GOD
IT'S ABOUT TIME

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An excursus in the Philosophy of Time and the Kalām Cosmological Argument

Contents

Introduction

"What then is time? If no one asks me, I know what it is. If I wish to explain it to him who asks, I do not know."

- Saint Augustine, Confessions Book 11.

Time is a curious thing. And it is just that: a thing. For philosophers and scientists know not specifically what it is. Is it abstract? Is it physical? Does it flow, or is it static? For many thinkers including Saint Augustine and Sir Isaac Newton time consisted of an ever flowing present. However, in the early 1900s a surge of writing on the Philosophy of Time came out, being sparked by Albert Einstein's revolutionary new concept of time in his Special Theory of Relativity. This explosion in philosophical analysis was spearheaded by analytic philosopher J.M.E. McTaggart, and was carried on by C.D. Broad, to Bertrand Russell, to A.N. Prior, and has been left with contemporary philosophers such as L. Nathan Oaklander and William Lane Craig.

With the influx of writing on the Philosophy of Time, it became apparent that it was not some esoteric branch of philosophy. Rather, the essence of time affects the basis of one's ontology and metaphysics. As was seen later on, it also affects a prominent argument in Natural Theology known as the Kalām Cosmological Argument. Depending on which theory of time one adopted, the argument could either have a basis in reality or be completely unfounded from the start.

The purpose of this thesis is to (1) prove that the Kalām Cosmological Argument requires an A-Theory of Time, (2) defend this claim against recent works which attempt to show the contrary, and (3) analyze one main argument for both the A-Theory of Time and the B-Theory of Time, with objections to both arguments. It will then conclude that the A-Theory of Time is the correct theory, with the B-Theory possessing no warrant in light of recent scientific advancements, and thus one should adhere to it in order to create an ontology that most accurately represents the way the actual world is.

Chapter 1: Kalām and Time

1.1. How does the Kalām Cosmological Argument relate to time?

The Kalām Cosmological Argument is an argument for the existence of God which has recently become a prominent argument in Natural Theology, thanks to the work of Dr. William Lane Craig.[1] The Kalām argument was first developed by Muslim theologians called the *Mutakallim* who attempted to render their faith intellectually acceptable in the eyes of Greek philosophers. In order to do this, they developed philosophical arguments to defend their doctrines, the most famous being the Kalām Cosmological Argument which is aimed at upholding their doctrine of *creatio ex nihilo*. The argument can be simply stated as:

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.[2]

The purpose of this paper is not to fortify this argument, as that has been aptly done by Dr. Craig in numerous places,[3] but rather to discuss a major philosophical underpinning of the argument: whether or not the Kalām Cosmological Argument requires one to adopt an A-Theory of time, and if so, if there is any reason to adhere to it. This paper will attempt to explain how the Kalām Cosmological Argument requires the A-theory of Time. Before moving any further, let's explicate what the A- and the B-theories of time are.

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[1] William Lane Craig, *The Kalām Cosmological Argument*, Library of Philosophy of Religion (London: Macmillan, 1979).

[2] Craig, *Kalām Cosmological Argument*, p. 63. The argument has taken different forms throughout the centuries under different Islamic philosophers such as al-Kindi and al-Ghāzāli, but this is the most recent version.

[3] See Craig, *Kalām Cosmological Argument*, "Graham Oppy on the Kalam Cosmological Argument," Reasonable Faith website, "Reflections on 'Uncaused Beginnings,'" *Faith and Philosophy 27* (2010), p. 72-78, "J. Howard Sobel on the Kalam Cosmological Argument," *Canadian Journal of Philosophy 36* (2006), 565-584.

1.1.1. The A-Theory and the B-Theory

The question of whether or not time exists in an A-series or in a B-series was first coined by the British philosopher J.M.E McTaggart.[4] According to McTaggart, the B-series is a series of all the events that take place in the universe, or the universe's timeline of events (called the C-series), which has the A-series, the present moment, move across it. It is important to unpack these terms a little. First, the A-series is the moving present. There is only one time that exists on the A-series, and that is the present moment. The moving present of the A-series creates A-determinations, such as past, present, and future. The past is the time which the A-series was at, but has now moved on past. The present is the time at which the A-series is currently at, and the future is the time at which the A-series will eventually move to. As the A-series moves, times progressively go from being future, to being present, to being past.

In order to understand what the B-series is, the third series, what McTaggart called the "C-series," must first be understood. The C-series is a static, atemporal series akin to the set of natural numbers. It is the timeline of events in the universe's history which are laid out along a line, like a set of numbers. McTaggart believed that in the actual world, the A-series and the C-series both existed and were incorporated with each other. This combination of the present moment moving across a C-series timeline created McTaggart's B-series. It is the A-series that gives time any reality on McTaggart's view, for he believed that time required some sort of movement, movement that could only be realized through the moving present of the A-series. Without the moving present, the B-series would be robbed of any temporal aspect, and would become the static C-series. He states "And this—the B-series—cannot be got out of the A series alone. It is only when

[4] McTaggart, John McTaggart Ellis. The Nature of Existence. 2 vols. Edited by C. D. Broad. Cambridge: Cambridge University Press, 1927. Reprint Edition: 1968.

the A-series, which gives change and direction, is combined with the C-series, which gives permanence, that the B-series can arise."[5] He also claims

> "The B series... cannot exist except as temporal, since earlier and later, which are distinctions of which it consists, are clearly time determinations. So it follows that there can be no B series where there is no A series, since where there is no A series there is no time.
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> But it does not follow that, if we subtract the determinations of the A series from time, we shall have no series left at all. There is a series-a series of permanent relations to one another of those realities which in time are events-and it is the combination of this series with the A determinations which gives time. But this other series-let us caIl it the C series-is not temporal, for it involves no change, but only an order. Events have an order. They are, let us say, in the order M, N, 0, P. And they are therefore not in the order M, 0, N, P, or 0, N, M, P, or in any other possible order. But that they have this order no more implies that there is any change than the order of the letters of the alphabet, or of the Peers on the Parliament RoIl, implies any change.... It is only when change and time come in that the relations of this C series become relations of earlier and later, and so it becomes a B series."[6]

Thus, the moving present of the A-series establishes A-determinations, such as past, present, and future, which is the necessary foundation for any temporal relation. But since the present is moving, it must be moving across something already existent, and thus it moves across the static C-series, creating a temporal B-series, where all moments are equally real. But as the A-series moves across the B-series, different times are highlighted as the present. It is from McTaggart that their exists the distinction between the A-theory and the B-theory. This is because his view of time

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[5] J.M.E. McTaggart, "The Unreality of Time," *Mind 17* [1908]: p. 464.
[6] Ibid, pp. 461-462.

which combined the two series led to a formidable paradox, aptly called McTaggart's Paradox, which required him, in his mind, to deny the complete existence of time.[7] Philosophers of time after McTaggart decided instead to separate the two series, the A- and the B-series, into two distinct ontological theories, called the A- and the B-theory, rather than deny time's existence.

Due to the A-series' creation of A-determinations which resemble the tense determinations in language, the A-theory of time has also been called the tensed theory of time. Similarly, the B-series' implication of B-determinations which are always existent and unchanging resembles the timeless truths of tenseless sentences such as "On September 13, 1998, Kendall Matthews is born," which allows the B-theory to be called the tenseless theory of time. It is important to note that even though the sentence "On September 13, Kendall Matthews is born" contains the verb "is," which is present tense, the context in which it is used is what makes it tenseless. Because the event happens on that date, if it is true that it happens on that date, no matter what, it can be said to be tenseless. The truth of this sentence is timeless and does not change, as opposed to tensed sentences, whose truth is determined by the changing A-determinations. Tenseless truths are therefore timeless, since they are always true and never change in their truth value. So, it is true to say "JFK will be assassinated" when spoken before November 22, 1963, but it is false to say "JFK will be assassinated" when spoken after November 22, 1963. This is because the "will" in the sentence is future tensed, and so is true about an event that is yet to happen, but is false about an event that has already happened.

The major difference between these two theories is the ontological status that they give to tensed statements such as these. Since tensed statements require there to exist a specific time that possesses a greater ontological status, called the present (since future and past tensed statements

[7] Ibid.

are future and past relative to the present), the A-theory is characterized by its commitment to the existence of a real and actual present, one that is not relative to observers at a specific time. That is, a present that is not dependent upon the mind, but describes the state of affairs in the world. Since the A-theory of time was derived from the denial of there existing a B-series through which the A-series moves in order to avoid McTaggart's Paradox, the truest and purest form of the A-theory is presentism, which states that the only time which exists is the present moment.

On the other side, the B-theory gives no ontological status to tensed statements, but rather states that either tensed sentences can be reduced to tenseless truth conditions or truth makers,[8] or that, more radically, tensed statements are simply not true and say nothing about reality. On the B-theory, all times have an equal ontological existence; there is no distinction between past, present, and future, but the only temporal relations which exist between equally existing events are the relations of *earlier than* and *later than*.[9] Another important distinction between the A-theory and the B-theory is the reality of temporal becoming, which will play a major role in determining the validity of the Kalām Argument. From the existence of an ever changing present and the non-existence of the future, it can truly be claimed that on the A-theory that things come into being. However, since on the B-theory all things exist at their temporal location and there is no moving present to change their ontological status, temporal becoming is a façade created by the minds of

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[8] That is, whatever makes a tensed sentence true or whatever conditions are required for a tensed sentence to be true, are tenseless statements. These statements are either date-sentences, which was argued for by Bertrand Russell, Gottlob Frege, and W.V.O. Quine, or they are tenseless, token-reflexive statements which refer back to the original tensed statement, as is believed by Hans Reichenbach and J.J.C. Smart. D.H. Mellor has offered a new form of interpreting tensed sentences in his *Real Time*, (Cambridge: Cambridge University Press, 1981), and in his *Real Time II*, (London: Routledge, 1998) into a tenseless metalanguage which deserves attention. However, assessing the arguments about the reality of tense based upon language will not be featured in this paper due to, ironically, time restraints.

[9] It will sometimes be lodged against the B-theorist by the A-theorist that, bar the reality of tense, they have nothing to ground the relations of *earlier than* and *later than*, and thus either have to take those temporal relations as a brute fact, in that case the A-theory becomes superior in how it describes the acquisition of temporal relations, or that there are no temporal relations, and thus the B-theory is not an actual theory about time. See Craig, *Tenseless Theory of Time*, (Kluwer Academic Publishers), ch. 7.

the perceiver. The main focus of the next part will be to unravel whether or not the Kalām Argument requires temporal becoming to remain valid.

1.2. What does it mean to begin to exist?

The Kalām Cosmological Argument is predicated upon the notion of beginning to exist. The first and second premise of the argument "everything that begins to exist has a cause of its existence" and "the universe began to exist" both appeal to this concept of beginning to exist. Thus, it is important to define what it means to begin to exist. Craig defines begins to exist as "x begins to exist at *t* iff x comes into being at *t*."[10] This is hardly a satisfactory definition, as it raises the question of what it means to come into being. Craig, knowing this, proceeds to define "come into being" as:

> "X comes into being at *t* iff (i) x exists at *t*, and the actual world includes no state of affairs in which x exists timelessly, (ii) *t* is either the first time at which x exists or is separated from any *t'*<*t* at which x existed by an interval during which x does not exist, and (iii) x's existing at *t* is a tensed fact."

What is peculiar, and worth noting, about this definition is that it requires the A-theory of time, or that tensed facts exist. This is because it is a common belief that on the B-theory of time, temporal becoming does not exist, which is why one recent philosopher in the field has labeled it the Static Theory of Time, while labeling the A-theory as the Dynamic Theory of Time.[11] Before delving into whether or not temporal becoming requires the existence of tensed facts, let's examine the preceding principles that define "comes into being."

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[10] William Lane Craig and James D. Sinclair, "The Kalam Cosmological Argument," *The Blackwell Companion to Natural Theology*, (Oxford: Wiley-Blackwell, 2012) ed. William Lane Craig and J.P. Moreland, p. 184.
[11] Michael Tooley, *Time, Tense, and Causation*, (Oxford: Clarendon Press, 1997).

The first premise is quite obvious: that the object exists at the point in time which it is said to exist at, and it is never in a state of timelessness in the actual world. The first part of this requirement is basic: in order for something to be said to come into being at a time, the object must exist at that time. Otherwise, the statement “this ball comes into existence at time *t*,” when it does not exist at *t*, is false, since the ball does not even exist at time *t*.

The second part of (i), however, is more substantial. It creates an important distinction between things that exist temporally and things that exist timelessly. If something exists timelessly, for instance, abstract objects, then they never come into being *per se* because they would always exist in a timeless eternity, similar to how most theologians view God to exist.[12] If a timeless entity (e.g. God) were to suddenly become temporal, it would not come into being as the proponent of the Kalām argument is trying to conceive of it. It would always be: when it exists in its timeless state, it exists (tenselessly), and then once it enters into time, it could be said to exist temporally. In both cases, the object in question is always in a state of existence. It never “begins” to exist in the sense that it went from a state of non-being to being. It only begins a new stage in its life: a transition from a timeless eternity into a temporal existence, with a specific time *t* designating when it began its temporal stage in its life.[13] Thus, in order for an object to truly be said to come into being, it must not exist in a state of timelessness that is explanatorily prior to its state of temporality, but it must only exist temporally.

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[12] See Brian Leftow, *Time and Eternity*, Cornell Studies in Philosophy of Religion (Ithaca, New York: Cornell University Press, 1991), Eleonore Stump and Norman Kretzmann, "Eternity," *Journal of Philosophy 78* (1981), pp. 429-58, Jonathan L. Kvanvig, *The Possibility of an All-Knowing God* (New York: St. Martin's, 1986), pp. 150-65; Edward R. Wierenga, *The Nature of God: An Inquiry into Divine Attributes*, Cornell Studies in Philosophy of Religion (Ithaca, N.Y.: Cornell University Press, 1989).

[13] This is a basic description of how Craig views God as existing [*God, Time, and Eternity*, (Dordrecht, Netherlands: Kluwer Academic Publishers, 2001)]. He believes that before the creation of the universe, God existed in a state of timeless eternity, but once he acted to create the world, His state changed from one of inaction to one of action, and He entered into the first instant of time.

The second requirement is also important, in that it does not require one to claim that the time at which the object stated comes into being is the first time at which that object exists. In fact, one could say that the object had existed before at a time *t'*<*t*, as long as there is a separating interval of time in which the object did not exist. This is important, because it emphasizes that coming into being does not mean that the time in which it is said to come into being is the first time at which it exists, but rather that the time at which an object is said to come into being is preceded by a state of non-existence. Temporal becoming is predicated upon there being a state of affairs in the actual world in which an object does not exist, either temporally or timelessly, and then after that period of nonexistence, there is a period where the object can be said to exist. It is a going from non-being into being.

The third and final requirement for something to be said to come into being is the most important: that the objects existing at that time *t* is a tensed fact. It is at this point that the B-theorist will be turned off from the Kalām argument. For if the argument requires that one accepts the A-theory of time, the B-theorist will have no issue with the argument, no matter how strong the justification one gives for the universe beginning to exist (i.e. the universe not being eternal, but temporally limited). This exposes why Benjamin Victor Waters' recent essay on how the Kalām Cosmological Argument can work on a B-theory of time fails. Waters rightly points out that Craig's way of formulating the Kalām argument makes it difficult for contemporary philosophers of religion to accept due to it requiring one to "adopt such controversial positions as the dynamic theory of time and the metaphysical impossibility of an actual infinite."[14] However, Waters misunderstands the reason behind why the Kalām argument requires the A-Theory of time. He views it as the result of one of Craig's arguments for the finitude of the past, namely, the

[14] Benjamin Victor Waters, "Towards a New Kalām Cosmological Argument," *Cogent Arts and Humanities* (2015), p. 1.

impossibility of forming an infinite set from consecutive temporal events. Waters claims that this argument requires that "a series of past times be (dynamically) formed in successive fashion"[15] which would require, in order to be dynamic, a moving present, which requires an A-theory of time.

Whether or not this is a correct interpretation of Craig's argument is not of concern at this point. The valiant issue is that Waters falsely believes that the A-theory of time only comes into play when discussing whether or not the temporal series is finite or infinite. Waters proposes his own proof of time's finitude, creating a hypothetical situation about an immortal man named Methuselah. He states

> I first consider the case of an individual named Methuselah, who is stipulated to have been alive for every finitely distant past day. Moreover, throughout his long life, Methuselah has maintained a purely fictional diary in which he records imaginary events that never took place, and where each entry in his diary concerns the imaginary events of some day. With the ability to accurately remember everything he did on the previous day (provided there was one), Methuselah works on entries for his diary at a constant rate of half an entry per day in the following manner: for any finitely distant past day that is not also a first day, if Methuselah remembers working on the first (second) half of an entry for some earlier finitely distant past day on the previous day, then he will work on the second (first) half of an entry for the same (following) day, otherwise he will work on the first half of an entry for the current day. On the other hand, for a finitely distant past day that is also a first day, Methuselah works on the first half of an entry for that day.
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> Now, the above scenario is constructed in such a way that the distance between any finitely distant past day on which Methuselah is writing and the finitely distant past day about which he is writing is always increasing at a rate of one day for every two days of work. But then it also follows that the same distance is similarly decreasing in the direction of the past, so that the above scenario requires the existence of a first day on which Methuselah began working on entries for his diary. Hence, the above scenario is coherent only if the series of finitely distant past days is finite. But now notice that Methuselah's powers of memory and

[15] Ibid, p. 4

> dispositions concerning his diary, although somewhat idealized in the former case and contrived in the latter case, are very much like the sorts of powers and dispositions we could have had (and coherently exercised) if we had Methuselah's life span, which suggests that the aforementioned powers and dispositions ascribed to him form a coherent scenario. And so it seems that there must have been a first day finitely distant in the past, which suffices to establish the finitude of the past.[16]

What Waters wishes to provide here is a way to prove the finitude of time which does not require one to believe in the A-theory of time nor believe that an infinite cannot exist. This would provide a more attractive version of the Kalām Cosmological Argument for the majority of philosophers.

Discussion of whether or not his hypothetical situation is sufficient to provide reason to believe in the finitude of the past, or if the situation is any more than tautologous, stating that "the series of finitely distant past days is finite"[17] will be begged off. Rather, it will be sufficient to show that the question of whether or not time is infinite does not play a role in detailing how something can come into being on the B-theory. Waters seems to believe that it is the fact that one cannot argue for the finitude of the past without appealing to metaphysically debated doctrines such as the A-theory of time or nominalism that turns the B-theorist away. Thus, he attempts to formulate a way in which one can prove the finitude of the past without appealing to "any particular theory of time."[18] This is attacking a straw man, for B-theorist can coherently claim that the Spacetime block in which the universe exists has a front edge, and so is not infinitely extended, while still claiming that the universe never comes into being.[19]

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[16] Ibid, pp. 3-4.
[17] Ibid, p. 4.
[18] Ibid
[19] Craig, *God, Time, and Eternity*, p. 109. Craig says "it (the universe) begins to exist only in the sense that a meter stick has a beginning: there is a front edge to the space-time manifold, that is to say, it is finite in the earlier than direction." This clearly states that the finitude of the Spacetime block only entails that it has a front edge, not that it came into existence at some point. This will be delved into further in this section.

