understood as such after the initial revelation of God in order to create a community of faith. Revelation then precedes teleology. Paul is aware of the design in the universe, yet this is subservient to the axiom of God's existence and revelation, not preceding or prior.¹⁸¹ Without the community of Israel however the witness of nature to God would be left unheard or at best not understood.¹⁸²

Lastly, other than the testimony of nature to God's existence and goodness, the other salient point to note on the Jewish concept of God and Creation is the concept of Chaos. Chaos is central to the cosmogony of Israel. God's battle with Chaos is sidelined when compared to the other traditions surrounding Israel, but it remains.¹⁸³ Chaos is that which Yahweh tamed in his creative acts at the beginning of the universe. Chaos is that which may have already existed in material form but not necessarily so. The pre-existence of Chaos is necessary for God to battle with it, whether it be material or spiritual.¹⁸⁴ Whatever the case

“Yahweh has the upper hand but is not fully in control”¹⁸⁵

The freedom of creation however allows for the continued experience of Chaos in the world, but with the eventual over-riding check of the authority of Yahweh.¹⁸⁶

Appendix vii: Cosmologies Explained

The Big Bang Model

There is postulated a beginning of the universe whereby the initial point of the universe's existence consisted an infinitely dense point of all space-time, including all matter and energy. This point expanded at a terrifying rate. In the first few fractions of a second the density dropped sufficiently for the structure of the universe to develop its first vestiges of today's physical system. Eventually the universe still expanding rapidly dropped sufficiently in density for the first matter to form in terms of subatomic particles. Electrons and photons whizzing through a dense soup of particle-antiparticle mayhem. As the universe continued to expand the particle-antiparticle annihilation rate dropped and more calm entered the universe. Energies and densities dropped far enough for the first electrons to be captured by protons thus forming Hydrogen. As this process continued the first atoms of Helium could then form and eventually clouds of these atoms could coalesce to form stars and eventually galaxies.

The universe continues to expand from this initial point of singularity. As it expands it will continue its history in one of three ways:

- i. Eternal expansion. The gravity of all the matter in the universe is not sufficient to pull together the universe against the force of the expansion. The expansion will continue unabated for ever.
- ii. Equilibrium. The gravity and the expansion are exactly equal. At some point the universe will halt its expansion but be sufficiently diffuse to not collapse back in on itself, held out by the freezing temperature of empty interstellar space, now lifeless.
- iii. Big Crunch. The matter in the universe creates an overall gravitational attraction which outweighs the expansive force from the initial point of the Big Bang. The Universe about-turns and starts contracting. Eventually the entire universe will collapse back to a singularity. If this generates a renewed big bang then the old universe will be lost, erased forever, and the new universe will appear unique to any observers which eventually form. It is possible that our universe is only one phase out of a million phases of expansion and contraction.

Inflationary Universe

Whatever the initial point of the universe was, there is postulated a phase at which the universe expanded horrifyingly fast, faster than the speed of light. This is necessary for the continued existence of order. In the early universe the major occupation was annihilation. Particles annihilated their anti-particle siblings. If the universe had not expanded so rapidly there would be nothing left for us to inhabit, just raw energy, which may on occasion turn itself briefly into matter, but never enough to create anything meaningful.

The Steady State Model

The expansion of the universe which is confirmed by modern cosmologists is not a product of the Big Bang or the inflationary period of a post-wave-fluctuation event, rather it is the continuing emergence of matter and energy. Continuous creation causes the expansion.

Recently cosmologists have discovered evidence for renewing the status of Einstein's cosmological constant, the invention of which Einstein said was the biggest mistake of his career. The cosmological constant is the anti-thesis of the gravitational constant. The gravitational constant accounts for the attractive force of gravity permeating the universe, while the cosmological constant accounts for the expansive force evident in the recession of galaxies. The recent work goes some way to supporting the steady-state theory, except that it has fallen out of fashion in the science world, hence the recent findings are more commonly interpreted in the context of a Big Bang model.

Appendix viii: The Anthropic Principle

Observation: The fundamental constants of nature, laid down since the beginning of time, necessarily have the values they do for life to exist. If any one of the series of constants varied by even as little as a few percent, life could not exist in this universe.

View 1: We ought to be surprised at this highly unlikely state of affairs. The chances of all these constants being so finely in balance across the whole of the universe must be evidence of purpose in the universe. It would not matter to the universe as a physical system if life did not exist, the values could happily be other than they are and thus the universe could be other than it is. However the fact remains that the universe is exactly, and improbably right for the existence of life, us!

View 2: We ought not be amazed at this highly unlikely state of affairs. The chances of all these constants being so finely in balance across the whole universe should not be taken as evidence of purpose in the universe. If the universe were other than it is then we would not exist to ask the question 'why is the universe this way?' That we exist and so can ask the question does not mean the universe is designed for us to exist in. It is simply necessary that given the random occasion of a universe¹⁸⁷ being adequate to support life, enough time will pass for that life to evolve and then develop to a state where they might ask the question.

In generalising the first view may be called the Strong Anthropic Principle, and the second view the Weak Anthropic Principle. It should be recognised that the exact definition separating the SAP and the WAP is not agreed. Different authors will recognise various ways of interpreting the Anthropic principle as strong or weak. For the purposes of this project I will simplify the matter (since it is not crucial) and make the generalisation that the SAP is the argument most often held by theists, and the WAP is the argument most often held by atheists.

There is another common interpretation of the SAP however which must deserve mention. It is that whereas the WAP proposes no design simply because we could not observe unless we existed, and the universe exists this way because through statistical reasoning it must somewhere and sometime be this way, the SAP suggests that there is one universe out of a myriad of universes (MWI again?) which statistically must have these constants and so support life. This may seem no different to the WAP. However the important distinction which makes one the WAP and the other SAP, is that the WAP suggests domains within the same universe which have different constants than other domains. Across the whole universe there will be at least one domain where the constants are correct for life to exist. The SAP suggests an entire universe with the same constants throughout. The other crucial factor here is that the concept of probability, the kingpin in the whole argument, is not clear when you talk about separate universes. How can it be said out of many universes there will be one which has the correct constants for life. If the universes are really universes then they will be totally independent of each other. Therefore to create a statistical system out of them is false. At best you will end up with the WAP, whereby each universe becomes a domain

within the system, or meta-universe. You are left then with either the WAP of the atheists, which is mostly untenable in the light of modern physics which prefers a unified system of constants across the whole universe for its methodology of investigation, or the SAP of the theists with a single instance of a universe miraculously suitable for carbon based life forms.

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¹ Worthing, p4-5, 199-200

² Gilson, p70

³ Gilson, p72

⁴ Copleston, p51f

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- ⁵ Copleston, p68
⁶ Gilson, p76
⁷ Copleston, p68f
⁸ Copleston, p70-1
⁹ Gilson, p128-9
¹⁰ Copleston, p12
¹¹ Davies (1992) quotes W L Craig's *The Cosmological Argument from Plato to Leibniz* (London, 1980), p159 in which he makes clear that the full context for Aquinas' proofs of God's existence encompasses his *Summa Theologiae* Vol2. 2-11.
¹² Aquinas, p13
¹³ Davies (1992), p21f
¹⁴ Copleston, p110
¹⁵ On the originality or otherwise of these arguments see Davies (1992), p26
¹⁶ Hick, p39
¹⁷ Hick, p41
¹⁸ Hick, p41
¹⁹ Physical motion is not the only change Aquinas referred to. He thought there were three modes of change: quality, quantity, and place (Kenny, p7)
²⁰ Copleston, p111
²¹ Aquinas, p15
²² Copleston, p111
²³ Aquinas, p15
²⁴ Copleston (1955), p77f; see also Crawford, p8 for further insights on Aristotle's importance to Aquinas
²⁵ Aquinas, p17
²⁶ Drees, p384; Penrose, 1989, Ch.10; Davies, 1983, Ch.6. Also see Tilby, p230-1
²⁷ Hick, p3
²⁸ Polkinghorne, 1994b, front cover and p3
²⁹ Polkinghorne, 1986, p80
³⁰ Brunner (1952), p151f
³¹ Ferris, p163f
³² Polkinghorne, 1988, p36
³³ Barth (1957), p102
³⁴ Barth (1958), p50
³⁵ Brunner (1952), p6
³⁶ Brunner (1952), p152
³⁷ Brunner (1952), p162
³⁸ Brunner (1962), p133-4
³⁹ Dunn (1998), p28
⁴⁰ Dunn (1998), p29
⁴¹ See Appendix vi
⁴² It is evident that to conduct theistic argument along these lines necessitates a realist approach to observation of the world
⁴³ Hick, p37
⁴⁴ Sparkes, p65
⁴⁵ Hick, p42
⁴⁶ Hick, p71
⁴⁷ Hick, p84
⁴⁸ Hick, p90-1
⁴⁹ Worthing, p35
⁵⁰ Kemp-Smith, pp500-7 or Ch.3 §4
⁵¹ Kemp-Smith, pp507-14 or Ch.3 §5
⁵² Kemp-Smith, pp518-24 or Ch.3 §6
⁵³ Kemp-Smith, p519 or Ch.3 §6
⁵⁴ Kemp-Smith, p519 or Ch.3 §6
⁵⁵ Kemp-Smith, p519
⁵⁶ Kemp-Smith, p520
⁵⁷ Kemp-Smith, p520
⁵⁸ Kemp-Smith, p521
⁵⁹ 'mind' is my own addition and may not be fair to Kant. I think it is helpful though if it does not introduce a different agenda.
⁶⁰ Kemp-Smith, p522
⁶¹ Davies (1992), p26
⁶² Kemp-Smith, p508
⁶³ Kemp-Smith, p508