Waters does, however, seem to believe that his hypothetical situation seems to "provide a straightforward understanding of what it means for some temporal entity to begin to exist at a particular moment."[20] What he is referring to is when he, analyzing his argument, states that it requires that "every temporal entity must have a first moment since otherwise there would… the existence of such a first moment for every temporal entity provides us with a natural starting point for identifying when temporal entities begin to exist."[21] Waters definition of what it means to begin to exist is what has been stated before, minus the requirement of that entity's existing at its first moment is a tensed fact. Though he does not realize it, this is the most important statement he has made in the entire paper. For the question of whether the Kalām Cosmological Argument requires an A-theory of time boils down not to how one argue for the finitude of the past, but rather on how one defines "comes into being" or "begins to exist." For if coming into being, which is necessary and sufficient for something to begin to exist, does not in fact require that the object's existing at the time at which it is considered to begin to exist is a tensed fact, then one can happily argue from the finitude of the past for the existence of a transcendent creator. This is the route that another recent commentator on the validity of the Kalām Cosmological Argument given the B-theory of time has taken.[22]

Curtis Metcalfe realizes that most B-theorists believe that "the reality of temporal becoming itself is denied," but he questions whether B-theorists must hold to that belief.[23] He questions, "Why, for example, couldn't x's existing at t simply be a tenseless fact temporally indexed earlier-than every other moment?"[24] In other words, why can coming into being not be defined by the first

[20] Waters, "Towards a New Kalām," p. 4.
[21] Ibid.
[22] Curtis J. Metcalfe, "A Defense of the Kalam Cosmological Argument and the B-Theory of Time," 2013.
[23] Ibid, p. 10.
[24] Ibid.

two premises that x exists at *t* timelessly and that *t* is either the first time at which x exists, or that *t* is preceded by a period where x does not exist. The justification that he provides for this is the example that he "began at a time *later-than* Ronald Reagan's presidential inauguration, and *earlier-than* George H. W. Bush's."[25] What he means by this is that he is born, and thus the first time at which the person Curtis Metcalfe exists, is at a time later-than Ronald Reagan's inauguration. So there is a first moment at which he is said to exist. The problem with his analysis is that on the B-theory, all events at a certain time always exist at that time, and thus, barring the existence of a moving now, those events cannot be said to ever start existing unless one says that the temporal block in which those times are held are said to begin to exist. Metcalfe responds to this point, saying

> "it is not the case that there is no temporal order to the B-series. It is not as if, by being tenseless events, all of the above events surrounding my birth are *simultaneous* with one another. Indeed, certain events are earlier than others, and when they do, they begin earlier as well." [26]

Metcalfe, however, misrepresents the point being made. The A-theorist is not charging the B-theorist with having all events existing simultaneous at the same time, but rather that all times exist within the same temporal block. No time can be said to have any ontological superiority over any other time; instead, all times are said to exist equally. The B-series can be ordered by the temporal relations of *earlier than* and *later than*, but that does not mean that events that occur at an earlier time than another are said to begin to exist before another, because they do not in fact begin to exist before the other time. All times exist, and just because one event is ordered *earlier than* another on the temporal series does not mean that it begins to exist before that event, but just that it occurs on the B-series in front of the other event. This is akin to the number 2 existing

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[25] Ibid.
[26] Ibid, p. 11.

numerically prior to the number 3 on the series natural numbers (ordered from smallest to largest). Just because 2 occurs on the series before 3 does not mean that 2 comes into being before 3; 2 is simply ordered before 3. Both numbers equally exist, since they are timeless entities, similar to how events on the B-series exist tenselessly at their temporal location. Metcalfe recognizes this and attempts to rescue his argument saying

> "But none of this is exactly what Craig means by something's beginning to exist, since, according to the B-theory, it is not true objectively at Ronald Reagan's inauguration that I do not exist. The truth of that statement is perspectival to those simultaneous-with the inauguration event, but I exist tenselessly along with all other moments of time. This is part and parcel to the B-theory, so I maintain there must be something unique about a first moment of the universe that allows even a B-theorist to say 'it begins.'"[27]

What makes this first moment unique, according to Metcalfe, is that it is the front edge of the Spacetime block. Before the first moment, there is no time, making the first moment of time special. He believes that if defines "coming into being" according to the first two premises that Craig presents then it would only be satisfied by the first moment of time. Every event that occurs at a moment of time different than the first moment of time would be said to already exist at a time earlier than where it is tenselessly located, whereas the first moment of time would be the only time at which there is no time earlier than it at which it could be said to exist tenselessly. Metcalfe confuses the view that on the B-theory, all times exist at their tenseless time determination, and that all times exist at all other times. His argument, therefore, is misconceived in that the event of his birth does not exist at the time of Ronald Reagan's inauguration but rather is said to exist tenselessly at its time determination. Thus, just because there is a time earlier than his birth does not mean that his birth happens to exist at that time. In other words, the B-theory of time has all

[27] Ibid.

times existing tenselessly at their temporal locations, never coming into or out of existence. Now, Metcalfe does bring up a good point about the first moment of time in asking

> "Why would it be impossible for there be a state of affairs in which God exists changelessly and timelessly without the universe, and for there to be a first moment of creation in which God creates the B-series of events which include the first moment of cosmic inflation, and every other tenseless moment?"

This gets to the heart of the issue: if the Spacetime block has a front edge, then one should be able to stipulate that there needs to be a transcendent creator who creates Spacetime, making it temporally limited. If the Spacetime block has a front edge, then it does not extend for infinity, but rather is temporally limited, and one must ask how that block comes into existence, and why it cannot be the case that God, existing timelessly, did not create the temporal block at time t_1. In order to answer this question, an understanding of what Spacetime is on the B-theory is required.

The concern here is not with Spacetime as Minkowski envisions it, but rather as how the B-theory requires there to be a temporal block where all times exist. On the B-theory, there exists a four dimensional Spacetime manifold which contains all times and is ordered by the temporal relations *earlier than* and *later than*. Inside the temporal block, time exists. It is what bounds time. But the temporal block taken as a whole or taken from the outside, so to speak, is timeless. It has always existed. This all-encompassing temporal block is characterized to be extrinsically timeless, but intrinsically temporal. Since the temporal block contains all times, the block itself cannot be in time, unless there exists a hypertime in which this temporal block is embedded. Since the block itself is timeless, it never comes into being because that would require it to be inside of time. Thus, even if the temporal block has a front edge at the Big Bang, it would not begin to exist anymore than a meter stick could be said to have a beginning, i.e. it has an edge to it.[28] This makes it possible

[28] Craig, *God, Time, and Eternity*, p. 109.

to answer Metcalfe's question "why would it be impossible for there be a state of affairs in which God exists changelessly and timelessly without the universe, and for there to be a first moment of creation in which God creates the B-series of events which include the first moment of cosmic inflation, and every other tenseless moment?"[29]

His solution, that if the temporal block has a front edge it could possibly be said to be brought into existence by God, would simply lead into a vicious infinite regress of temporal blocks. Assuming that the temporal block did come into existence, it could not begin to exist at a time that is contained within the block itself, because that would be circular, stating that the temporal block could not exist without the first moment of the block, but the first moment of the block is contained within the temporal block, and thus could not exist without the block. Rather, one would have to stipulate a hyper-time in which the temporal block is said to exist, as that hyper-time would give the temporal block a time determination for when it is said to come into being. But then it must be asked if that hyper-temporal block ever began to exist, which will end in an infinite regress of hyper-temporal blocks that allow the block on the level below it to begin to exist. In order to avoid this infinite regress, the B-theorist must stipulate that the temporal block as a whole exists in a timeless eternity, and it is only inside of it that there are any temporal relations. Thus, the B-theorist is capable of consistently believing that time has a first moment at the Big Bang, but that the temporal block in which this first moment is held has always existed, and thus the universe does not truly come into being.

Through this, one realizes the importance of one's theory of time to the validity of the Kalām Cosmological Argument. If one is a B-theorist, the argument fails as the concept of coming into being does not exist on the B-theory, but if one is an A-theorist, beginning to exist is a real

[29] Metcalfe, "A Defense of the Kalām," p. 13.

phenomenon, and so the major philosophical basis for the argument is accepted which allows the argument's premises to be debated. Thus, in order to determine the soundness of the Kalām Cosmological Argument, arguments for both the A- and B-theory of Time must be examined.

Chapter 2: Experience of the Present

2.1 Introduction

One of the principal arguments for the A-theory of time comes from people's everyday experiences. Humans naturally intuit from their experiences that there exists a present: they observe events as happening presently, they observe events in a present manner, and they feel the innate flow of time and temporal becoming. All of these are based off of there existing in their experience some true, ontologically significant present. Psychologist William Friedman comments on this experience that "Like [temporal] order and the causal priority principle, the division between past, present, and future so deeply permeates our experience that it is hard to imagine its absence."[30] Because of this, there seems to be a consensus among philosophers, A-theorists and B-theorists alike, that the view of the common man is that there is a real and objective past, present, and future, and that events to come into being and then pass away.[31] The belief in past, present, and future are formed without any attempt to explain their experience of time, but are rather formed automatically from such experiences. While the experience of time is of course an experience based upon the external world, it is not like the experience of sight or sound which could be susceptible to mental dysfunction or illusions. It is instead an intuition that is automatically formed

[30] William Friedman, About Time (Cambridge, Mass.: MIT Press, 1990), p. 92.

[31] L. Nathan Oaklander, *Temporal Relations and Temporal Becoming* (Lanham, Maryland: University Press of America, 1984), Steven F. Savitt, "The Direction of Time," *British Journal for the Philosophy of Science 47* (1996), Paul Horwich, *Asymmetries in Time* (Cambridge, Mass.: MIT Press, 1987), and 1.1. C. Smart, "The Reality of the Future," *Philosophia 10* (1981).

"in the context of our experience of the world"[32] which is basic to the human race and cannot be explained on the B-Theory of time.[33]

2.2. Experiences as Present

2.2.1. Presentness, properties, and proper basicality

Every day humans experience billions of different events. They experience themselves waking up after a prolonged period of unconsciousness, they perceive the darkness of their bedroom or wherever they fell asleep in the morning, they feel the raging headache that could either be caused from a concussion or hangover, but they can't remember which. They experience all of these events as occurring presently. As Dr. Craig states, "Every one of us lives in the present."[34] All of the events that humans participate in are automatically inferred as occurring presently, as is seen through the unconscious usage of the present tense when describing events. The sentence "I am running" is formed with present tense verbs without any recourse to self-reflective inference, but rather is formed automatically because it is the way in which humans experience events as happening. But they also do not form their belief that they are currently running based off of any other belief; they simply experience themselves as running, and then unconsciously infer that this event is present. Take, for instance, the perceiving of a tree.[35] If

[32] Craig, *Tensed Theory*, p. 133.

[33] It is an interesting question to ask what one's experiences should be expected to be like if the world was in fact described by the B-Theory of time. Would they, in fact, be the same? What shall be shown is that they would not be the same, since the current experiences are inexplicable on the B-Theory, though one is unable to know how they would experience events on the B-Theory. The point is not to show what should be expected on the B-Theory and what should be expected on the A-Theory, but rather that what is experienced is explained given that the A-Theory is true, but is not explained given that the B-Theory is true.

[34] Craig, *Tensed Theory*, p. 139.

[35] This example comes from Alvin Plantinga in "Reason and Belief in God," in *Faith and Philosophy*, ed. Alvin Plantinga and Nicholas Wolterstorff (Notre Dame, Ind.: University of Notre Dame Press, 1983).

someone were to ask the tree watcher what they are doing, they would answer with the sentence "I am looking at a tree." This is not based off of any prior proposition, but simply because they are being appeared to in a treely manner. From this appearance, they develop the belief that they are looking at a tree. This sentence "I am looking at a tree" also means the same thing as the sentence "I am presently looking at a tree." Since their belief that they are presently seeing a tree is the same as their belief that they are seeing a tree, then that belief in the presentness of their experience is just as basic (not based off of any proposition) as their belief in seeing a tree. Also, the sentence "I am looking at a tree" is certainly not reducible to any B-theoretic statement "I am looking at a tree on November 29, 2016," for that does not convey the same information.[36] Instead, the experience of looking at a tree requires fundamentally the belief that there exists a present moment.

D. H. Mellor concedes this point, as he states that if there are, in fact, properties such as pastness and presentness which can be observed through events, then the B-Theory is disposed of. Some clarification is needed as to what Mellor, as well as the A-theorist, means when they refer to presentness as an observable property. He does not mean that the property of presentness is observable in the sense that it can be experienced with the five senses. What he is instead referring to is ""that all observation, of all events, itself occurs in the present. That is, our own experiences, of seeing and hearing things are given to us in experience as being present tense events."[37] What he is talking about is what is called the presence of experience. People do not see or hear

[36] See Craig, *Tensed Theory*, ch. 2. The information which the B-theoretic sentence fails to express is the information that the event is currently happening. Though through the addition of the date one can specify what was implicit in the A-theoretic statement (that is, the time of the present), it does not have the same meaning. Take a person who does not know the date. Someone could tell them the two statements "I am running" and "I am running on November 29, 2016," and he could come away with two different meanings. The first sentence tells him that the person he is talking to is running currently, while the second sentence tells him that the person he is talking to is running at a specific date, but since he does not know the date, he could infer that the person's running is either now over, or has yet to happen. See also, Quentin Smith, *Language and Time*, (New York: Oxford University Press, 1993), John Perry, "Cognitive Significance and New Theories of Reference," *Nous 22* (1988).
[37] D.H. Mellor, *Real Time*, (Cambridge: Cambridge University Press, 1981), p. 25.

presentness, but they do see and hear events in a present manner. These properties are intuited, and if people reflect upon their experiences, they will see that they only experience events as happening presently to them. If the B-theorist insists that presentness must be some external property instantiated within certain events, it could be pointed out that there exists non-sensible properties such as unity, number, and existence, as Gilbert Plumer shows.[38] And though people cannot experience the presentness of events directly, they experience them indirectly.[39] Mellor concedes that if the observations of presentness are properly basic, then the B-Theory is done.[40] Mellor, instead of arguing against these experiences, being the good empiricist that he is and not wanting to completely undermine the foundations of all the knowledge of the human race, attempts to show that people do not actually observe events in the world as being present, and that their introspective belief that their experiences are present is non-veridical.

2.2.2. The presentness of external events

First, Mellor deals with people experiencing events as being present. Mellor claims that they do not actually observe events to be present. Events are observed presently, but Mellor claims that this has been mistaken for the events themselves being present. Mellor believes that it is the belief in the presentness of the experience of some event that forms the basis for the belief that an

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[38] Gilbert Plumer, "Detecting Temporalities," *Philosophy and Phenomenological Research 47* (1987): 453.

[39] See H. Scott Hestevold, "Passage and the Presence of Experience," *Philosophy and Phenomenological Research 50* (1990), pp. 542-544.

[40] For an account of properly basic beliefs, see Plantinga, "Reason and Belief in God," and Plantinga, *Warrant and Proper Function*, (Oxford: Oxford University Press, 1992). Plantinga characterizes properly basic beliefs as those which are not based off of other beliefs and which evident to the senses (though this does not, as he points out, exhaust the definition of properly basic). He states that properly basic beliefs must be grounded in specific circumstances, such as one's rational functions working properly and them being in an environment that is conducive to their senses. Thus, if someone is in an environment where they know every time they hear a bird call they think that they are seeing an elephant, they would not be justified in forming the belief that there is an elephant in front of them. It is important to note that properly basic beliefs are defeasible, but they can sometimes enjoy so much warrant that they overwhelm any defeaters lodged against them. Plantinga calls these "intrinsic defeaters."

event is occurring presently. There is no property of presentness that people observe events to have. Mellor uses an example of someone stargazing through a telescope.

> I observe a number of events, and I observe the temporal order in which they occur: which is earlier, which later. I do not observe their tense. What I see through the telescope does not tell me how long ago those events occurred. That is a question for whatever theory tells me how far off the events are and how long it takes light to travel that distance.... So, depending on our theory, we might place the events we see anywhere in the A series from a few minutes ago to millions of years ago. Yet they would look exactly the same. What we see tells us nothing about the A series positions of these events.[41]

Mellor notes correctly that events which are observed through a telescope will not be occurring presently. Due to the limited velocity of light, an event, say a supernova, would have occurred long in the past by the time that it is being observed. Any belief that is formed stating that the supernova is presently occurring would thus be incorrect. It would have happened billions of years in the past. Not only is the wrong A-property observed, but the event itself is place incorrectly along the A series. Mellor views this as strong evidence against the belief that there are A-theoretical properties that are observed in events, for not only are properties observed wrong, but the event is placed incorrectly along the A series.

There are a few problems with Mellor's argument. First, when analyzing the argument, it must be asked what the worst possible outcome is if the argument is true. In this case, Mellor claims that people experience events which have happened far in the past as present. This is true,

[41] Mellor, *Real Time*, p. 26. Craig points out that this argument actually undermines not only our observations of tense, but also any observation of B-relations which are required on the B-Theory. For there can be two galaxies, one that is larger, yet further away from Earth than the other. By using the magnitude of the luminosity of the galaxies to determine their distances, the one that is larger yet further away will project the same amount of light as the one that is closer yet smaller. Thus, an astrologist would conclude that the two galaxies are approximately the same distance away from the Earth, and that events that they observe to occur in one will occur simultaneously with the other. This would, however, be erroneous, for the events in the galaxy further away would actually have to occur earlier than the events in the other one in order for the astrologist to receive the light from them simultaneously.

but Mellor's conclusion that this disproves the experience of any event as occurring presently is overdrawn. Rather, what it shows is simply that the belief in the presentness of events is defeasible. Craig notes this, and states that

> All this proves is that our basic belief that certain events are presently occurring is defeasible and sometimes defeated. One might as well argue that the deliverances of our senses are not properly basic because when we look through a microscope things appear to be larger than they are. Nor does anything in these illustrations depend on the use of instruments: just as to the unaided eye a star which has in fact ceased to exist appears to be present, so the proverbial stick in the water appears to be bent. In both of these cases, physical theory serves to defeat and correct erroneous basic beliefs.[42]

Just because the experience is defeasible in one case does not mean that it is therefore unfounded. If Mellor wished for this to be the true conclusion of his argument, then by parity of reasoning he would have to accept that his vision is untrustworthy and he could not base any belief off of his perceptions. In fact, Mellor does not simply want to say that the belief in an event being present is unfounded because the experience of it is defeasible, but more strongly that because of this defeasibility, people do not actually observe any property of presentness at all in any event. This would be the same as saying that because people's perceptions are sometimes defeasible, they would have to say that there are no visual properties of the external world, which would seem ludicrous! Mellor's unwillingness to argue "against the deliverances of my senses"[43] shows that he is not ready to accept that his perceptions of the world are untrustworthy, and by the same token he should not be prepared to "abandon the general veracity and proper basicality of our observations of things and events' being present."[44] One may object that in the cases of the microscope and the stick in the water that the perceptions are being influenced by some external

[42] Craig, *Tensed Theory*, p. 143.
[43] Mellor, *Real Time*, p. 25.
[44] Craig, *Tensed Theory*, p. 143.

object, yet in the case of stargazing, people still infer the wrong belief that the supernova is occurring presently even though no object is inhibiting their perceptions. This objection fails, however because while no object influences their perceptions of the supernova, the distance of it from the Earth does. For the light from the supernova does not reach the Earth instantaneously due to its limited velocity, and so the distance of the supernova from the Earth prohibits people from perceiving the event exactly when it occurs. Also, their experience of the supernova could be restated as the experience of the light from the supernova reaching them without changing the meaning of the experience, which itself would be occurring at the same time as their belief. One may also state that people are incorrect in observing any event to occur presently due to the fact that none of the events that they sense happen simultaneously with the experience that they have of it. But as Craig points out, “the things and events we observe are contained within a brief temporal interval which is present, for example, the so-called "specious present," and our basic belief that "E is presently occurring" makes no reference to instants, so that such a belief remains properly basic even for scientifically educated persons like ourselves.”[45] Thus, even if their belief that the events which they experience are present can be defeasible, this does not require them to reject they do not, in fact, observe the tense of events.