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- ⁶⁴ Kemp-Smith, p508-9
⁶⁵ Swinburne, p116
⁶⁶ Kemp-Smith, p508
⁶⁷ Kemp-Smith, p509
⁶⁸ Kemp-Smith, p507
⁶⁹ Kemp-Smith, p501
⁷⁰ Kemp-Smith, p502
⁷¹ Kemp-Smith, p504
⁷² Kemp-Smith, p504
⁷³ Kemp-Smith, p505
⁷⁴ Kemp-Smith, p532
⁷⁵ Kemp-Smith, p532
⁷⁶ Kemp-Smith, p300; Guyer, p250-1
⁷⁷ Kemp-Smith, p508
⁷⁸ Guyer, p251
^{78b} Hick, p69f
⁷⁹ Barbour (1966), p75
⁸⁰ McGrath (1999), p18
⁸¹ Walker, p1
⁸² Walker, Ch.1
⁸³ Barbour (1966), p74f
⁸⁴ For a fuller discussion see Walker, ch.1: 'How is Synthetic A Priori Knowledge Possible?'
⁸⁵ For a discussion on Hilbert Spaces see Penrose, 1989, pp332-6
⁸⁶ Newman, p2027
⁸⁷ Sakurai, p11 and footnote
⁸⁸ See also McGrath (1999), p136 for a similar discussion
⁸⁹ "we have...inferred its existence from its internal possibility—which is nothing but a miserable tautology." Kemp-Smith, p504
⁹⁰ Walker, p7
⁹¹ Walker, p7
⁹² Newman, p2027
⁹³ For a discussion contemporary to Kant (Locke and Hume) see Caird, 234f. For a re-statement of the problem see Copleston (1960), and his discussion of Kant's views on mathematics and physics in Ch.XII
⁹⁴ Ohanian, p1042
⁹⁵ Appendix ii
⁹⁶ Barbour (1966), p74
⁹⁷ See Appendix i
⁹⁸ Quoted from Worthing, p25 who cites Erwin Hiebert, "Modern Physics and Christian Faith", in *God and Nature*, p431
⁹⁹ See for example, *Black Holes Beheld in Two Galaxy Cores*
¹⁰⁰ See for example, *Further Evidence for Frame Dragging*
¹⁰¹ Schutz, p125
¹⁰² See Appendix v
¹⁰³ See Appendix v
¹⁰⁴ Drees, p383. See also Polkinghorne (1986), pp47-9
¹⁰⁵ Penrose, 1989, p362. Also see Appendix iii for definitions
¹⁰⁶ Macquarrie, p240
¹⁰⁷ Davies (1983), p174
¹⁰⁸ Schlegel, p173
¹⁰⁹ Drees, p384
¹¹⁰ Schlegel, p174
¹¹¹ Polkinghorne (1988), p50. See also Worthing p42
¹¹² Schlegel, p175-6
¹¹³ Worthing, p107
¹¹⁴ Craig, p473
¹¹⁵ Worthing, p104
¹¹⁶ Drees, p385
¹¹⁷ Shu, p355
¹¹⁸ Drees, p389
¹¹⁹ p125-6 Even if according to Hume it is only a human construct: McGrath (1999)
¹²⁰ Worthing, pp79-84
¹²¹ Hawking, p174
¹²² Drees, p373 *abstract*
¹²³ Aquinas, 1a. 2. 2. This depends on the understanding that the universe is treated as an *effect*