Second, Mellor’s conception of how people form their belief that they are observing a supernova as present is faulty. People do not, as Mellor wishes to think, form the belief that the supernova is present from intuiting that they are presently experiencing the supernova, for they do not, in most cases, form any such belief, unless someone were to bring it to their attention. Rather, the belief that the supernova is presently occurring is properly basic, being based off of no other belief. It is just as basic as the belief “I am seeing a supernova,” for the two sentences “I am seeing

[45] Ibid.

a supernova" and "I am presently seeing a supernova" are synonymous. The person does not need recourse to any prior proposition in order to form the belief that they are seeing the supernova occur presently. This puts Mellor in a difficult position. He has already stated that he does not wish to argue against the deliverances of the senses, as that would undermine the entire foundation for the knowledge of the human race, but he has also stated that if the observation of tenses in events is properly basic, then the B-Theory will fail. As has been shown, the belief that people form regarding the tense of the events that they experience are properly basic, which by Mellor's own admission dispenses of the B-Theory immediately.

The third and final problem is that even if his argument is correct and the objections to it fail, it still leaves the presentness of the experience of seeing a supernova in the minds of the perceiver untouched. For it does not attack the belief that they are presently experiencing some event, but that the event which they are experiencing is present. This is an introspective belief which is infallible. When dealing with this issue, Mellor concludes

> So my judging my experience to be present is much like my judging it to be painless. On the one hand, the judgment is not one I have to make: I can perfectly well have experience without being conscious of its temporal aspects. But on the other hand, if I do make it, I am bound to be right, just as when I judge my experience to be painless. The presence of experience, like some at least of its other attributes, is something of which one's awareness is infallible.
>
> ...No matter who I am or whenever I judge my experience to be present, that judgement will be true. That is the inescapable, experientially given presence of experience….[46]

Though any observation of tense in external events are incorrect, according to Mellor, the observation of tense in internal experiences are not. In order to overcome the argument from the

[46] Mellor, *Real Time,* p. 53.

experience of tense, Mellor must present something more that will eliminate even the inerrant belief that people experience events in a present tense manner.

2.2.3. The presence of experience

Mellor provides just that argument. First, Mellor claims that “although we observe our experience to be present, it really isn’t.”[47] But how can that be? Mellor admits that the judgement a person has that their experience is present is infallible, so how could it be that they truly do not observe the presentness of their experience? It seems as if Mellor has conceded the point that people’s experiences are present to them, and that there is therefore some property of presentness that is ingrained in reality. In order to show that people really don’t experience events in a present tensed manner, Mellor attempts to show that the judgement that their experience is present is tautologous. The idea here is that since tautologies are trivial, then any truth that comes from the sentence “my experience of the supernova is present” is trivial. Thus, the belief that events are experienced presently is trivial, and as such the property of presentness should be excluded from people’s ontologies.

Before describing Mellor’s argument, it must be noted that it is based off of his New B-Theory of Language which attempts to establish the truth conditions for A-theoretical statements in B-theoretical statements. By doing this, the B-theorist is able to base all A determinations off of B relations and determinations, robbing A determinations of any special status in the world. From this, the B-theorist need not say that B-theoretical statements mean the same as A-theoretical statements, but simply that A-theoretical statements find their truth in B-theoretical statements,

[47] Ibid, p. 26.

and so B-theoretical statements are the foundations for all time relations. Tense determinations therefore do not prove the A-theory, as they are only true because of tenseless determinations.[48]

Mellor's New B-Theory of Language takes the belief:

1. Those experiences of which I am having now possess presentness (or the property of presentness).

and gives it truth conditions based off of the tenseless, token-reflexive sentence

2. Those experiences which a person S has at the time of the tokening of (1) possess the property of existing at the time of the tokening of (1).

Thus, according to Mellor, since the truth conditions of (1) are trivial, (1) is therefore trivial.

Craig, during his discussion of Mellor's analysis of the presentness of experiences, presents five different objections, four of which will be considered here.[49] First, Craig points out that the sentence that Mellor provides is not like the belief that is actually formed. Instead, for the case of a supernova, people would form the belief

1′. My experience of seeing the supernova is present.[50]

This sentence, unlike the first one, is not tautologous. It is not necessary to identify only present experiences as being present, but rather the proper names or definite descriptions of the experience could be used in order to identify them. This way people do not need to be tautologous in saying that the experiences which they presently have are present. They could instead say that a specific experience of theirs, say hearing a bird call, is present to them, which is itself informative, since

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[48] For a complete description of the New B-Theory of Language, see Mellor, *Real Time*, and Mellor, *Real Time II*, (London: Routledge, 1998). For critiques of his theory, see Smith, *Language and Time*, and Craig, *Tensed Theory*.

[49] See Craig, *Tensed Theory*, pp. 145-147. The fifth reason that Craig gives is that the New B-Theory of Language is inadequate in providing truth conditions for A-theoretical statements, and thus Mellor's argument has no basis from the start. Since there has not been given an adequate description of Mellor's New B-Theory in this paper, the reasons for Craig rejecting it will not be presented, as it would not do justice to Mellor or his theory.

[50] Ibid, p. 145.

there is nothing inherent of a bird call or them hearing a bird call that would require it to possess the property of presentness.

The second problem is that taken *de re* instead of *de dicto*, not even sentence (1) is a tautology. Taking a sentence as a *de re* description focuses on the properties of the things that are mentioned in the sentence. By doing this, the speaker is no longer referring to just any experience of theirs, but the experience which they are *now* having. This is significant due to the fact that people have millions of experiences, but they are singling out one experience out of all of those as the one which they are presently having. Thus, the ascription of the property of presentness to one experience out of the millions of others that they have is non-trivial.

The third problem is perhaps the most interesting. Craig states that “even if (1) is tautologous, it does not follow that the presentness of experience is trivial.”[51] What does he mean by this? How could it be that a tautologous sentence has meaning behind it? Craig points to a situation where a philosopher is trying to disprove that people have any experiences at all. He asks his reader to

> Consider by way of analogy a misguided philosopher who denies that anyone has any experiences at all. We might point out to him that we have a basic belief that we have experiences, and perhaps he will admit that this belief is incorrigible. What value, then, would his reply have that
>
> 3. My experiences are my experiences.
>
> is tautologous and therefore the belief that one has experiences is trivial? None at all, for the fact that one has experiences is not denied by (3).[52]

While the tautologous sentence is trivial, the triviality does not explain away the fact that someone has experiences. It just shows that the sentence formed is tautologous, but the content of the

[51] Ibid.
[52] Ibid.

sentence is not therefore meaningless. In the same way, the tautologous sentence "my present experiences are present"[53] does not deny the property of presentness. The properties contained within the sentence are not meaningless, just the sentence itself.

The fourth and final problem that will be described is that simply supplying trivial truth conditions for a tensed sentence does not show that the tensed sentence itself is trivial. In order for this to happen, one would need to adopt the Old B-Theory of Language, where A-theoretical sentences are synonymous with their B-theoretical counterparts, and thus the triviality of the B-theoretical statement would entail the triviality of the A-theoretical statement. This theory of temporal language has been abandoned due to scathing rebukes.[54] Mellor admits this, claiming that by supplying tenseless truth conditions for a tensed sentence does not mean that the A-Theory is wrong, but it simply allows for B-Theorists to account for tensed sentences. Also, by supplying tenseless truth conditions for tensed sentences the proper basicality of the tensed belief is not undermined in any way, which puts Mellor in a corner. For if the proper basicality of the belief is not defeated, and if the belief is incorrigible, then by his own admission the B-Theory is done for. Even if his argument from triviality were to follow through, the tenseless truth conditions still would not dispose of the tensed sentence, otherwise they would be synonymous and Mellor would recourse back to the Old B-Theory of Language. In order for Mellor to defeat the A-Theory of time, he has to appeal to McTaggart's paradox, even though he himself believes that if the experience of tense is properly basic, then there is no point in arguing against the A-Theory. Thus,

[53] Ibid, p. 146.

[54] See Richard Gale, *The Language of Time*, International Library of Philosophy and Scientific Method (London: Routledge, Kegan & Paul, 1968) for a discussion of the Old B-Theory of Language and its objections.

no reason has been given to believe that the property of presentness contained within properly basic beliefs do not represent the way reality is.[55]

2.3. The Experience of Temporal Becoming

The third and final argument from experience that will be examined is that people experience temporal becoming, the crux of the A-Theory itself. This is perhaps the most evident experience, as it is ingrained within the very way that people observe reality. Humans observe the world as being a dynamic, changing world instead of the static one predicted by the B-Theory of Time. They observe objects coming into existence and falling out of existence. Craig notes that people "do not experience a world of things and events related merely by the tenseless relations earlier than, simultaneous with, and later than, but a world of events and things which are past, present, or future."[56] Even more fundamentally, humans know what it is like to experience the flow of thoughts within their own mind; they know that some thoughts are now in the past, that they are having thoughts presently, and they anticipate future thoughts. This flow of mental events does not stop and provides constant evidence for the existence of temporal becoming. Craig puts it nicely when he says that "If the experience of temporal becoming is an illusion, if in reality there is no such thing as temporal becoming, then it is hard to imagine what is left to us about which we should not be skeptical."[57] Richard Taylor, when forming his metaphysics, states "it cannot be

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[55] One may ask if they should expect their experiences to be any different given the B-Theory of Time. They might say that until the A-theorist provides an account of what their experiences should be like on the B-Theory, then there is no powerful argument for the A-Theory from experience. This misses the point, however. As stated earlier, the A-Theory is the commonsense view. It is the one that is adopted by the regular person through their own experiences. This automatically shows that on the B-Theory of time people would not have the same experiences that they in fact do have. Thus, the B-theorist must argue that the experiences that people do have are compatible with the B-Theory of Time, which, as has been shown, they have failed to do. Asking the A-theorist to describe how time would be experienced on the B-Theory is asking them to describe an experience that they have never had.

[56] Craig, *Tensed Theory*, p. 159.

[57] Ibid, p. 160.

denied that things in time seem to pass into, through, and out of existence. That can be our datum or starting point, and if metaphysics declares this to be an illusion, then it is up to metaphysics to show that it is."[58]

Instead of making claims about how people's experience is and leaving it up to the B-theorist to explain those experiences, two different arguments based around the experience of temporal becoming will be place forth. The first comes from Delmas Kiernan-Lewis in his analysis of A.N. Prior's paper "Thank Goodness That's Over." He opens by stating the ontological status of temporal becoming on the B-Theory of Time:

> If reality is tenseless, then reality cannot *begin to have* or *cease to have* any feature that it does not tenselessly possess. Hence, on this view, the only available sense of 'exist', and the only sense needed to provide a complete description of reality, is the *tenseless* sense. Something cannot begin to exist or cease to exist *tenselessly*; it either does or does not exist tenselessly, and that is all there is to say about its existence.[59]

Lewis rightly points out that on the B-Theory true temporal becoming is an illusion. Any discussion of things coming into or out of existence is just figurative, in the same way that A-theorists speak of time flowing. Lewis forms his argument for tense based around "an item of knowledge. It is the sort of knowledge we have when we are pleased that something has ceased."[60] His argument, he acknowledges, runs along similar lines as the argument against physicalism propounded by Thomas Nagel and Frank Jackson.[61] This argument states that physicalism includes

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[58] Richard Taylor, *Metaphysics*, 2d ed., Foundations of Philosophy (Englewood Cliffs, N. J.: Prentice-Hall, 1974), p. 82.
[59] Delmas Kiernan-Lewis, "Not Over Yet: Prior's 'Thank Goodness' Argument," *the Journal of Philosophy 66* (1991), p. 241.
[60] Ibid, p. 242.
[61] See Frank Jackson, "What Mary Didn't Know," *The Journal of Philosophy 5* (1986), 291-295.

only propositional knowledge of brain states for experiences such as feeling pain, but excludes the *de se* knowledge of how it feels like to be in pain.[62] Lewis' argument goes as follows:

> Advocates of tenselessness hold that the world is entirely tenseless. So complete tenseless knowledge is complete knowledge *simpliciter*. However, I know what it is like to cease to be aware of a headache (or: to be aware that a headache of mine has ceased). I could not know this if the tenseless account of reality were true. Hence, the tenseless account is false.[63]

Lewis's point is that people know the feeling of what it is like to have some unpleasant, or pleasant, event cease to exist. This is *de se* knowledge of temporal becoming, knowledge that is not accounted for on the B-Theory of Time. This undercuts Oaklander's response to Lewis that people can on the tenseless theory know what it feels like for a headache to cease. Oaklander states that

> On the tenseless theory, there are the tenseless facts: (a) I am conscious of having a headache at t_1, (b) I am conscious of taking an aspirin (and having a headache) at t_2, and (c) I am conscious of feeling fine (and not having a headache) at t_3. The succession of these different states of consciousness is the ontological ground of knowing that a headache of mine has ceased to exist.[64]

Oaklander is dealing with the propositional knowledge that at a certain time a person is no longer experiencing a headache, not with the experiential knowledge of what it feels like to have a headache cease. Thus, his contention that Lewis' argument "is either false or question-begging since it assumes that the tensed account of existence is true"[65] is resolved. What Oaklander means by the "tensed account of existence" is that on the A-Theory, when something is said to cease to exist, it truly stops existing, as opposed to on the B-Theory where when something is said to cease

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[62] For an account of knowledge *de se*, see David Lewis, "Attitudes De Dicto and De Se," *The Philosophical Review 88* (1979), pp. 513-543.
[63] Lewis, "Not Over Yet," p. 242.
[64] L. Nathan Oaklander, "Thank Goodness It's Over," *The Journal of Philosophy 67* (1992), pp. 256-257.
[65] Ibid, p. 247.

to exist it is just not existing at a specified time. However, while this might be a nice way to separate humans' knowledge *de dicto*, it is still the case that their knowledge *de se* points towards the fact that the headache truly did stop to exist.

Lewis points out as much in his response to Oaklander:

> Suppose we tried to say that the experience of my headache ceasing to exist is 'nothing but' my headache (or temporal parts thereof) tenselessly existing at times before other times at which it does not tenselessly exist. Well, if we tried such a reduction, the essential features of the ceasing-to-exist of my headache, simply because the subjective features are different from the tenseless features. Someone—say, a timeless God—who knew all but only the tenseless facts, and so knew my headache 'ceases' in the sense of there being times after which it tenselessly occurs, would still not know what it is like for a headache to cease. Since no analysis of my experience of the ceasing-to-exist of a headache in tenseless terms is possible, no tenseless reduction of my experience can succeed. Therefore, a tenseless description of reality is necessarily incomplete: reality contains irreducibly tensed features.[66]

The experience of a headache ceasing is irreducibly tensed, for if it is described in any other way, the true meaning of what it feels like to stop feeling a headache would be lost. Craig summarizes the challenge nicely: "Lewis's challenge to the B-theorist is thus two-fold: (1) The B-theorist must explain how I can be deceived by the awareness that things cease to exist in cases where it is my inner experiences themselves of which I am aware that they cease to exist; and (2) The B-theorist must explain how an awareness of becoming can exist if reality is tenseless."[67] Hence, there are irreducible aspects of humans' temporal experience that would lead them to believe in temporal becoming.

The second argument for temporal becoming comes from the experience of waiting. This is a universal feature of mankind. Everyone has waited for some event to occur with eager

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[66] Lewis, "The Rediscovery of Tense: A Reply to Oaklander," *The Journal of Philosophy 69* (1994), p. 232.
[67] Craig, *Tensed Theory*, p. 160.

anticipation or with horrifying dread, whether it be a pleasant or an unpleasant event. As they wait, they experience time flowing past them, metaphorically speaking. In more literal terms, they experience the event coming into being through the lapse of time that they wait through for the event to occur. This feeling of time passing is grounded in temporal becoming. People feel events coming into and falling out of existence as they wait, and they feel the anticipated event getting closer and closer to coming into existence. They do not simply occupy a temporal interval, but feel the passage of time as they are anticipating the event. This feeling of time passing certainly would not appear on the B-Theory, for it requires the concept of temporal becoming, which is denied on the B-Theory. Richard Gale addresses this when discussing analogies between space and time, saying "If I wait for *n*-time units my use of 'now' denotes a different time, regardless of whether I move or not. But the spatial analog to this is nonsense, since there is no sense to 'waiting for or through space.'"[68] But since tenseless time would operate like how space does in this analogy, that is, that it is static and isotropic, not having any direction preferred over any other, people could not, therefore, be said to wait on the B-Theory.[69]

George Schlesinger states that this analysis of what it means to wait is wrongheaded, but rather that waiting only requires one to occupy a temporal interval.[70] If this is true, then one can be said to wait on tenseless time, as it does not require temporal becoming. However, if his analysis is true then it also means that a pen sitting on a desk is technically waiting for someone to use it, since it is occupying a temporal interval. His response to this objection that all this shows is that one needs consciousness while existing through a temporal interval also fails, for people can be

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[68] Gale, "'Here' and 'Now'," *Monist 53* (1969), p. 409.
[69] For a discussion on the direction of time on the B-Theory, see Craig, *Tensed Theory*, ch. 7, Craig, *Tenseless Theory*, ch. 7, and Lawrence Sklar, *Space, Time, and Spacetime*, (Berkeley: University of California Press, 1976), ch. 5.
[70] George Schlesinger, "The Similarities between Space and Time," *Mind 84* (1975), p. 164.

conscious of time flowing by yet not be waiting for anything. One could be sitting on their porch, enjoying the nice fall weather while being conscious that time is passing by while still not waiting for anything. Instead, in order to wait for something, there must exist some aspect of temporal becoming from which the concept of waiting is based off of. If there was no such thing as temporal becoming, then people would just occupy a temporal interval, yet this is not at all what they experience while they are waiting. Thus, the experience of waiting itself discloses that temporal becoming is a real and existent part of the world.

2.4. Conclusion

It has been shown from these four arguments that the experiences that people have are not only based off of an irreducibly tensed ontology, but that they are indeed properly basic to them, and, even more powerfully, that some of these experiences are incorrigible. The present is not only grounded in external events but also in their own internal perception of those events. The perception of these events are fundamental to humans' noetic structure, and are so ingrained within them that if the B-theorist is correct in stipulating that these experiences are false, then there shall be nothing that humans are not skeptical of. The entire foundation of mankind's beliefs would come crashing down. Since these experiences are universal and properly basic to all mankind, it is plausible to suppose that their experience of the present and temporal becoming offer so much warrant for the A-Theory that it simply overcomes any objection lodged against it, in the same way that the belief in the universe emanating from God for all eternity would overcome any objection about the impossibility of an actual infinite. But before the search for the correct theory of time is concluded, it is necessary to look at the B-Theory's principal argument to see if there exists equal or more warrant for the B-Theory of Time.