- ¹²⁴ Hawking, p136. At the initial point of the Big Bang general relativity breaks down and is replaced by the quantum theory of gravity (Hawking, p50-1; Drees, p374).
- ¹²⁵ Hawking, p140
- ¹²⁶ Craig, p474
- ¹²⁷ Vilenkin, 1982, p26. See also Hartle & Hawking, p2961
- ¹²⁸ Vilenkin, 1982, p26
- ¹²⁹ Drees, p390
- ¹³⁰ Davies & Brown, p11
- ¹³¹ Rae, p27-30
- ¹³² Worthing, p201
- ¹³³ Worthing, p201
- ¹³⁴ Hawking, p134
- ¹³⁵ Worthing, p201
- ¹³⁶ Worthing, p105
- ¹³⁷ Worthing, p108
- ¹³⁸ Torrance (1971), pvii
- ¹³⁹ See Appendix viii
- ¹⁴⁰ McGrath (1999), pp181-6; McGrath (1998), pp111-8
- ¹⁴¹ McGrath (1999), p184; McGrath (1998), p114
- ¹⁴² While time is not Euclidean and linear in Hawking's universe words fail me and I simply use 'start' here
- ¹⁴³ See Appendix ii
- ¹⁴⁴ Craig, p482
- ¹⁴⁵ Craig, p482
- ¹⁴⁶ Craig, p482
- ¹⁴⁷ Drees, p387
- ¹⁴⁸ Hartle & Hawking, p2975
- ¹⁴⁹ Hawking, px
- ¹⁵⁰ Drees, p388
- ¹⁵¹ Craig, p474
- ¹⁵² Swinburne, p126-7, *cf.* Drees, p387
- ¹⁵³ Hick, p42-3; Craig, p476
- ¹⁵⁴ Worthing, p43
- ¹⁵⁵ The COBE satellite findings provided a media storm when unveiled a few years ago. See *COBE's Mission Completed*, Sky & Telescope, 95:5 pp18-19
- ¹⁵⁶ Hawking, p125
- ¹⁵⁷ Worthing, p43
- ¹⁵⁸ Hawking, 1988, p166
- ¹⁵⁹ Polkinghorne (1988), Ch.3
- ¹⁶⁰ Penrose, p346*f* sees objectivity in some areas of quantum mechanics. Strict Copenhagen interpretation however would not.
- ¹⁶¹ Ohanian, p989
- ¹⁶² Ohanian, p992
- ¹⁶³ Schutz, p121-3; Ohanian, p234 & §IX 1-3
- ¹⁶⁴ Schutz, p125; Ohanian, §IX 1
- ¹⁶⁵ Shu, p140*f*
- ¹⁶⁶ Hartle & Hawking
- ¹⁶⁷ Penrose, 1989, p362
- ¹⁶⁸ Tipler, p206
- ¹⁶⁹ Tipler, p207. *NB* Schlegel's account of MWI (p177) is incorrect on this point but is otherwise helpful.
- ¹⁷⁰ Barbour (1990), p142
- ¹⁷¹ Beiser, p540-5
- ¹⁷² Hawthorne et al., p354 §1
- ¹⁷³ Eichrodt, p98
- ¹⁷⁴ Eichrodt, p97
- ¹⁷⁵ Eichrodt, p98
- ¹⁷⁶ Eichrodt, p98
- ¹⁷⁷ Although see Brueggemann, contra p534*f*, and pro p537*f*
- ¹⁷⁸ Eichrodt, p99
- ¹⁷⁹ Eichrodt, p104, 108
- ¹⁸⁰ Eichrodt, p109
- ¹⁸¹ see also discussion of Divine freedom to create as fundamental, Eichrodt, p111-2
- ¹⁸² see Brueggemann, p529 and footnote 7.
- ¹⁸³ Brueggemann, p147

¹⁸⁴ Brueggemann, p158-9

¹⁸⁵ Brueggemann, p534

¹⁸⁶ Brueggemann, p534,6

¹⁸⁷ Note the connection with the MWI from our discussion of Quantum Physics, and Davies (1983), p171f