Chapter 3: The Special Theory of Relativity

3.1. Introduction to the Argument:

The Special Theory of Relativity is one of the most commonly accepted physical theories, and is one of the cornerstones of contemporary physics. It has important implications for time and space, such as the relativity of simultaneity and length, and as such, should play an important role in any philosophical theory about space and time. The principal argument for the B-theory of time is predicated upon the received view of the Special Theory of Relativity, Minkowski's Spacetime theory, which is claimed to require one to accept the belief that the actual world exists in a four-dimensional Spacetime block in which all times exist. In order to understand this argument, an understanding of what led Einstein to create his theory, as wells as the basic postulates of the theory is required.

3.2. What is the background for the Special Theory of Relativity?

3.2.1. Newtonian Mechanics and Galilean Relativity

In order to fully comprehend how dramatic of a shift Special Relativity caused in Physics, one must have a basic knowledge of the physical theories and experiments that occurred before Einstein's time. The concept of relativity had been playing a part in classical physics since Newtonian mechanics, relativity in this since meaning that an observer who is located in a reference frame moving with a uniform velocity (otherwise known as an inertial frame) will be incapable of determining through physical experiments whether or not he is in motion. This principle would later be used by Einstein as one of his foundational postulates for his theory of relativity. A good example of the relativity of inertial frames is given by Galileo Galilei's famous ship illustration:

> For a final indication of the nullity of the experiments brought forth, this seems to me the place to show you a way to test them all very easily. Shut yourself up with some friend in the main cabin below decks on some large ship, and have with you there some flies, butterflies, and other small flying animals. Have a large bowl of water with some fish in it; hang up a bottle that empties drop by drop into a wide vessel beneath it. With the ship standing still, observe carefully how the little animals fly with equal speed to all
> sides of the cabin. The fish swim indifferently in all directions; the drops fall into the vessel beneath; and, in throwing something to your friend, you need throw it no more strongly in one direction than another, the distances being equal; jumping with your feet together, you pass equal spaces in every direction. When you have observed all these things carefully (though there is no doubt that when the ship is standing still everything must happen in this way), have the ship proceed with any speed you like, so long as the motion is uniform and not fluctuating this way and that. You will discover not the least change in all the effects named, nor could you tell from any of them whether the ship was moving or standing still. In jumping, you will pass on the floor the same spaces as before, nor will you make larger jumps toward the stem than toward the prow, even though the ship is moving quite rapidly, despite the fact that during the time that you are in the air the floor under you will be going in a direction opposite to your jump. In throwing something to your companion, you will need no more force to get it to him whether he is in the direction of the bow or the stem, with yourself situated opposite. The droplets will fall as before into the vessel beneath without dropping toward the stem, although while the drops are in the air the ship runs many spans. The fish in their water will swim toward the front of their bowl with no more effort than toward the back, and will go with equal ease to bait placed anywhere around the edges of the bowl. Finally the butterflies and flies will continue their flights indifferently toward every side, nor will it ever happen that they are concentrated toward the stem, as if tired out from keeping up with the course of the ship, from which they will have been separated during long intervals by keeping themselves in the air. And if smoke is made by burning some incense, it will be seen going up in the form of a little cloud, remaining still and moving no more toward one side than the other. The cause of all

> these correspondences of effects is the fact that the ship's motion is common to all the things contained in it, and to the air also.[71]

This relativity principle would not hold if the ship were to suddenly speed up or slow down, as the experiment only involves uniform or translatory motion. The other type of motion, acceleration and deceleration, had not been relativized in classical Newtonian mechanics, but rather was used as proof for the existence of absolute space, a concept that would be attacked by Einstein's Special Theory of Relativity. Newton's employment of acceleration, more specifically, rotational acceleration, to prove the existence of absolute space is epitomized in his famous rotating bucket experiment. The experiment has one fill up a bucket with water, tie a rope to the bucket and attach it to the ceiling and then twist the rope. Next, release the rope, and as the rope starts to unwind, the experiment undergoes several different stages according to Newton:

> [T]he surface of the water will at first be plain [i.e., flat], as before the vessel began to move; but after that the vessel, by gradually communicating its motion to the water, will make it begin sensibly to revolve, and recede by little and little from the middle, and ascend to the sides of the vessel, forming itself into a concave figure (as I have experienced), and the swifter the motion becomes, the higher will the water rise, till at last, performing its revolutions in the same times with vessel, it becomes relatively at rest in it. This ascent of the water shows its endeavor to recede from the axis of its motion; and the true and absolute circular motion of the water, which is here directly contrary to the relative, becomes known and may be measured by this endeavor. . . . [T]his endeavor does not depend on any translation of the water in respect of the ambient bodies, nor can true circular motion be defined by such translation. There is only one real, circular motion of any one revolving body, corresponding to only one power of endeavoring to recede from its axis of motion, as its proper and adequate effect; but relative motions, in one and the same body, are innumerable, according to the various relations it bears to external bodies, and, like other relations, are altogether destitute of any real effect, any otherwise than they may perhaps partake of that one only true motion.[72]

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[71] Galileo Galilei, Dialogue Concerning the Two Chief World Systems-Ptolemaic and Copernican [1632], trans. Stillman Drake (Berkeley: University of California Press, 1962), pp. 186-188.

[72] Isaac Newton, The Principia, trans. I. Bernard Cohen and Anne Whitman, with a Guide by I.

The water enters into stages of rest, then motion, and then once again rest. Maudlin explains that "At the beginning of the experiment, before the bucket is let go, the water is at rest relative to the bucket, and the surface of the water is flat" and that once the bucket starts spinning "the water and bucket spin together, the water is again at rest with respect to the bucket."[73] The water is at rest relative to the bucket at both stages, but in the final stage, the water forms a concave shape, whereas in the first step, it was flat. This discrepancy cannot be contributed to relative motion, as the water is at relative rest to the bucket in both of these stages, and so should not experience any change, but is rather contributed to the water's motion through absolute space. The relativization of accelerated motion had not been attempted until Einstein's General Theory of Relativity, and so will not be discussed in this paper, but Newton's bucket experiment sets up the belief in absolute motion and space, which is an important factor in Einstein's Special Theory of Relativity.

3.2.2. The Michelson-Morley Experiment

Over the next two centuries, Newtonian mechanics and Galilean relativity were the predominant view amongst physicists up until James Clerk Maxwell's development of electrodynamics. In the 19th century, most physicists held to the belief that light propagated as a wave through a luminiferous aether that pervades all of space and matter.[74] Maxwell was able to develop electrodynamic equations utilizing the concept of electromagnetic fields propagating

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Bernard Cohen (Berkeley: University of California Press, 1999), p. 11.

[73] Maudlin, *Philosophy of Physics*, p. 22.

[74] For a brief explanation of why this was so, see Craig, *Time and the Metaphysics of Relativity*, (Dordrecht: Kluwer Academic Publishers 2001), pp. 5-6. Craig points to the phenomenon of the aberration of starlight as the major reason for why physicists accepted the wave-theory of light as opposed to the corpuscular theory of light propagation. Also, almost all physicists believed light to have the same constant velocity *c* no matter how fast the source that emitted them was going, due to the observation of double-star systems. More recent experiments have proven this to remain true even for particles moving at 99.97% of the speed of light (see J.G. Taylor, Special Relativity, Oxford Physics Series [Oxford: Clarendon Press, 1975], pp.2-5).

through this aether with a constant velocity *c*. This inspired physicist A.A. Michelson, later accompanied by E.W. Morley, to create the famous Michelson-Morley experiment designed to detect the Earth's motion through the aether. This experiment (which will not be explained here due to time restraints)[75] would find any discrepancy between the speed of light signals sent in different directions, which would disclose the Earth's motion through the aether. However, the experiment concluded that there were no discrepancies between the speed of the light signals, which meant that the Earth was at rest relative to the luminiferous aether.

This conclusion seemed absurd as it was known at the time that the Earth moved in orbit around the sun, as well as rotated around its own axis. In order to explain this, physicist came up with the phenomenon called "aether drag" where parts of the aether were carried along with matter that moved through it. Another physicist, by the name of H.A. Lorentz came up with a different hypothesis to explain the counter-intuitive results of the Michelson-Morley experiment "that something having velocity *c* in one reference frame has *c* with respect to a second inertial frame in motion relative to the first."[76] Lorentz proposed that when objects are at motion relative to the aether, they shrink, or contract, by a factor of $\sqrt{1-(v^2/c^2)}$ due to motion through the electromagnetic fields which change the molecular structure of objects, since molecules are fundamentally bound through electrical forces.[77] This same phenomenon was independently proposed by George Fitzgerald, and has become known as the Lorentz-Fitzgerald Contraction.[78] Discontent grew amongst physicists due to the supposed *ad hoc* nature of both of these

[75] For a basic introduction to the experiment, see above, pp. 7-10.
[76] Michael Friedman, *Foundations of Spacetime Theories* (Princeton: Princeton University Press, 1983), p. 15.
[77] H. A. Lorentz, *Versuch einer Theorie der elektrischen und optischen Erscheinungen in bewegten Körpern* (Leiden: E. J. Brill, 1895); reprinted in *The Principle of Relativity*, with Notes by A. Sommerfeld, trans. W. Perrett & G. B. Jeffery (1923; rep. ed.: New York: Dover Publications, 1952), pp. 5-6.
[78] "The Ether and the Earth's Atmosphere," *Science 13* (1889), p. 390.

explanations, and it is within this atmosphere of restlessness that Einstein first published his paper on the Special Theory of Relativity.

3.3. Why did Einstein create the Special Theory of Relativity?

3.3.1. Electromagnetism

There are two main reasons that are attributed as to why Einstein created his Special Theory of Relativity. The first he stated in his 1905 paper "The Electrodynamics of Moving Bodies." The reason given here is that Einstein was upset with classical physics' theoretical description of electromagnetic phenomenon. For example, take the case of a magnet and an electric conductor which are in motion with each other. Whether the magnet is taken to be at rest and the conductor in motion, or the conductor to be at rest and the magnet in motion, an electric current is produced within the conductor. However, the theoretical descriptions for each case are different in the context of classical physics. When the magnet is taken to be at rest and the conductor in motion, the electric current arises from a force exerted upon the conductor from the magnet. When the conductor is taken to be at rest and the magnet in motion, on the other hand, the electric current is said to be created from an electric field surrounding the magnet. This discrepancy between theoretical explanations for the same phenomenon concerned Einstein, later stating that "the thought that one is dealing here with two fundamentally different cases was for me unbearable."[79] This difference led him to believe that the only true, objective difference between the two cases was the difference in the choice of reference frame. Thus

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[79] Albert Einstein, Fundamental Ideas and Methods of Relativity Theory. Presented in their Development. unpublished manuscript cited by Gerald Holton, "On Trying to Understand Scientific

> “the existence of an electric field was therefore a relative one, depending on the state of motion of the coordinate system being used, and a kind of objective reality could be granted only to the electric and magnetic field together, quite apart from the state of relative motion of the observer or the coordinate system. The phenomenon of the electromagnetic induction forced me to postulate the (special) relativity principle.”[80]

3.3.2 Speed of Light and the Michelson-Morley Experiment

The second reason that Einstein had for creating his Special Theory of Relativity was due to the constancy of the speed of light. Einstein found it troubling that light is measured to move at the same constant rate in all reference frames, no matter how fast the source that emitted the light signal was moving. In order to solve how this could be possible, Einstein proposed one of the most groundbreaking shifts in all of physics: the elimination of absolute space. This is a central part of his Special Theory of Relativity, and will be discussed more in depth later.

It is difficult to determine how great of a role the Michelson-Morley experiment played in influencing Einstein to create his theory, as there is a mixed view in the literature surrounding it, and Einstein himself has given mixed answers. However, recent discoveries have found letters written by him to his fiancée Mileva Maric within 6 years of his publication of “The Electrodynamics of Moving Bodies” where he discusses a paper written by Wilhelm Wien of Aachen[81] which covers the Michelson-Morley experiment and explanations of it, as well as his own wishes to carry out experiments to disclose the Earth’s motion relative to the aether.[82] The

Genius," in Thematic Origins of Scientific Thought: Kepler to Einstein (Cambridge, Mass.: Harvard University Press, 1973), p. 363.

[80] Ibid, pp 363-364.

[81] Wilhelm Wien, "Ueber die Fragen, welche die translatorische Bewegung des Lichtäthers betreffen." Annalen der Physik und Chemie 65, no. 3, Beilage (1898): i-xvii.

[82] The letter where Einstein discusses Wilhelm Wien’s paper is, Albert Einstein, "Letter 57. To Mileva Maric," in John Stachel, ed. *The Collected Papers of Albert Einstein, Vol. 1: The Early Years, 1879-1902* (princeton, N. J.: Princeton University Press, 1987), p. 233, and the one where he discusses his desire to conduct his own experiment to determine matter’s motion relative to the aether is, Ibid, “Letter 128. To Mileva Maric," p. 325.

Michelson-Morley experiment, however, was only a secondary reason for Einstein to create his Special Theory of Relativity, as he refused to accept Lorentz's and Fitzgerald's hypothesis of length contraction in order to save the idea of absolute space. He claimed that it was an "*ad hoc* assumption" that was "only an artificial means aimed at saving the theory."[83] Einstein desired to, and succeeded in creating a revolutionary theory of physics that would solve not only the asymmetries in theoretical descriptions of equivalent phenomenon in classical physics and the problem of the constancy of the speed of light, but also would move physics away from a constructive approach to physics, doing away with artificial hypotheses whose only support was that it preserved the classical notion of physics.

From these two reasons, Einstein created the Special Theory of Relativity, which aimed at showing that space and time was observer relative. He based his theory off of two postulates: 1.) the Principle of Relativity, which states that not only are the laws of mechanics valid, but also are the laws of optics and electrodynamics, in a reference frame moving with uniform velocity (known as an inertial frame), and 2.) The Principle of the Constancy of the Velocity of Light, which states that light propagates with the same speed relative to every reference frame, and the speed of light is not affected by the speed of its emitting source.[84] The combination of these postulates creates the postulate that there are no privileged observers, or that no observer in an inertial system is capable of determining whether or not they are in motion. The two postulates, however, are seen to be contradictory at the outskirts of Einstein's theory. However, in order to understand this contradiction and how Einstein avoided it, Einstein's definition of simultaneity must be examined.

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[83] A. Einstein, "Über das Relativitätsprinzip und die ausdemselben gezogenen Folgerungen," *Jahrbuch der Radioacktivitiit und Elektronik 4* (1907), p.413.

[84] Albert Einstein, "On the Electrodynamics of Moving Bodies," trans. By Arthur I. Miller, p. 392.

3.4. What is Einstein's definition of simultaneity and how does he determine it?

Einstein attempts to define simultaneity in physical or epistemological terms. Arthur Miller states that it is "nothing less than an epistemological analysis of the nature of space and time."[85] First, Einstein defines 'time' and the uses of time as statements of what is simultaneous. When someone asks "what time is the game?" and their friend says "the game starts at 5," what is really meant is that the games starting and the reading of their clock at 5 are simultaneous.[86] The time of the event is simply the simultaneous reading of a clock at the same spatial location at the event. He states, "the 'time' of an event is the reading simultaneous with the event of a clock at rest and located at the position of the event, this clock being synchronous, and indeed synchronous for all time determinations, with a specified clock at rest."[87] This form of local simultaneity is "an undefined given,"[88] with Einstein complaining about "the inexactitude which lurks in the concept of simultaneity of two events at [approximately] the same place."[89]

While this works for events that are close to us, it does not work for events that occur over a large spatial distance (in more technical terms, this would be called space-like separation on Minkowski's Spacetime, that is, two events that cannot be connected by a light signal[90]). In order to reconcile this definition with events spatially separated, Einstein tries to come up with a method of creating a common time between the two events. The method is called the light signal synchronization method. First, one sets up a hypothetical situation where there are two spatially

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[85] Arthur I. Miller, *Albert Einstein's Special Theory of Relativity,* (Reading, Mass.: Addison-Wesley, 1981), p. 123.
[86] Einstein, "Electrodynamics of Moving Bodies," p. 392. This is exactly what Newton would say is relative or common time, but Einstein tries to say that this 'common time' is all there is to time.
[87] Ibid, p. 394.
[88] Craig, *Metaphysics of Relativity*, p. 29.
[89] Einstein, "Electrodynamics of Moving Bodies," p. 393.
[90] Craig Callender, "Finding 'real' time in Quantum Mechanics," in *Einstein, Relativity, and Absolute Simultaneity*, p. 54.

separated points, point A and point B, which each have clocks at rest in their system. These two points, for simplicity's sake, are taken to be at relative rest to each other. It is assumed that it takes light the same "time" to travel from point A to point B as it does for it to travel back from point B to point A. Now, let there be an observer at point A send off a light signal at A-time $t_A$to point B. Upon reaching point B at B-time $t_B$it is reflected back to point A and received at A-time $t_A{}'$(figure 2)[91].

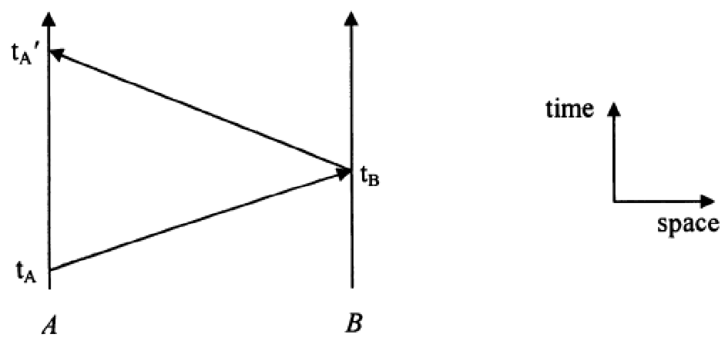


Fig. 1. A light signal is sent out from point A at time $t_A$to point B and reaches there at time t_B. Upon arriving, the signal is reflected back to point A and arrives there at time $t_A{}'$. The times are measured by clocks that are at rest in the systems of point A and point B.

In order for these clocks to be considered synchronized, the time that it took for light to travel from point A to point B must equal the time that it took light to travel from point B back to point A. The equation for this is $t_B - t_A = t_A{}' - t_B$. Another way of putting this equation is $t_B = t_A - \frac{1}{2}(t_A{}' - t_A)$. The ½ in this equation comes from the fact that the travel time between point A and point B is half of the light signal's total travel time. That is, it takes half of the total travel time of light to complete half of the journey. This becomes important during the discussion of whether Einstein's definition of simultaneity is a satisfactory one or not.

[91] Craig, *Metaphysics of Relativity*, p. 28.

Both of these equations will determine whether or not the clock at point B is synchronized with the clock at point A, for if it truly took the same time to go from point A to point B and back to point A, then the two clocks recording of time will be in sync with one another. Thus, Einstein's definition of time is vastly different from that of Newton's: where Newton believed that time was absolute and metaphysical, being an entity which is separated from humans' corrigible measurements, Einstein believes that it is completely the clock measurements. If two events are not recorded to be simultaneous by the clocks in their reference frames, then they are not simultaneous. Einstein also seemed to believe that time was in some sense physical, stating that "it is not said that the time is absolute, that is, has a meaning that is independent of the state of motion of the reference frame."[92] Time being affected by motion means that in some way, time is considered physical. From this, Einstein is able to form the doctrine of length contraction and time dilation.

3.5. Absolute Space and Relativity

Now that Einstein's operational definition of simultaneity have been examined, it is possible to unravel how he is able to combine both postulates of his theory of relativity. It stands to reason that an inertial frame that is moving towards a light signal will record the light signal to be moving faster than the given constant *c*. This would thus cause the laws of optics and electrodynamics to act differently in this reference frame than it would in a frame that is considered to be at rest with respect to the emitting source of the light signal. A perfect illustration of this

[92] Albert Einstein, "Die Relativäts-Theorie" *VierteljahrsschriJt der naturforschenden Gesellschaft in Zurich 56* (1911), p. 9.

problem is given by L. Epstein.[93] First, he wants the reader to imagine two rocket ships, ship A and ship B, moving in tandem with one another, and so at relative rest to one another. Now, ship A sends a light signal to ship B, who, upon receiving the signal, sends it back to ship A (fig.1).

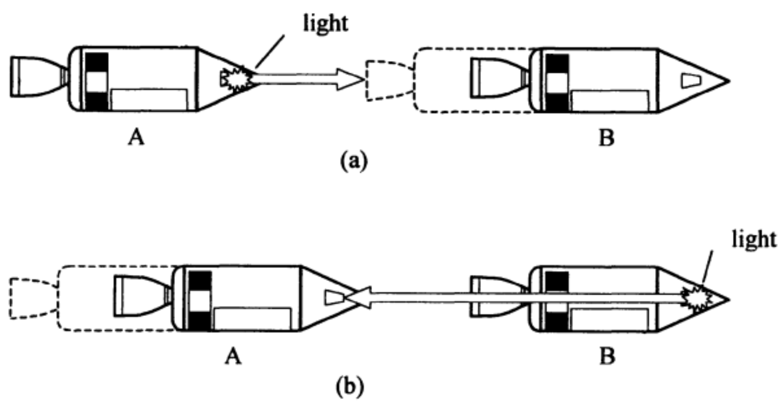


Fig. 2. Two rocket ships are moving at speeds close to the speed of light. When the light signal is sent from ship A, ship B would have moved its position further away from the emitting point. But when ship B sends the light signal back to ship A, ship A would have moved closer towards the emitting point, and thus would not measure the velocity of light to be *c*.

The problem is this: if light does not take on the velocity of its emitting source, which it has been proven not to by the phenomenon of double star systems,[94] how can light be measured to be travelling at the same speed in all reference frames, even if the reference frames are at relative rest to one another but are travelling in tandem, as in figure 1? How is it possible that light is measured to have the same constant speed *c* with respect to rocket ship B's reference frame which is moving away from the light signal, while also being measured to have the same constant speed *c* with respect to rocket ship A's reference frame which is moving towards the light signal? In classical kinematics, any object that is moving towards an object that is being measured, such as a car moving towards a speeding bullet, will record the bullet to have a greater velocity than someone

[93] Epstein, *Relativity Visualized*, p. 57.
[94] Albert Einstein, *Relativity: The Special and General theory*, (New York: Pi Press, 2005), trans. Robert W. Lawson, p. 25.

who is either on the ground measuring the bullet or is in a car moving away from the bullet. The bullet will take a shorter time to reach the person in the car moving towards it than it would take the bullet to reach a person standing still on the ground or a person in a car moving away from it. But light is not measured to do this. Light is measured to be a constant *c* in all reference frames, no matter if one is moving towards the light beam or away from it.

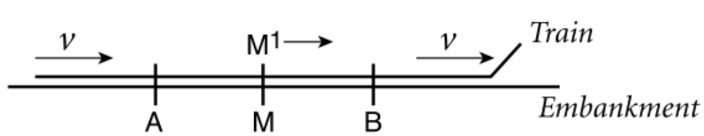
In order to avoid this problem, Einstein revolutionizes the entire concept of space. Einstein deals with this problem in his removal of an absolute reference frame. Without an absolute reference frame, there is no absolute motion, only relative motion. A frame cannot be said to be at rest or in motion, but only at rest or in motion relative to some other frame. Thus the problem of the rocket ships moving in tandem is able to fall away. As Craig says "to speak of A and B's being at relative rest but moving in tandem presupposes an absolute space or aether rest frame relative to which they are moving together."[95] With the existence of an aether frame, one could stipulate that light did in fact travel a longer distance from A to B than from B to A, but without one, the distances are the same, since relative to each other they are at rest. Therefore, light can consistently be measured between the two reference frames of rocket ship A and B to *c* because the only motion the two frames are said to have is with respect to some third, outside frame. But the two frames, from their point of view, could see the third frame as moving, and them as being at rest. The two frames of reference are completely stationary unless one brings in another reference frame which is in motion to them. There is not absolute space through which they move, and thus it is meaningless to say that the two reference frames move in tandem with one another. Thus light does not in fact travel a longer distance in one leg of the journey than in the other.

[95] Craig, *Time and the Metaphysics of Relativity*, p. 38

This seems a strange concept, due to its requirement that objects do not move through some background space, but that the only space that exists are reference frames: independent of any reference frames, space does not exist. The absurdity of such a proposition is mused at by Milic Capek when he says "... we are all unconsciously Newtonians even when we profess to be relativists, and the classical idea of world-wide instants, containing simultaneous spatially separated events, still haunts the subconscious even of relativistic physicists."[96]

3.6. The Relativity of length and simultaneity

With the removal of absolute space and his light signal method of clock synchronization, Einstein proposes an interesting outcome of his theory. Starting his second section of his 1905 paper off with a restatement of the Special Theory of Relativity's two postulates, Einstein then develops the "Relativity of Lengths and Times."[97] Einstein gives a clear example of the relativity of simultaneity and length in action in his book *Relativity — The Special and General Theory*.[98] He asks his reader to envision an observer on a train moving past a stationary observer on the railway embankment (fig. #).



[96] Milic Capek, *The Philosophical Impact of Contemporary Physics* (Princeton: D. Van Nostrand, 1961), pp. 190-191.
[97] Einstein, "Electrodynamics of Moving Bodies," p. 395
[98] Albert Einstein, *Relativity - The Special and General Theory*, translated Robert W. Lawson, [2005], pp. 34-37.

Fig. 3. A train is moving with velocity *v* along an embankment. Two lightning bolts, A and B, strike it at either end. M^1 is the midpoint of the train, and M is the midpoint between the two lightning bolts, according to the observer on the embankment.

Both observers use the light signal method of clock synchronization to synchronize all events which occur in their respective reference frames. Now, he imagines that two lightning bolts, A and B, strike both ends of the train simultaneously, relative to the observer on the embankment. In order to do this, the observer must calculate both lightning bolts to reach the midpoint M at exactly the same time. The observer on the train is sitting at M^1, the midpoint of the train, and he also wants to calculate whether or not the lightning strikes are simultaneous. When the lightning bolts strike, both M and M^1 coincide, so that if the observer on the train was not moving with the train with a velocity *v* towards the right of the diagram, then he would remain at M. Now the observer on the train will calculate if the lightning bolts strike simultaneously in the same way that the observer on the embankment did: by remaining at the midpoint and measuring if the light from the lightning bolts arrive simultaneously. However, since the train is moving towards lightning strike B, the observer on the train will measure B to occur before A. This discrepancy cannot be corrected by pointing to some privileged frame and stating that the lightning bolts occurred simultaneously in that frame, as some would be apt to do, since Einstein has removed the concept of absolute space, but rather must be explained by stating that the simultaneity of events is observer relative.

With the relativity of simultaneity established, Einstein proceeds to explain how lengths and distances are likewise relative.[99] To do this, he asks his reader to imagine that the observer on the embankment and the observer on the train both wish to determine the length of the train. For the observer on the ground to do this while the train is moving, he gets two of his friends. The

[99] Einstein, *Relativity*, pp. 38-39.

friends stand some distance apart and synchronize stopwatches per the light signal method. The train comes by at a set time, say 4:00, and when the observers find themselves at the front and rear of the train, they punch their stopwatches. They then stand in their spots and another observer measures the difference between the two. This establishes the length of the train relative to the embankment. In order for the observer on the train to measure the length of the train, he sets up two reflectors at the rear and the front of the train and sits at the midpoint M^1. From M^1 the observer sends out a light signal towards the front and towards the back of the train, and upon their simultaneous arrival back at the midpoint, he finds the time elapsed and then calculates the length of the train. To calculate it, he computes $(t_A'-t_A)=\frac{2L}{c}$, where L is the length of the train. According to Craig "The signal toward the front end of the train traveled a longer distance toward the front reflector than it did back to the emitter, and the signal toward the back traveled a longer distance from the reflector back to the emitter than it did from the emitter to the reflector"[100] due to the fact that when the light signal going towards the front of the train goes there, the train is moving away from it, and when the light signal going towards the back of the train is coming back, the observer moves away from it. These discrepancies are equal to each other, so that the light signal's "out-and-return distances are equal so that the signals return simultaneously,"[101] but they are not offset by the fact that when the light signal going towards the front of the train is coming back, the observer moves towards it, and when the light signal going towards the rear of the train is going there, the rear reflector moves towards it. This causes the length of the train, as measured by the passenger, to be longer than the length of the train as measured by the observers on the embankment. What is interesting is that Einstein has computed the difference between the two

[100] Craig, *Time and the Metaphysics*, pp. 45-46.
[101] Ibid, p. 46

lengths to be by a factor of $\sqrt{1 - v^2/c^2}$, which is the exact same factor that Lorentz said rods in motion would deform by.[102]

[102] Einstein, *Relativity*, pp. 40-46.

Chapter 4: The Minkowski Interpretation of Relativity

4.1. The Einsteinian interpretation of Special Relativity

There are two main interpretations of the Special Theory of Relativity: the Einsteinian interpretation and the Minkowskian interpretation. Einstein's original interpretation kept the long held ontology of there being 3 dimensions of space and 1 dimension of time, with space and time existing only relative to reference frames. Craig states that "SR, as Einstein originally formulated it, postulates a 3+1 ontology,"[103] where, due to the relativity of length and simultaneity, reality is broken into observer dependent realms of space and time. According to Arzelies, the competing Minkowski four-dimensional view "should therefore be regarded as a useful tool, and not as a physical 'reality'"[104] which helps people to understand relativity and its effects. Thus, reality is not Minkowskian four-dimensional, but instead has space and time divided into sections. There is no objective reality, reality is dependent upon the reference frame one is in. Clocks run at different speeds and rods have different lengths depending upon the reference frame one is in. Minkowski Spacetime is viewed only as a geometrical model that is useful in mathematical calculations and representations, but has no ontological status.

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[103] William Lane Craig, "Metaphysics of Relativity" in, *Einstein, Relativity, and Absolute Simultaneity* [New York: Routledge, 2008] edited by William Lane Craig and Quentin Smith, pp.12.
[104] Arzelies, Henri (1996) *Relativistic Kinematics*, rev. Ed., Oxford: Pergamon Press, pp. 258.

4.2. Time and Minkowskian Relativity

But what is Minkowski Spacetime? Minkowski Spacetime was first developed by Hermann Minkowski in his 1908 lectures "Space and Time" in which he attempts to give a new revolutionary ontology of space and time under Special Relativity. While space and time had been combined into Spacetime diagrams before (such as Aristotelian and Galilean Spacetime), it had only been regarded as a mathematical tool that helped represent events in space and time separately. However, Minkowski proffered a new way to look at Spacetime: instead of it being a purely mathematical entity, it should be regarded as a real continuum which represents truly how space and time exist. Three dimensions of the continuum would be space, while the fourth would be time, and the two combined would be able to explain the relativistic effects produced by Special Relativity.[105] This is caused by the movement of an object's world-line through the space-time structure. An easy example is the Twin's Paradox. One twin stays in his spaceship with his engines turned off, while the other twin turns his engines on and starts moving relative to the first twin. After a while, the second twin turns his engines back on briefly, but in the opposite direction, so that he moves back towards the first twins. When the two coincide, the second twin turns his engines on again to negate all motion relative to the first twin, bringing the two at absolute rest again. The world-line for the first twin is a straight line moving along the t-axis with no change in the x-, y-, or z-axis, and the world line for the second twin is a straight line moving out diagonally along the x- and t-axis (for simplification purposes, there is no change in the y- and z-axis), first out away from the world-line of the first twin, then towards the world line of the first twin.[106] By

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[105] See H. Minkowski, "Space and Time," in *The Principle of Relativity*, by A. Einstein, et al., trans. W. Perrett and G. B. Jeffery (New York: Dover Publications, 1952), pp. 75-91.

[106] Tim Maudlin, *Philosophy of Physics: Space and Time,* (Princeton: Princeton University Press), pp. 94-95. It seems to me that this classification of the world-lines is dependent upon a third reference frame which is at rest to the twin at rest, or upon the frame of the twin at rest. But then it could be asserted that due to the relativity of motion (not including acceleration), that the second twin could state that he is at rest in his own reference frame and that the

using the metric for Minkowski spacetime, $ds = \sqrt{dx^2 + dy^2 + dz^2 - dt^2}$ (where x, y, and z represent the three spatial dimensions, and *t* represents the temporal dimensions, and *ds* represents the Spacetime interval), it is possible to calculate the distance through space-time that both of the twins traveled. After calculating these, it is found that the twin who was considered to be moving has actually traveled a shorter distance through space-time than the twin who stayed at rest. Thus, Spacetime provides a mathematical and dynamical explanation of the phenomenon of length contraction and clock retardation which is caused by the Minkowski metric and movement through space-time. Another important feature of Minkowski Spacetime is the light cone structure. A light cone is the Spacetime shape created from light signals that go out and towards an event in

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first twin is the one in motion, so that the first twin should actually appear to be younger than the second twin on their reconnection. But this result is contrary to what physical experiments have found. Maudlin counters saying that "there is an objective geometrical structure to spacetime that defines inertial trajectories for all bodies, irrespective of the existence of any other bodies" (ibid pp. 97). What Maudlin is saying is that there is an objective fact of how the universe exists and how events occur in space-time and that it is not reliant upon what is observed in any inertial frame. This would in fact avoid the problem of reciprocal measurements of clock retardation between the two twins, and it also solves a problem that was prevalent in Einstein's original formulation of SR. Einstein's original formulation of SR required that reality is dependent upon reference frames, so that reality would be broken up into reference frames. This means that there is no underlying reality. However, in order to avoid this problem by positing an objective structure to spacetime, it would seem that there would need to be a preferred frame of reference to which all events are considered and which shapes the space-time structure. Inside the space-time structure one would still have relativistic effects such as the relativity of length and simultaneity due to relative motion, but those effects, recorded in a specific inertial frame, would have no ontological status unless the inertial frame was at absolute rest in the space-time structure, which is another concept that Maudlin wishes to expunge, but that appears to be impossible given the objective structure of spacetime. This would thus simply be a space-time formulation of Lorentz's ether theory in which there is a preferred reference frame, which has, as will be shown later, nothing that would justify the acceptance of over a classical 3+1 ontology.

Spacetime (fig. 4).

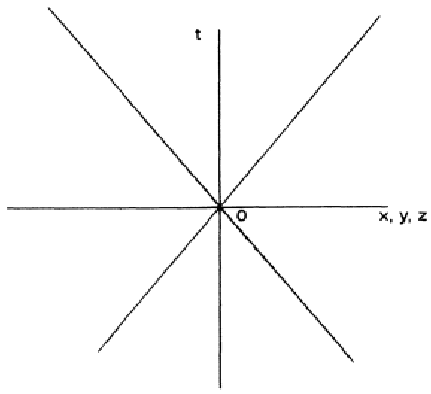

Fig. 4. The light cone structure for event *O* represented on a two dimensional cartesian plane. The x-axis represents the three spatial dimensions and the y-axis represents the one temporal dimension. The lines underneath event *O* represent the past light cone of *O*, including all events that could causally influence *O*. The lines above *O* represent the future light cone of *O*, including all the events that light signals from *O* could causally influence. These structures are what make up Spacetime, giving it some absoluteness. The light signals go out at 45^o angles from event *O*, meaning that light travels at one temporal unit per one spatial unit.

There are two light cones for every event (except for the Big Band Singularity): one past light cone which includes all of the events which can have causal influence upon the event, and a future light cone which includes all of the events that can be causally influenced by the one event. All of the events that lie outside of event *O*'s past and future light cones are space-like separated from *O*, in that the spatial coordinates of those events are such that it is impossible for light to reach those events before they occur in Spacetime, and thus cannot be causally influenced by *O*. Within Minkowski Spacetime, light has been construed as moving at one time unit per one spatial unit, and thus the light cones are at 45^o angles to event *O*.

Time restraints prohibit a complete analysis of how and why Minkowski Spacetime is superior and superseded the Einsteinian interpretation of relativity, but suffice it to say that Minkowski Spacetime, with its Spacetime metric, was capable of establishing a causal reason as to why there exists time dilation and length contraction.[107] With a basic understanding of relativity theory and the most popular interpretation of the theory (Minkowski Spacetime) in place, it is now possible to develop how Minkowski Spacetime and the B-Theory of time relate.

4.3. Minkowski Spacetime and the B-Theory

Being a thoroughbred theory of relativity, Minkowski's interpretation retains the definitions and postulates created by Einstein, including his definition of simultaneity. Minkowski retains Einstein's light synchronization method for synchronizing distant clocks, and combines this with the light cones of observers to determine classes of simultaneous events. Take an observer *S* located at the origin and at rest with respect to event *O*, with the x-axis representing the 3-spatial dimensions and the y-axis representing the temporal dimension, who is trying to synchronize his clock with an event *P*. The observer sends a light signal at $t_O=0$ to event *P*, which is then reflected at $t_P=4$, and is then received again by the observer at $t'_O=8$ (fig. 5).[108]

[107] For a description of how Minkowski Spacetime is used to describe length contraction and time dilation (such as the twins paradox), see Tim Maudlin, *The Philosophy of Physics: Space and Time*, (Princeton: Princeton University Press), ch. 4. For an analysis of the merits of both interpretations of relativity, see Craig, *Time and the Metaphysics*, pp. 77-102.

[108] Craig, *Time and the Metaphysics*, p. 74.

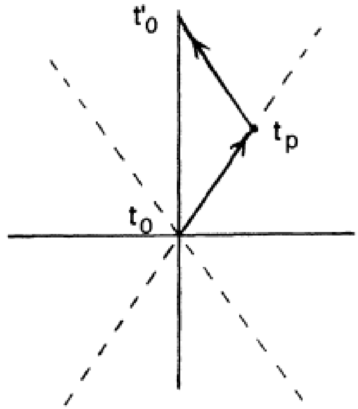

Fig. 5. *S* uses the light synchronization method to determine what time event *P* occurs with respect to his clock recording *O*-time.

The observer *S* uses the equation $t_B = t_A - \frac{1}{2}(t_O{}' - t_O)$ to get his clock in sync with the clock at event *P*. Now, observer *S* wishes to find which event in *O*-time is considered to be simultaneous with event *P* at t_P. In order to do this, he uses the equation $t^*_O = ½(t_O + t'_O)$, where t^*_O is the event which is considered to be simultaneous with t_P. From this calculation, observer *S* finds that $t^*_O = ½ (0 + 8)$ equals 4. Thus, the event in the inertial frame of *S* who remained at rest with event *O* and has his clocks synchronized with event *O* that is simultaneous with event *P* will occur at the Spacetime point (0,0,0,4), where the first three points are the spatial coordinates, and the last one is the temporal coordinate. This event will be space-like separated from t_P as they are both considered to occur at the same time, and thus no causal signal could travel between the two events to influence each other. Observer *S* will draw a hyperplane of simultaneity from t^*_O to t_P in order to determine which events are considered to be simultaneous with event *P* (fig. 6).[109]

[109] Ibid.

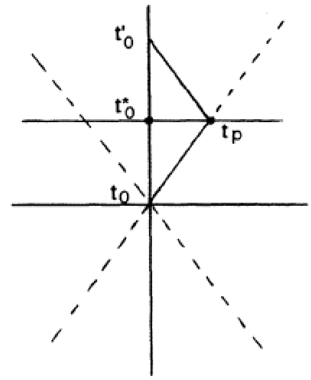

Fig. 6. *S* calculates which set of events are simultaneous with time t^*_O, creating a hyperplane of simultaneity.

Observer *S* is capable of using this method of light signal synchronization to find classes of simultaneity for each measurement of the proper time τ of *S*'s inertial system σ. This creates a way for *S* to establish global simultaneity. However, Einstein's method of light signal synchronization to determine clock times causes the relativity of simultaneity, which poses a problem for those trying to establish objective global simultaneity. For example, take an observer *S′* who is moving relative to *S* with a significant velocity. When *S′* coincides with *S* at the *O* and time t_O, he sends out a light signal to a reflector at relative rest to him at event *P*. But since *S′* is moving relative to *S*, *S′* will receive the the light signal reflected from event *P* at t_P before observer *S* does on the Spacetime diagram (fig. 7).[110]

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[110] Craig, *Time and the Metaphysics*, p. 75

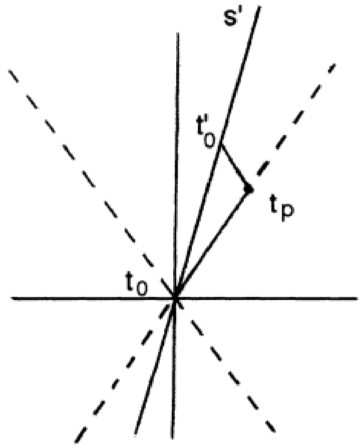

Fig. 7. observer *S′* is moving relative to *S*. Both send a light signal out to event *P* at t_O, with observer *S′* receiving his signal first due to his motion towards the reflected light signal.

Because observer *S′* receives his light signal before observer *S* does, at say $t'_O = 6$ as opposed to *S* receiving his light signal at $t'_O = 8$ (where $t_O = 0$), observer *S′* will calculate a different class of events which are simultaneous at t_P. In this situation, *S′* will calculate t^*_O to be $t^*_O = ½(0 + 6)$ which equals 3, and will thus draw a hyperplane of simultaneity from the Spacetime coordinate (0,0,0,3) (fig. 6).[111]

[111] Craig, *Time and the Metaphysics*, p. 76.

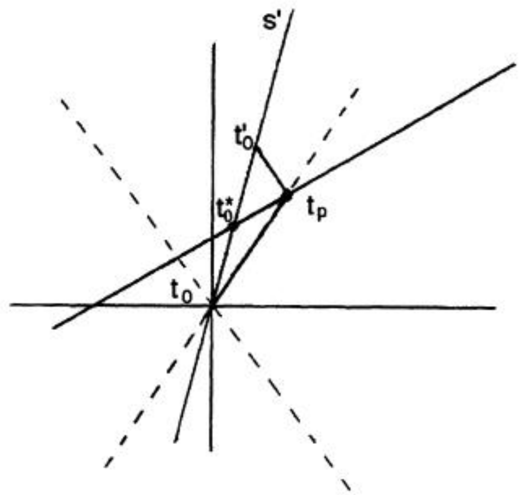

Fig. 8. The hyperplane of simultaneity for *S′* is at an angle to the x-axis, as opposed to *S*'s which is parallel to the x-axis, due to the motion of *S′*, which is the cause of the relativity of simultaneity.

This hyperplane of simultaneity with event *P* in *S′*'s inertial frame includes events which are considered to be both in the future and past light cones of observer *S*. But since both observer *S* and *S′* exist, and there is no preferred frame of reference according to Special Relativity, then both sets of events which are considered to be simultaneous with *P*, *S*'s and *S′*'s, are correct. This discrepancy in the planes of simultaneity is the reason why Special Relativity, on Minkowski's interpretation, requires one to accept that all times exist. An observer in relative motion to another observer will calculate the hyperplanes of simultaneity with their world-points as including different events than the other observer at the same point, due to Einstein's method of light signal clock synchronization. The first observer, due to his motion towards the light signal, will calculate events which are both future and past relative to the second observer as being present in his reference frame, though he could never observe these events, as they are all spacelike separated from him. This establishes that future and past events are not truly future and past, but are only future and past relative to some observer, and thus that all events on the Spacetime diagram exist, and that from all these events, certain ones are considered present to one observer, while others are considered present to another observer. This present is not an objective present, but is simply a class of events simultaneous with an observer at a world-point in Spacetime, which is dependent upon the observer's motion. Thus, the underlying assumption is that the observer is real, and that all events which are calculated to occur simultaneous with him are real. With this, the B-theorist is able to state that the Minkowskian interpretation of Relativity requires that all events in Spacetime are real, which entails the B-theory of time. Accordingly, the arguments for and against Minkowski's theory of relativity, along with arguments for and against its competing view, Lorentzian Relativity must be examined.

Chapter 5: The Challenge to Einstein's Special Theory of Relativity

5.1 What is the Lorentzian Theory of Relativity?

The Lorentzian Theory of Relativity is an alternative theory to Einstein's Special Theory of Relativity. The theory was formed, like Einstein's, in order to explain how light could be measured as the same constant *c* in all inertial frames. The theory is based off of the notion of an ether which was present in classical physics. The ether is considered to be a preferred reference frame that discloses the true spatial and temporal coordinates for the universe. Any observer at rest with the ether will record the true time, as Lorentz states

> Assume there were an aether; then there would be among all systems x, y, z, t one singled out in that the coordinate axes as well as the clock is at rest in the aether. If one conjoins with this the idea . . . that space and time are something wholly different and that there is a 'true time' (simultaneity would then exist independently of location, in accord with the circumstance that it is possible for us to conceive of infinitely great velocities), then one easily sees that this true time would have to be indicated just by clocks which are at rest in the aether.

Clocks at rest with the ether determine the true and absolute time, as well as the true and absolute spatial coordinates. There are three important characteristics to an ether theory: (i) physical objects are of a certain spatial extension (n-dimensional) and they endure through time, (ii) the velocity of light is constant in the preferred reference frame and is independent of the velocity of its propagating source, and (iii) any system that is in motion to the preferred reference frame experiences the same relativistic time dilation and length contraction that is seen in Special

Relativity.[112] The last two points are the most interesting to focus on. According to them, light only propagates at a constant speed in the frame of the ether. In all other reference frames, it will not be moving at a constant speed, but rather will be subjected to the same law of addition of velocities as any other object. As Craig states

> the existence of a fundamental reference frame for light propagation implies that the speed of light is isotropic only with respect to observers which are stationary relative to the fundamental frame (the fundamental observers). With respect to an observer which is moving with a velocity v relative to the fundamental frame, light will approach such an observer with the speed of c + v in the line of v and overtake it with a speed of c - v in the line of v. These departures from constant c will not, however, be detectable to such observers due to length contraction and time dilation.

The reason why these discrepancies in the speed of light cannot be detected is due to the phenomenon of length contraction and time dilation. On a Lorentzian Theory of Relativity, all objects at motion to the preferred ether experience deformation and dilation in the physical and temporal sense.[113] The contraction and dilation expected to occur is calculated by the Lorentz - Fitzgerald contraction $\sqrt{1-(v^2/c^2)}$. This is the same the same factor of contraction that is present in Einstein's Special Theory. Thus, the Lorentzian Theory of Relativity is fundamentally different

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[112] Maciel, A. K. A. and J. Tiomno "Analysis of Absolute Space-Time Lorentz Theories", *Foundations of Physics 19* (1989), 507–8.

[113] For explanations as to how motion relative to the ether causes length contraction, see Tuomo Suntola, "The Dynamic Universe: Zero-Energy Balance Restores Absolute Time and Space," in, *Ether Space-Time and Cosmology Volume 2*, ed. Michael C. Duffy and Joseph Levy, (Apeiron: Montreal, Quebec), pp. 67-134. The Dynamic views space as a "spherically closed zero-energy system of motion and gravitation" where "relativity in the Dynamic Universe is the measure of the locally available share of total energy" and "the energy structure of space is described in terms of nested energy frames starting from hypothetical homogeneous space as the universal reference and proceeding down to local frames in space" (Ibid, 67). Also, see S. J. Prokhovnik, Light in Einstein's Universe (Dordrecht, Holland: D. Reidel, 1985), pp. 84-85, G. Builder, "Ether and Relativity," Australian Journal of Physics 11 (1958): 279-297, reprinted in *Speculations in Science and Technology 2* (1979), pp. 239-241, Albrecht Giese, "Relativity Based on Physical Processes, Not on Space-Time," in *Ether Space-Time and Cosmology Volume 3*(Apeiron: Montreal,Quebec), pp. 143-192, László Székely, "Relativity in Terms of Measurement and Ether: Lajos Jánossy's Ether-Based Reformulation of Relativity Theory," in *Ether Space-Time and Cosmology Volume 2*, pp. 3-36.

from the Special theory of Relativity in that it maintains absolute space and time, with relativistic occurring because of motion relative to the ether.

5.2. Time and the Lorentzian Theory of Relativity

With the Lorentzian Theory of Relativity providing an alternative explanation for relativistic effects, one can now adopt the A-Theory of time. By denying that all times are relative, the Lorentzian theorist is can adhere to the concept of an absolute present that is inherent in the A-Theory, though is barred from the B-Theory.

5.2.1 Lorentzian Relativity and the A-Theory

The major problem of the A-Theory is how it squares up with relativity, namely the relativity of simultaneity. In Einstein's and Minkowski's theories, the readings of clocks that are simultaneous with an event give the time of the event. Time is solely a physical measurement which is relative to inertial frames.[114] This would mean that any event which is measured by a distant clock, or by a clock that is in motion relative to the event's inertial frame will record a different time as the clock at rest and near to the event in question. As seen in the discussion about Minkowski Spacetime, this discrepancy in clock readings creates several different planes of simultaneity, which includes events that are considered past and future relative to another observer. This forces the rational person to accept that all times must exist. Since time is reduced to its physical measures of (clock readings), this means that there is no objective time in which the event occurred. It is all subjective.

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[114] William Lane Craig, *Time and the Metaphysics of Relativity*, (Dordrecht: Kluwer Academic Publishers 2001), pp. 28.

This is a large obstacle for the A-Theorist, since in order for there to be a moving present, or an objective present, there must be objective simultaneity in which distant events that are space-like separated can be classified as occurring at the same time. In order to avoid this problem of measuring universe wide simultaneity, which is debatable about whether or not this is really a problem,[115] A-theorists are forced to adopt Lorentz's theory of relativity. In Lorentz's theory, there exists an ether which permeates throughout all of reality and is the preferred inertial frame. In this reference frame, one is capable of establishing a universe wide simultaneity, since any clock in this reference frame will be not only at relative rest to each other, but will be at absolute rest, so it would allow for an accurate measure of time that is not confounded by clock retardation caused by motion.[116] This allows for an objective time throughout the universe that can be measured and won't be affected by relativistic effects.

From this universal time it is possible to avoid the charge of B- and Spacetime theorists that Special Relativity requires time to be split up amongst observers, and if there is no objective , universal time, then there can be no objective, universal present.[117] While most A-theorists tend

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[115] See above, pp. 149-170.

[116] According to the Lorentzian theory of Relativity, length contraction and clock retardation are effects of the electromagnetic and gravitational fields of objects being dragged as it moves through the isotropic ether, creating anisotropic effects which require the objects to contract in order to maintain their equipotential equilibrium states. See above, pp. 180 and S.J. Prokhovnik, *Light in Einstein's Universe* (Dordrecht, Holland: D. Reidel, 1985), pp. 84-85, 89. A similar description of the ether's dynamical effects are given by Lajos Janossy in his, *Theory of Relativity Based on Physical Reality*, (Akademiai Kiado, 1971). He believes that the ether is the carrier of electromagnetic waves, and that when objects start in motion to it, the dynamical equilibrium of their atoms are disturbed due to the forces causing the acceleration. This is what causes the length contraction for a short period of time, then the object's atoms find a new equilibrium in their new state in relative motion to the ether.

[117] This is a simplified version of the argument that Hilary Putnam gives in, "Time and Physical Geometry," *Journal of Philosophy 64* (1967): 240-247. His argument takes the form:

I. I-now am real
II. What appears to me-now is real and actual.
III. There are other physical observers in the universe, and some of those observers are in motion relative to me.
IV. Given the Special Theory of Relativity, events which are future or past relative to one observer's reference frame may be present relative to an observer in relative motion to their reference frame.
V. Special Relativity requires there to be no special or privileged observer or reference frame.

to adopt Einstein's original 3+1 formulation of SR,[118] Lorentz's 3+1 formulation with an absolute, all embracing ether presents a less fantastic ontology than that of Einstein's original ontology.

Further, what is important about there being an absolute time is that it once again is able to give meaning to the separation of Spacetime into space and time. Einstein originally proposed relativity on a 3+1 ontology where space and time were distinct, but later rejected this view in favor of Minkowski's theory because the "division into time and space has no objective meaning since time is no longer 'absolute.'"[119] This is because it would intuitively seem that if there can be given no universal definition to time, as it would be dependent upon which inertial frame an observer is in,[120] then time on a 3+1 ontology is relative and subjective, which is insufficient to provide a definition for time. This is one reason why Spacetime was popular amongst physicists, as it sought to restore a universal definition to time, though it is questionable as to whether or not the "time" referred to in space-time is truly time at all.[121]

Interestingly enough, one does not even need to deny the existence of Spacetime in order to accept the A-Theory of time.[122] It is sufficient to add a foliation to Spacetime which introduces

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VI. If there are no privileged observers, then what is present to the observer in relative motion to me is also real and actual.

VII. Therefore, all events are real and actual, and presentness has no distinct or significant meaning.

This argument only works, however, if one adopts a Minkowski Theory of Relativity in which all events exist in Space-time.

[118] For example, see,, Milic Capek, "Do the New Concepts of Space and Time Require a New Metaphysics?" in *The World View of Contemporary Physics*, ed. with an Introduction by Richard F. Kitchener (Albany: State University of New York Press, 1988), pp. 90-104.

[119] Albert Einstein and Leopold Infeld, *The Evolution of Physics* (New York: Simon & Schuster, 1938), pp. 220

[120] This is due to the fact that Einstein defines time in terms of simultaneity classes, or in terms of events occurring at a clock time. With this operative definition, time loses any objective meaning and is instead replaced with the subjective, relative readings of clocks in different inertial frames. See, William Lane Craig, *Time and the Metaphysics of Relativity*, (Dordrecht: Kluwer Academic Publishers 2001), pp. 27-42. Of course it is questionable if this positivistic view towards the definition of time is sufficient, as there could be something more to the nature of time than simply clock measurements, as Newton seemed to think.

[121] See William Lane Craig, *The Tenseless Theory of Time*, (Kluwer Academic Publishers), pp. 149-166.

[122] Though, what will be shown is that one cannot believe that Relativity Theory provides full knowledge of Spacetime. Tim Maudlin, when discussing new theories which have been used as proof for absolute simultaneity, claims that "Indeed, the cost exacted by those theories which retain Lorentz invariance is so high that one might rationally prefer to reject Relativity as the ultimate account of spacetime structure" [Tim Maudlin, *Quantum Non-*

the concept of absolute time. By adding absolute time to Spacetime, the B-theorist's argument from the relativity of planes of simultaneity falls apart. Now, one does not need to state that the times calculated to be simultaneous relative to one observer truly be simultaneous with them. One could state that there is only one true plane of simultaneity that is absolute and observer independent, with the other relative planes of simultaneity being mathematical calculations that are influenced by relativistic phenomenon. The motion of clocks causes them to become out of sync with the absolute time of the universe, and thus the calculations of planes of simultaneity will be retarded. Each individual plane of simultaneity loses its ontological significance, with the plane of absolute simultaneity being the only one that matters.[123]

Thus, the A-theorist need only state that times that are considered simultaneous with the moving present (as measured by the plane of absolute simultaneity) are the only times that exist. With an objective, universe wide time, A-theorists are capable of both affirming their belief in objective becoming while also affirming the validity of the Special Theory of Relativity. Thus, the Lorentzian theory of relativity allows one to be an A-theorist.

Locality and Relativity. Aristotelian Society Series 13. (Oxford: Blackwell, 1994) p. 220]. In fact, Maudlin claims that if one adopts absolute simultaneity, they must in turn reject Einsteinian Relativity in favor of a different form of Relativity, namely, Lorentzian Relativity. This theory of relativity, as Popper states, does not require one to give up the formalisms of Relativity, but rather go back to Newton's conception of absolute time and space (Karl Popper, *Quantum Theory and the Schism in Physics* (Totowa, N. J.: Rowman & Littlefield, 1982). For an account of how to have absolute time and Spacetime, see Maudlin, "Space-Time in the Quantum World" in *Bohmian Mechanics and Quantum Theory: An Appraisal*, ed. by James T. Cushing, Arthur Fine, and Sheldon Goldstein. (Dordrecht: Kluwer Academic Publishers, 1996), pp. 285-307.

[123] This plane of absolute simultaneity helps to create a distinction between time and space, one that was blurred by Einstein when he said, talking about relativity on Minkowski Spacetime "It is not said that time is absolute, that is, has a meaning which is independent of the state of motion of the reference frame. That is an arbitrary element which had been contained in kinematics" (Einstein, "Die Relativäts-Theorie," p. 9). According to Einstein, it was the fact that time was influenced by its state of motion that made it not only relative, but in some sense physical. By establishing absolute time, the A-theorist can now separate time and make it distinct from space. Of course, their measurements of time will be influenced by their state of motion, due to their measuring devices being physical, and thus susceptible to deformations caused by physical processes. However, if one wishes, they could still talk coherently about Spacetime even if time is absolute and thus being a distinct entity from space. Spacetime provides useful explanations and descriptions of models and reality.

5.3. Which Theory of Relativity is superior: Einstein's or Lorentz's?

Now that it has been established how Lorentzian relativity effects the theories of time, the reasons for preferring Lorentzian relativity to the two different interpretations of Einstein's theory of relativity, the Einsteinian interpretation (Einstein's original interpretation) and the Minkowskian interpretation, must be examined. While Lorentz's physical interpretation of the theory may not be the common one, it is nonetheless equivalent to Einstein's theory in that it makes the same predictions as Einstein's theory does (they both predict clocks and rods at relative motion to an observer will appear to be desynchronized and either contracted or lengthened), and they are both based off of the same amount of assumptions.

5.3.1. Appeal to simplicity

Most physicists and philosophers against Lorentz's theory state that Einstein's theory is empirically simpler than Lorentz's. However, H.E. Ives has proved this wrong, as he was able to derive the Lorentz transformations from only two assumptions: (i) the laws of conservation of energy and momentum, and (ii) the laws of transmission of radiant energy.[124] This creates a rival theory of relativity which possesses the same mathematical "beauty" as Einstein's relativity does, according to Martin Ruderfer.[125] Now, according to Einstein's positivism, two theories, if they are empirically indistinguishable, can be considered as equivalent theories.[126] Both theories of relativity, Einstein's and Lorentz's, contain length contraction and clock retardation as real,

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[124] Herbert E. Ives, "Derivations of the Lorentz Transformations," *Philosophical Magazine* 36 (1945): 392-401.
[125] Martin Ruderfer, "Introduction to Ives' 'Derivation of the Lorentz Transformations'," *Speculations in Science and Technology 2* (1979): 243.
[126] See, Lawrence Sklar, *Philosophy and Spacetime Physics* (Berkeley: University of California Press, 1985), p. 6

physical effects, and both contain the Lorentz Transformation equations, which are foundational to mathematical relativity, with the same amount of assumptions. The only difference between the two theories is the theoretical entity of a preferred reference frame, which at the time could not be physically identified. If one is to remain consistent with the positivistic ontology that Special Relativity was based off of, then there is no reason to hold to Einstein's SR over Lorentz's SR.

5.3.2. The ad hoc argument

However, physicists over time came to view Lorentz's theory as *ad hoc* and therefore inferior to Einstein's due to the fact that it posits theoretical entities which could not be measured or discovered physically (the ether frame and absolute simultaneity). But this, claims Craig, leads to "a strange inconsistency: in order to reject Lorentz's theory in favor of Einstein's they appealed to a verifiability criterion of meaning to eliminate the aether frame, absolute simultaneity, and so on; but in so doing they undermined the thesis of the equivalence of observationally indistinguishable theories, thereby exposing the metaphysical elements in science."

Even more inconsistencies arise when one realizes that SR itself has two radically different interpretations: Einstein's original interpretation, which posits a classical 3+1 space and time ontology, and Minkowski's interpretation, which posits a 4-dimensional ontology of Spacetime. These two views are empirically equivalent, yet Einstein's interpretation has been rejected due to Spacetime realists claim of theoretical superiority.[127] This further reveals the metaphysics behind the Special theory and how positivism failed as an ontological foundation for the theory, as the Spacetime view itself is strictly metaphysical, positing an independent, unobservable reality

[127] See discussion in, Craig, "Metaphysics of Special Relativity," p. 22-26, and, *Time and the Metaphysics of Relativity*, ch. 5.

through which all objects move and exist. With the collapse of positivism, one can no longer restrict themselves to arguing for a theory based off of empirical predictions, but must broaden it to metaphysical considerations. The only way to figure out which theory of Relativity is preferable is through metaphysical considerations. No longer can the Spacetime realist claim supremacy over the Lorentzian theorist due to the Lorentzian's belief in Newtonian absolute space and time. As Richard T.W. Arthur comments,

> "Mach himself, of course, is no longer a force to be reckoned with in the philosophy of space and time, the positivist position which he inaugurated having come in for its own share of debunking in recent years. This applies particularly to his attack on Newton's conception of an enduring absolute space, a conception which the latest generation of spacetime theorists has done much to rehabilitate."[128]

Since the rejection of Newton's absolute space and time is grounded in the positivistic critique of it being metaphysical, and thus useless, and since positivism has been exposed to be inadequate from the preference of Minkowski's theory over Einstein's theory due to metaphysical considerations, the entire concept of absolute space and time, and thus Lorentzian relativity, is once again open to debate. Thus, in order to determine which theory of relativity is superior, one must look at the metaphysical entailments of the theory. This is easier said than done. Both interpretations of relativity (the ether interpretation and the Spacetime interpretation) entail, or at the very least allow, radically different theories of time. The only way to determine which theory one prefers metaphysically will be to weigh the arguments for and against each theory of time, which is far out of the scope of this paper.[129] Instead, it will be examined if there are any physical

[128] Richard T. W. Arthur, "Newton's Fluxions and Equably Flowing Time," *Studies in History and Philosophy of Science 26* [1995]: p. 323

[129] For an in-depth analysis of both theories of time, see, *The Tensed Theory of Time*, and, *The Tenseless Theory of Time*, and, L. Nathan Oaklander, *The Ontology of Time*, (Amherst, New York: Prometheus Books, 2004).

reasons to prefer one theory over the other. It will therefore be assumed that there is no determining factor for which theory one should prefer based off of their ontological commitments.

5.4. Physical Theories that prove absolute simultaneity

Since the conceptions of Einstein's Special Relativity, numerous experiments have been contrived in order to test the predicted outcomes of the theory. In fact, eleven different, independent experiments have been developed, all of which confirm Special Relativity. However, none of these experiments empirically distinguish or favor Einstein's theory from Lorentz's ether theory. Surprisingly, according to Tom van Flandern

> Historically, de Sitter, Sagnac, Michelson, and Ives concluded from their respective experiments that SR was falsified in favor of the Lorentz theory. De Sitter argued that the forward displacement of starlight (aberration) depended on absolute, not relative, speeds because both components of a double star, each with some unique velocity, had the same aberration. Sagnac argued that the fringe shifts expected but not seen in the Michelson-Morley experiment are seen if the experiment is done on a rotating platform. Michelson argued in the 1925 Michelson-Gale experiment that the Earth was just such a rotating platform. Ives argued that ions radiated at frequencies determined by absolute, not relative, motion because they had to pick a specific frequency to radiate at. In each case, a complex-but-now-familiar SR explanation could account for the same observed results.[130]

All of these experiments are capable of being explained under Special Relativistic physics, yet their explanations are much more complicated and complex than the explanations that Lorentzian Relativistic physics gives. So the tables have turned on Special Relativity: no longer is Special Relativity the "simplest" solution to explaining relativistic phenomenon, but Lorentzian Relativity is, giving us, according to Occam, more warrant to believe in Lorentzian Relativity than Special

[130] Tom van Flandern, "Global Positioning System and the Twins' Paradox," *Einstein, Relativity, and Absolute Simultaneity*, p. 217.

Relativity. Barring the argument from simplicity, several new physical theorems, experiments, and interpretations seem to confirm the concept of absolute simultaneity that Einstein sought to destroy in his Special Theory due to its unobservability, which pulls the rug out from under the B-theorist's claim that Special Relativity requires all events in Spacetime exist.

5.4.1. Absolute time and General Relativity

In fact, even Einstein himself helped to re-establish this concept with his General Theory of Relativity. According to the most widely accepted cosmological models of General Relativity, including the Friedmann model, there exists a plane of homogeneity and isotropy which establishes the hypersurface for spacetime. This hypersurface becomes the preferred reference frame in which time becomes absolute, and it is in this reference frame that scientists are able to state that the Big Bang occurred 13.7 billion years ago. Craig and Smith state that "The Special Theory has been supplanted by the General Theory of Relativity (GTR) and that simultaneity does not have the relativity attributed to it by the Special Theory but instead is absolute in the "cosmic time" which emerges through a cosmological application of GTR."[131] In fact, Einstein himself proposed a cosmological model of General Relativity in 1917[132] in which space was finite and possessed "the geometry of the surface of a sphere in three dimensions with a constant radius R."[133] Time in this model is decoupled from space and extends from $-\infty$ to $+\infty$. Einstein envisioned the universe being static, in which a cosmological constant offset gravitation just enough so as to prevent gravitational collapse on the one hand, and cosmological expansion on the other. The metric for this universe is

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[131] William Lane Craig and Quentin Smith, "Introduction" in, *Einstein, Relativity, and Absolute Simultaneity* [New York: Routledge, 2008], edited by William Lane Craig and Quentin Smith, p. 6.
[132] Albert Einstein, "Cosmological Considerations on the General Theory of Relativity," in *The Principle of Relativity*, by Einstein, *et al.*, with notes by A. Sommerfeld, trans. W. Perrett and G.B. Jeffery (rep. Ed.: New York: Dover Publications, 1952), pp. 177-188.
[133] Craig, *Metaphysics of Relativity*, p. 203.

$ds^2=-dt^2+R\ [dr^2+sin^2r(d\theta^2+sin^2\theta d\phi^2)]$, where the introduction of time into the equation "represents in a certain sense the restoration of the universal time which was destroyed by SR."[134] That same year, Willem de Sitter also proposed a cosmological model of General Relativity in which the universe was expanding, while also making use of the belief in a universal time.[135] Five years later in 1922 Aleksandr Friedmann provided his cosmological model, which is now the most commonly accepted GR-based cosmological model in physics. His model posits an expanding universe characterized by "ideal homogeneity and isotropy" which lacks Einstein's Cosmological constant.[136] As stated earlier, this universal homogeneity and isotropy establishes a cosmic time due to the very definition of what it means to be homogenous and isotropic. In order to be considered homogenous, an object must be considered the same everywhere at a given moment in time. Thus, naturally, in order to have universal homogeneity and isotropy, there must exist a cosmic time. However, the concept of a cosmic time is ambiguous in the context of General Relativity, due to there being no cosmic inertial frame, and so one must come to understand this cosmic time as a parameter that distinguishes space-like hypersurfaces. Space-like hypersurfaces are three dimensional spatial foliations of Spacetime, and they can be slices that represent symmetries in Spacetime such as the homogeneity of the universe. Misner, Thorne, and Wheeler in their book *Gravitation* help to explain this concept, stating

> In Newtonian theory there is no ambiguity about the concept 'a given moment of time.' In special relativity there is some ambiguity because of the nonuniversality of simultaneity, but once an inertial frame has been specified, the concept becomes precise. In general relativity there are no global inertial frames (unless spacetime is flat); so the concept of 'a given moment of time' is completely ambiguous. However,

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[134] Bernulf Kanitscheider, Kosmologie (Stuttgart: Philipp Reclam., Jun., 1984), p. 155.
[135] Willem de Sitter, "On the Relativity of Inertia," in *Koninglijke Nederlandse Akademie van Wetenschappen Amsterdam. Afdeling Wis-en Natuurkundige Wetenschappen. Proceedings of the Section of Science 19* (1917): 1217-1225.
[136] Craig, *Time and the Metaphysics*, p. 204.

> another more general concept replaces it: the concept of a three-dimensional spacelike hypersurface. This hypersurface may impose itself on one's attention by reason of natural symmetries in the spacetime. Or it may be selected at the whim or convenience of the investigator.... At each event on a spacelike hypersurface, there is a local Lorentz frame whose surface of simultaneity coincides locally with the hypersurface. Of course, this Lorentz frame is the one whose 4-velocity is orthogonal to the hypersurface. These Lorentz frames at the various events on the hypersurface do not mesh to form a global inertial frame, but their surfaces of simultaneity do mesh to form the spacelike hypersurface itself.
>
> The intuitive phrase 'at a given moment of time' translates, in general relativity, into the precise phrase 'on a given spacelike hypersurface.' The investigator can go further. He can 'slice up' the entire spacetime geometry by means of a one-parameter family of such spacelike surfaces. He can give the parameter that distinguishes one such slice from the next the name of 'time'.... The successive slices of 'moments of time' may shine with simplicity or may only do a tortured legalistic bookkeeping for the dynamics [of the geometry of the universe]. Which is the case depends on whether the typical spacelike hypersurface is distinguished by natural symmetries or, instead, is drawn arbitrarily.[137]

From this it is seen that one is able to give a meaning to the phrase "a given moment of time" in General Relativity by stipulating that Spacetime is sliced up by the boundaries of universal homogeneity and isotropy. Of course, the universe is not completely homogeneous as there are discrepancies in matter on the galactic scale and smaller, but with models such as the Friedmann model, those small discrepancies are ignored, for on a universal scale they become negligible. Looking at the universe on this scale allows one to view galaxies as a homogenous perfect fluid or gas particle. An observer can be assigned to one of these gas particles who is at rest to the particle, and therefore observing the immediate gas particles surrounding his are at rest (have no average motion). This observer is called a "fundamental observer" and the particle he is assigned to is

[137] Charles W. Misner, Kip S. Thorne, and John Archibald Wheeler, Gravitation (San Francisco: W. H. Freeman, 1973), pp. 713-714.

called a "fundamental particle." The proper time of this observer will coincide with the cosmic time that is recorded in the slicing of Spacetime into homogeneous spacelike hyperplanes.[138] In 1935, H.P. Robertson and A.G. Walker created the Robertson-Walker line element metric which describes how the spatial geometry of cosmological models based off of homogeneity and isotropy must develop over time. The metric

$$ds^2 = -dt^2 + R(t)\,\frac{dr^2 + r^2(d\theta^2 + sin^2\theta\phi^2)}{(1 + kr^2/4)^2}$$

Decouples space from time, making space dynamic and its geometry time dependent. Craig states that

> The Robertson-Walker metric for our expanding universe is expressed in such a way that every fundamental particle has a fixed set of coordinates which do not vary with time. The "gas" of fundamental particles is itself a sort of ether in that it… allows in a natural way for the existence of (1) universal cosmic time; (2) 3-spaces of constant curvature orthogonal to the timelines; and (3) a frame of reference co moving with the substratum[139]

Thus, there is a cosmic, universal time which acts as a parameter for the universe, governing how its geometry develops in each successive spacelike hyperplane. Due to time being a parameter, it must be outside of the spatial manifold. Craig explains that

> cosmic time is fundamentally parameter and only secondarily coordinate time. Physical time can be related in two quite different ways to the manifold in which motion is represented. If it is part of that manifold, then it functions as a coordinate. If it is external to that manifold, then it functions as a parameter.[140]

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[138] For a good discussion on the creation of absolute simultaneity from cosmological considerations, see Richard Swinburne, "Cosmic Simultaneity," in *Einstein, Relativity, and Absolute Simultaneity*, (New York: Routledge, 2008), ed. William Lane Craig and Quentin Smith, pp. 254-260. See also Richard Swinburne, *Space and Time*, (The Macmillan Press, 1981), ch. 11.

[139] William Lane Craig, "Metaphysics of Special Relativity," in *Einstein, Relativity, and Absolute Simultaneity* [New York: Routledge, 2008], edited by William Lane Craig and Quentin Smith, pp. 29.

[140] Craig, *Time and the Metaphysics of Relativity*, p. 207. In this passage, Craig cites, Peter Kroes, *Time: Its Structure and Role in Physical Theories*, Synthése Library 179 (Dordrecht: D. Reidel, 1985), pp.60-96.

Cosmological models based off of GR such thus help to not only provide absolute, cosmic time which is necessary for the Lorentzian Theory of Relativity and the A-theory of time, but it also decouples the concept of time from space, rendering Spacetime an easy way to represent the theory, but by no means representative of how the world is.[141] Another important aspect about parameter time, as Peter Kroes points out, is that it helps to establish objective temporal becoming. He claims that

> In the space and time formulation of Newtonian physics, the increase of parameter time represents the objective flow of absolute time; for increasing values of parameter time, the distribution of the particles in space will be different, and therefore there is change and becoming with regard to parameter time. However, the same kind of reasoning, applied to parameter time in the spacetime formalism of relativity theory, leads to the conclusion that parameter time has an objective flow (but with the proviso that the flow of parameter time is not universal).[142]

It could be questioned as to whether the fundamental observers that have been posited all experience the same cosmic time. For, though both observers are considered at rest with respect to space, they are both in motion to each other, due to the recessional motion of the universe. Both observers are getting further away from each other, though neither are moving relative to the cosmological fluid. This prevents them from forming one universal inertial frame, since different parts of the universe are moving away from each other, and thus cannot form a uniform frame of motion. Because of this recessional motion and failure to create a uniform inertial frame, when

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[141] For justification as to why one should adopt Friedmann type models of the universe which include cosmic homogeneity and isotropy as opposed to Gödel type models where the universe is homogenous, but the substratum is spinning, and thus not isotropic, see Martin J. Rees, "The Size and Shape of the Universe," in *Some Strangeness in the Proportion*, ed. Harry Woolf (Reading, Mass.: Addison-Wesley, 1980), pp. 291-301. Rees points to (i) the Hubble constant, (ii) the microwave background radiation, and (iii) radio, optical, and x-ray observations as proof for universe wide homogeneity and isotropy. In fact, the microwave background radiation can be used as a candidate for the ether, as it fills all of space, is at rest with the cosmological fluid, and has allowed scientists to measure the velocity of the Earth relative to it as 390±60 km/sec [G. F. Smoot, M. Y. Gorenstein, and R. A. Muller, "Detection of Anisotropy in the Cosmic Blackbody Radiation," Physical Review Letters 39 (1977), pp. 898-901.]

[142] Kroes, *Time*, p. 96.

two fundamental observers, F and F′, attempt to synchronize their clocks, the other's clock will appear to run slower (fig #).[143]

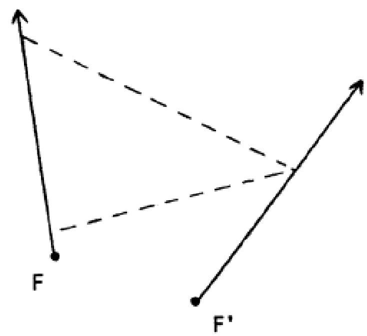

Fig. 9. Two fundamental observers, F and F′, try to synchronize their clocks via Einstein's light signal method for clock synchronization. Both observers, though at rest with respect to the cosmological fluid, are moving away from each other, and so F will record F′'s clock to run slower, and vice-versa.

The light signal travels a further distance on the return leg of its journey than on the outward leg of its journey, and so each fundamental observer will calculate the other's clock to be running slow. However, because both observers calculate each other's clocks to be running slow, there exists reciprocal effects, or "pure relativity" where the length contractions and time dilations that are calculated have no absolute effect, but are caused by the manner of observation. This is similar to how when two people move further from each other, they both determine the other observer to be shrinking in size. The two observer's hyperplane of simultaneity will not coincide with each other, since they do not have parallel world-lines, but their hyperplane of simultaneity will coincide with local events in the hypersurface of cosmic time. This is because both observers are at rest with respect to space. If they were moving relative to space, their hyperplane of simultaneity would

[143] Craig, *Time and the Metaphysics*, p. 209.

intersect the hypersurface of cosmic time at an angle. Instead, by being at rest with respect to space, their hyperplanes of simultaneity intersect the hypersurface of cosmic time like how a tangent line intersects a circle, thus allowing them to say that the local events which they determine to be simultaneous with them will appear on the hypersurface of cosmic time. Craig states two important consequences of this: "first, that the proper time of each fundamental observer coincides with cosmic time and, second, that all the fundamental observers will agree as to what time it is."[144]

Cosmic time on these General Relativistic models is not just parameter time, but can also function as coordinate time. Take on hypersurface of homogeneity, S_1, and assign all of the events on this hypersurface the coordinate time t_1. Then, create a grid of S_1 assigning spatial coordinates to it, and then project this grid of spatial coordinates onto successive hypersurfaces by following the world-lines of each of the fundamental particles. This creates the absolute spatial coordinates for all of Spacetime. The coordinates are moving with the cosmological fluid, keeping the fluid at rest with respect to space. In order to determine the time coordinates for each event not on S_1, use the time coordinate t_1 and add the lapse of proper time recorded by the fundamental observers to it. This thus creates "a co-moving co-ordinate system, in which a worldwide, absolute simultaneity is defined."[145]

But why should this cosmic time that is established by General Relativity be accepted? In fact, one could arbitrarily choose any inertial frame as the privileged frame, with the time associated with it recording the cosmic time of the universe. Kroes states that

> If cosmic time functions are considered in abstracto, i.e., without relating them to the notion of the evolution of the universe, it is immediately clear that the existence of these functions does not contradict the basic principles of RT. If a spacetime M admits the definition of one cosmic time function *f*, then infinitely many

[144] Ibid.
[145] Bernulf Kanitscheider, *Kosmologie* (Stuttgart: Philipp Reclam., Jun., 1984), p.187.

> other cosmic time functions can be defined; *f* is by no means unique. But this infinity of different cosmic time functions contains members which generate different total temporal orders of the events. RT does not, however, prescribe such a choice; it does not specify which is the 'real' cosmic time function with its corresponding 'real' total temporal order.[146]

What Kroes is stating is that for every inertial frame that exists, there is a time coordinate specific to that inertial frame. This time function could be considered as giving a cosmic time once its plane of simultaneity is stretched out across the entirety of the universe. Barring any possibility "to single out on the basis of objective physical principles, a unique cosmic time function as the 'real' one," one is left with an infinite number of cosmic time functions, each of which lend no reason to be accepted over any other (due to the equivalence of all inertial frames in Special Relativity).[147] However, there does exist strong physical reasons to believe that there is a privileged cosmic time. As Craig comments "once we introduce, however, considerations concerning the *de facto* distribution of matter and energy in the universe, then certain natural symmetries emerge which disclose to us the preferential foliation of spacetime and the real cosmic time in distinction from artificial foliations and contrived times."[148] By taking into consideration how the universe evolves in its isotropy and homogeneity, it is possible to foliate Spacetime using the cosmic time of the fundamental observers. This foliation reveals information about the universe that would otherwise be scrambled and lost if any arbitrary foliation was chosen. P.C.W. Davies summarizes this, explaining

> At any given place in the universe, there is only one reference frame in which the universe expands isotropically. This privileged reference frame defines a privileged time scale (the time as told by a clock at rest in that frame). Two separated places have their privileged reference frames in mutual motion, because

[146] Kroes, *Time*, p. 15.
[147] Kroes, *Time*, p.16.
[148] Craig, *Time and the Metaphysics*, p. 216.

> of the expansion of the universe. Nevertheless, the time measured by the entire collection of imaginary standard clocks are obviously correlated such that the global condition (e.g. average separation of two galaxies) of the universe appears the same at equal times as registered by every privileged clock (assuming they are all properly synchronized). Happily, the earth is moving very slowly relatively to the local privileged frame in our vicinity of the universe, so that Earth time is a fairly accurate measure of cosmic time.[149]

Frank Tipler also points to physical reasons for accepting this cosmic foliation stating that it is the natural foliation with regards to universe-wide distributions of matter and gravity, and that a universe described by that foliation will have rest frames that coincide with the frames that are at rest to the Cosmic Background Radiation, which fills all of space.[150] Thus, there exists strong cosmological reasons *de facto* to accept that there is a privileged foliation to Spacetime which reveals the homogeneity and isotropy of the universe. This privileged frame contains within it the privileged time function which establishes absolute simultaneity throughout the universe. Also, to the A-theorist's satisfaction, the Earth is moving relatively slow compared to this frame, and thus records an accurate measure of the universe's time.

5.4.2. Absolute simultaneity and the EPR Experiment

Absolute simultaneity is not only supported by cosmological models of the universe, but also by Quantum Mechanics. The most impactful and influential of these being the EPR experiment. The EPR thought experiment was created in 1935 by Albert Einstein, Boris Podolsky, and Nathan Rosen in order to help prove the inadequacy of Quantum Mechanics. What they ended up making was instead an experiment which would be used to help prove the existence of absolute

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[149] P. C. W. Davies, "Spacetime Singularities in Cosmology and Black Hole Evaporations," in *The Study of Time III,* ed. 1. T. Fraser, N. Lawrence, and D. Park (Berlin: Springer Verlag, 1978), p. 76.

[150] Frank 1. Tipler, "The Sensorium of God: Newton and Absolute Space," in Newton and the New Direction of Science, ed. G. V. Coyne, M. Heller, and 1. Zyncinski (Vatican City: Specola Vaticana, 1988), pp. 215-228.

simultaneity. The basic concepts of the experiment are based around the idea of indeterminacy in quantum physics. In quantum physics, objects have no distinct or determined properties until they are measured. So a ball has no momentum, velocity, or acceleration until it is measured by a device to have one. This is the indeterminacy in quantum physics. The EPR group created a thought experiment which was supposed to prove this doctrine of indeterminacy false, and thus makes quantum mechanics incomplete. The experiment was supposed to show that objects must have some properties before they are measured to have them.

In order to show this, the EPR group created a hypothetical scenario in which they would be able to measure a property of a particle without disturbing it, and thus being able to know the property of an identical particle. Craig explains

> Thus, if one could predict accurately, say, the position of a particle without in any way disturbing it via a measurement process, the particle must actually have a position. Accordingly, Einstein, Podolsky, and Rosen imagine the following scenario: two photons are fired in opposite directions along the line of motion. Complementarity forbids that both the momentum and position of one of the photons be measured simultaneously. But because the photons are identical, we know that if we determine the momentum of photon 1, then photon 2 must possess precisely the same momentum, even though no measurement is carried out on photon 2. Nor can our measurement of photon 1's momentum be said to disturb photon 2, for causal influences cannot propagate faster than the speed of light. Yet at the very instant that the momentum of photon 1 is established, photon 2 must have an identical momentum. Therefore, according to the EPR reality criterion, photon 2 must really possess a momentum. But, quite evidently, we could just as easily have chosen to measure photon 1's position instead of its momentum. But then by parity of reasoning, photon 2 would also have to possess a real position. So whether we choose to measure photon 1's momentum or position, photon 2, while remaining causally isolated, must also possess at the same time the relevant property, as really as does photon 1. But since the EPR reality criterion expresses a modal proposition, photon 2 must possess these properties not merely whenever measurements are carried out on photon 1, but whenever such measurements-and corresponding predictions-can be carried out. So long as we can predict photon 2's

> position and momentum without disturbing it, photon 2 must actually possess those properties. The quantum mechanical description of the system is therefore essentially incomplete: any description of the system will include specific values of only one of the complementary properties, even though the EPR experiment shows that the particles actually possess both. There must therefore exist hidden variables in any quantum mechanical situation which we are incapable of determining.[151]

Because the two photons are identical, they possess the same properties. Since photon one had been measured to have a momentum and a position, it now can be said to have those properties. Since photon one has those properties, photon two must have those properties, even though it hasn't been measured to have any of those properties.

This thought experiment became monumental in the discussion of whether or not absolute simultaneity exists once J.S. Bell got hold of it. He developed a set of inequalities which showed that hidden variable theories which prohibited action at a distance violated quantum mechanics.[152] In order to prove this, Bell used measurements on the ½ spin states of two entangled particles that are located at space-like separation from each other.

Now, the EPR experiment is based off of the idea of locality. The group believed that the measurement of one particle in no way disturbed the particle and its counterpart. Thus, when the momentum of photon one is measured, there is no change in the system of photon one and photon two that causes photon two to now have a momentum. Instead, they assumed that photon two always had a momentum. The situation is different when one deals with the spin states of entangled particles, however. According to quantum physics, neither of the two particles have any definite spin until their spin state is measured with a Stern-Gerlach device. In order to understand why this is so, an examination of how spin states are measured is required.

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[151] Craig, *Time and the Metaphysics*, pp. 224.
[152] J. S. Bell, "On the Einstein Podolsky Rosen Paradox," Physics 1 (1964): 195-200, see also Bell, "The Theory of Local Beables," in *Speakable and Unspeakable in Quantum Mechanics*, (Cambridge University Press, 1987).

Maudlin states that when one tries to measure the spin-state of two electrons that are grouped in a singlet state "quantum mechanics predicts that the outcomes will always be anti-correlated: one electron will exhibit x-spin up and the other x-spin down."[153] Both electrons cannot exhibit the same spin state, otherwise they would violate quantum mechanics. According to Bohmian mechanics which rules determinate quantum physics, "when one does a spin measurement on a particle… the outcome of the measurement will depend, first, on exactly how the spin-measuring device is constructed and, second, on the exact initial location of the particle."[154] These two factors determine the reading of the spin state of a particle. How a spin-measuring device, such as a Stern-Gerlach device, is constructed influences the reading of the spin state of a particle. The device could be set to where any particle that is fed into it and exits moving towards the ceiling is measured as being in a spin-up state, and any particle that exits moving towards the floor is measured as being in a spin-down state. The initial location of the particle also affects the recorded spin-state of a particle. Maudlin explains that

> For a single unentangled particle, the outcome depends solely on the position of the particle in space. Given the usual physical symmetry of the measuring apparatus, it is easy to show that particles that exit the device headed toward the ceiling (and so found to have x-spin up) entered the device in the upper part of the region allowed by the wave function, and particles that exit the device headed toward the floor entered the device in the lower region… To be concrete, suppose we prepare a beam of particles in the state y-spin up, and then subject the particles in the beam to an x-spin measurement. Quantum mechanics predicts that half the particles in the beam will exit the device going up and half going down. Bohmian mechanics further implies, Non-local correlations in quantum theory 161 for an apparatus like a Stern-Gerlach device, that the particles that

[153] Tim Maudlin, "Non-local Correlations in Quantum Theory: How the Trick Might be Done," in *Einstein, Relativity, and Absolute Simultaneity*, p. 162
[154] Ibid, p. 161.

> exit going up were all initially located in the upper region of their wave function, and the half that go down were originally located in the lower half.[155]

The position of a particle in its wave function thus plays a major role in determining its spin state. However, the EPR experiment deals with more than these single, unentangled particles. It deals with "pairs of particles that are entangled."[156] These entangled particles are paired in singlet states, singlet states that exist in either the upper region or the lower region of the wave function. Thus, it is impossible to determine the spin of one of the particles in the singlet state just by its position in the wave function. Maudlin explains "quantum mechanics predicts that the outcomes will always be anti-correlated: one electron will exhibit x-spin up and the other x-spin down. But whether a particular electron exhibits a particular result cannot be determined simply by the initial location of that particle: if it could, then there would be a completely local account of the spin measurements, and they could not violate Bell's inequality (which they do)."[157] From this it is seen that two particles that are in a singlet state do not, and in fact cannot, have a determined spin state. For if the two particles are located in the upper region of the wave function, they cannot both be measured to be in an x-spin state because that would violate the anti-correlation of spin states.The same can be said if they are located in the lower region of the wave-function.

With this in mind, it can now be seen how non-locality must exist in quantum mechanics. Take two electrons that are paired together in a singlet state and are located in the upper region of their wave function. As just shown, neither of these two electrons have a determinate spin state. Now send those two electrons in opposite directions. When the electrons achieve space-like

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[155] Ibid, pp. 161-162.
[156] Ibid, p. 162.
[157] Ibid. For an account of experiments violating Bell's Inequalities under the assumption of locality, see Alain Aspect and Philippe Grangier, "Experiments on Einstein-Podolsky-Rosen-type correlations with pairs of visible photons," in *Quantum Concepts in Space and Time*, ed. R. Penrose and C.J. Isham (Oxford: Clarendon Press, 1986), pp. 1-15; W. Tittel, 1. Brendel, N. Gisin, and H. Zbinden, "Long Distance Bell-type Tests Using Energy-Time Entangled Photons," *Physical Review* A 59/6 (1999): 4150-4163.

separation, measure the spin state of one of the electrons. Electron one will be measured to be in a spin-up state. Due to the law of anti-correlation, the second electron must be in a spin-down state. But it must obtain this spin-down state only after the first electron is measured to be in a spin-up state. It could not have obtained it earlier, for, as has been shown, the two electrons are not in a determinate spin state until one of them are measured, due to entanglement. Thus, the instant that the first electron is measured to have a spin state, the second electron obtains a spin state. These events occur simultaneously and over great distances. Maudlin explains that

> Since the exact outcome of the experiment depends on which x-spin measurement is made first, the notion of ‘‘first’’ and ‘‘second’’ has an ineliminable physical role in Bohm’s theory. In the non-relativistic theory, which measurement comes first and which second is determined by absolute simultaneity. And if one is to transfer the Bohmian dynamics to a spacetime with a Lorentzian structure, one needs there to be something fit to play the same dynamical role. Since no such structure is determined by the Lorentzian metric, the simplest thing to do is to add the required structure: to add a foliation relative to which the relevant sense of ‘‘first’’ and ‘‘second’’ (or ‘‘before’’ and ‘‘after’’) is defined.[158]

If the second electron were measured first, it would be recorded as being in an x-spin up state, and the first electron would be measured as being in an x-spin down state. Thus the terms “first” and “second” must have some absolute sense in order to explain this. It cannot be considered as measured first relative to some reference frame, or else one would be stuck with the same discrepancies that are in Special Relativity. Tooley, when asking the question if this phenomenon could be explained by relative simultaneity, states “It would seem that it cannot, since if it were true merely that the acquisition of a determinate spin by the second electron was simultaneous with the acquisition of a determinate spin by the first electron relative to some inertial frame, F, then there would be another inertial frame, F, such that, relative to that frame, the second electron

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[158] Maudlin, “Non-Local Correlations,” p. 162.

acquires a determinate spin after the first electron does."[159] If it were relative simultaneity, either electron could be considered to be measured first, and thus one is at a lost as to an explanation of why one electron was in fact in an x-spin up state and the other was in an x-spin down state. For if the position of the particle does play as important a role as scientist know it to, then whichever particle is measured first should be in the x-spin up state. But then, it should be measured that both of them are in an x-spin up state, since relative to one frame electron one is measured first, and relative to another frame electron two is measured first, which violates the law of anti-correlation.

The determination of which electron is measured "first" and "second" is not the only part of the EPR experiment that requires one to adopt absolute simultaneity. Michael Tooley has shown that in order for the EPR experiments to occur free from paradox and contradiction, the two electrons must obtain a definite spin state simultaneously.[160] There are two ways in which they can do this: one could adopt either a de Broglie-Bohm type theory with instantaneous causal signals, or a GRW (Ghirardi, Rimini, Weber) wave collapse theory. The de Broglie-Bohm model stipulates that there are causal signals that move faster than the speed of light, which are sent out from one of the electrons to the other upon its measurement. This means that when one of the electrons is measured, a causal signal goes out from it and reaches the second electron instantaneously. This causal signal is what causes the second electron to obey the law of anti-correlation. Once the first electron is measured as being in a spin-up state, the causal signal travels to the second electron and influences it to be in a spin-down state.

The GRW theory, on the other hand, does not stipulate the existence of causal signals that move faster than the speed of light. Instead, it states that the wave functions of the two electrons

[159] Michael Tooley, "A Defense of Absolute Simultaneity," in *Einstein, Relativity, and Absolute Simultaneity*, p. 241.
[160] Tooley, "Absolute Simultaneity," pp. 239-242.

constitute a single system. When the wave function of one of the electrons is disturbed, the entire system is disturbed. Thus, the two electrons are not causally connected, but rather, correlated. When the wave function of the first electron collapses due to the measuring of it, the wave function of the second electron collapses instantaneously. This way, one does not need to stipulate the possibility of causal signals moving faster than the speed of light.

It has been mentioned that once the first electron is measured to have a definite spin state, the second electron must obtain a definite spin state simultaneously. But why must this acquisition be simultaneous? Maudlin poses the situation: "The collapse can be instantaneous in at most one reference frame, leading to two possibilities: either some feature of the situation picks out a preferred reference frame, with respect to which the collapse is instantaneous, or the collapse is not instantaneous at all."[161] Tooley considers this possibility that the second electron obtains a definite spin state at some time later than when the first electron obtains a definite spin state, as opposed to simultaneously.[162] Given this option "there is a temporal gap between the time at which the first electron acquires a determinate spin, and every moment at which the second electron has a determinate spin."[163] However, this would mean that during this gap, the second electron would be capable of being measured by a Stern-Gerlach device. From this, "it would be possible for the measurement to yield a value for the spin along the axis in question that, in conjunction with the value of the spin of the first electron, would imply a violation of the principle of conservation of spin."[164] In other words, if the first electron is measured to be in a spin-up state, then, given a temporal gap, it is possible for the second electron to also be measured to be in a spin-up state,

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[161] Tim Maudlin, *Quantum Non-locality and Relativity* [Oxford: Blackwell 1994], pp. 196
[162] Ibid.
[163] Ibid, p. 240.
[164] Ibid.

which would violate the law of anti-correlation. Thus, it is impossible for there to be a temporal gap between measurements. The two electrons must obtain a definite spin state at exactly the same time, no matter how far apart they are, and this requires the existence of absolute simultaneity.

5.4.3. Conclusion

From these two theories and experiments, one can see that there is an obvious trend in modern physics to confirm the concept of absolute simultaneity: not only theoretically, but also physically. In order to provide an adequate description of the evolution of the universe on a cosmological scale under General Relativity, one must accept that there exists a preferred hyperplane of simultaneity for the entire universe. This is supported by the large-scale homogenous and isotropic structure of the galaxies as well as the Microwave Background Radiation that permeates all of the universe. This establishes a cosmic time that is separated from space and acts as a parameter to the spacelike hypersurfaces of Spacetime. Quantum Mechanics also establishes the existence of absolute simultaneity through the EPR experiment. With the phenomenon of entanglement, as well as the law of conservation of spin, one discovers that two particles that are spacelike separated from each other can both be affected simultaneously by a disturbance of just one of the particles. This simultaneity is not relative, but absolute. With the existence of absolute simultaneity, the structure of Spacetime, which is based off of the Special Theory of Relativity's doctrine of relative simultaneity, is completely changed. No longer must the scientifically informed person stipulate that all times exist and that there is no absolute present. With absolute simultaneity, one can say that the different hyperplanes of simultaneity are mathematical concepts which have no basis in reality. Rather, they are all a result of clock retardation which causes clocks to get out of sync with the universal clock which measures cosmic time. Thus, the A-theorist is able to avoid the charge that Spacetime requires all times to exist and that there is no absolute time that can be called the "present," as they, like Maudlin, "reject Relativity as the ultimate account of spacetime structure."[165]

[165] Maudlin, *Quantum Non-Locality*, p. 220.

Conclusion

It has been shown thus seen that the Kalām Cosmological Argument does in fact require the A-Theory of time in order to make sense of the term “comes into being.” If one stipulates that the Spacetime block of the B-Theory comes into being, then they must add a hyper-time dimension, on which the problem of coming into being resurges. From the preceding investigation, it has been shown that the A-Theory of time possesses more warrant than the B-Theory, and thus in order to fulfill their epistemic duties, one must adhere to the A-Theory. The A-Theory’s notion of the present moment and temporal becoming is confirmed by experiences, which are properly basic. These experiences cannot be explained on the B-Theory of Time, and hence one is forced to adopt the A-Theory until it is found that the B-Theory has equal, if not more, warrant for its position. But as shown, though the B-Theory was the scientifically grounded theory in the early 1900s, recent research has made the claim that Special Relativity discloses the proper structure of Spacetime highly dubious. In fact, Einstein’s own General Theory of Relativity helps to prove this. Thus, since the major argument for the B-Theory fails in view of contemporary Cosmology and Quantum Physics, and since there is no compelling reason for one not to accept their experience of the present as veridical, one must conclude that the A-Theory of Time is correct, and hence the Kalām Cosmological Argument has a basis in reality.

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