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Chapter Four

TIME: THE SCIENTIFIC ACCOUNT

In the history of science it has frequently been observed that every new theory involving highly abstract ideas has to be discussed and argued about for some time among the big brains, the egg-heads and the boys with the bifocals before it can be understood by the educated public in general. In the ordinary processes of conversation the words and phrases and analogies essential for its verbalization have to be generated and re-combined and hammered out in various ways before the theory can be communicated meaningfully to a larger audience.

At first the search for terms with which to convey the new idea is slow and tedious and, for all but a few specialists, quite inadequate. But in the course of time a form of literary 'natural selection' operates to eliminate terms that prove inappropriate, and to refine those that clarify the issues. Modes of expression are standardized. Specialized vocabularies emerge, and acceptable analogies find currency. More and more individuals come to attach the same meanings to phrases that are commandeered as the particular property of those who possess the new truth. A scientific jargon grows up that facilitates expression and gives new freedom not only to the *exchange* of ideas but even to the *creation* of them. The more abstract and removed from common sense the theory is, the longer it takes for it to percolate down to the lower levels. Occasionally the process is accelerated by the appearance of some scientific genius who has a peculiar gift for expressing the abstruse in remarkably appropriate common terms, thus bridging the gap from the specialist to the layman more rapidly. Sir Arthur Eddington and Sir James Jeans were men of this type.

The Theory of Relativity is a case in point. The difficulty of making the implications clear was increased by the fact that the concepts being dealt with were common ones, like space and time. This had the effect of misleading the public into supposing that employing the terms themselves is equivalent to grasping the special meanings now being attached to them. Since relativity is applied to *time,* everybody knows what is meant because we all experience apparent fluctuations — when we are waiting for somebody or when we are trying not to be late! And as far as space is concerned, it is just an enormous empty box with no top or bottom, and with the sides knocked out. All this is plain common sense.

The problem was further complicated by the fact that the novelty of the idea stirred the imagination of popular science writers who explained Relativity to their readers by the use of analogies which at first appeared to give immediate insight into the new mysteries but afterwards proved to be somewhat misleading. Those whose thinking had taken the wrong road found it difficult to escape from the insights supposedly gained. In order to achieve the more profound understanding, they had to undo their thinking and start again.

This chapter will suffer from both these difficulties: from the fact that we must use terms which we already assume we understand, and analogies which are bound to break down if they are pressed too far. Undoubtedly much discussion and argument will be required to generate the more precise terms and phrases needed to crystallize the somewhat new application of the Theory of Relativity to the biblical meaning of time and eternity and to the experience we shall all face when we make the passage from the one to the other as we pass out of this world into the next.

Time: an epiphenomenon of space

Now one of the basic tenets of Einstein's theory — and one which, as we have seen, he was by no means the first to enunciate — is that Time has no meaning or reality apart from the physical universe, and it cannot be said to have existed prior to the creation of it. This in itself is difficult enough for anyone who has not reflected upon it before. But there is an equally important corollary: namely, that in a purely spiritual world (in which matter as presently constituted has no place) the same situation would exist — there would be no passage of time as commonly understood. This must have been true before creation when only God existed. And when the present order of things is over there will still be a real enough world but it will be a world transformed in the same way that our physical bodies are to be transformed, possessing characteristics and capabilities entirely foreign to our present experience. The transformation is analogous to that which occurred to the Lord's body after the resurrection. Clearly his body no longer occupied space, even though He could at will so materialize it that they could hold Him by the feet, and Thomas could explore the wounds with his finger. Such a real world in which things do not occupy space has to be a world in which there is no time, or a world in which there is an entirely new *kind* of time.

The Theory of Relativity has brought to light the fact that Time does not exist in its own right, nor does it have a rate of flow which is eternally fixed. I do not mean by this merely that time is experienced by individuals differently while the rest of us continue to observe its uniform passage at an absolute rate. I mean that even if there was no one present at all, the flow of time would still be different in different parts of the universe. It has no universally sustained flow rate. Considered objectively, there is no absolute rate at which time flows by, or will flow by in the future, or has flowed by in the past. This is where we have to rethink our concept of Time. It is something which has been experimentally demonstrated in an entirely objective way, and has nothing whatever to do with the private world of the individual and his subjective experience of time.

Furthermore, Time turns out to be a kind of epiphenomenon of space and is therefore eclipsed in the experience of all those who escape from the confines of the natural world to which the concept of space is wedded. The relativity of Time in this sense is now part and parcel of the philosophy of modern physics, yet it is really only understood — apprehended, would be a better word — by something akin to spiritual insight. And the implications of it are highly complex, particularly with respect to the experience of the soul's passage from this life into the next when the journey is made from time into eternity, from a world confined in space into a world which is not confined in space. The light which is thrown upon many portions of Scripture in this connection fully justifies the effort which will be necessary to perceive the implications of what we are going to talk about in the rest of this volume — an effort made particularly necessary because we have first to abandon our common sense views of what Time is.

That Scripture explicitly and repeatedly takes into account the fact that Time is wedded to the material world but not to the spiritual world is by no means a new discovery. As we have seen, philosophers like Philo and theologians like Augustine saw it clearly enough. But a careful exploration of those passages of Scripture which reflect this wonderful truth reveals much more than has been hitherto suspected: and the revelation is, to put it quite simply, a truly wonderful one. But before examining these passages it will help somewhat to review briefly the historical background of the events which led up to Einstein's formulation of the essential principle of the Theory of Relativity. It is, however, very important to observe that the experiments which led to Einstein's formulation of the concept of the relativity of time are not the basis upon which our understanding of the New Testament view of time must be built, although they *have* provided a stimulus to a more careful study of the implications of what is said in the New Testament on the matter. Even if the Theory of Relativity should one day prove wrong, we can still be thankful that it was formulated because it has led us to a more perceptive examination of what the New Testament has been saying about the journey we shall all make out of time into eternity when we pass to be forever with the Lord.

It will be convenient in this study to consider the matter under two headings: first, RELATIVITY of *time;* and second, its coincidence with or dependence upon the physical world. In slightly different terms these might be stated in the form of two questions: How fast does time really go? and What kind of life shall we live when it is independent of matter and therefore of space — and so also of time?

The first question involves us in a brief review of the experiments which led Einstein to his formulation, and the second involves us in what the Word of God has revealed about the nature of eternity — which, in the chapters which follow, will carry us away from science and philosophy into the Scriptures themselves.

Measuring the speed of light

Now it was once thought that light was instantaneous. No sooner did a man switch on his flashlight than the beam hit the wall. The speed of a light beam was *infinite*. But in the seventeenth century an astronomer named Ole Roemer (1644 - 1710) found that eclipses of the moons of Jupiter occurred sixteen minutes earlier when Jupiter and the earth were on the same side of the sun than when on opposite sides. After some reflection, he rightly concluded that light was taking *time* to arrive at the earth. Light was therefore not instantaneous after all. The difference in distance between the earth and Jupiter in the one case made the light late in arriving, so that the events at Jupiter were seen later than expected. His predictions of the timing of the eclipses of its moons thus needed correction. By measuring the "error" in time and knowing the distances involved in the two situations, he was able to calculate how long it took for the light to cross the intervening distance. The time measured was sixteen minutes and when this was divided into the number of miles, he found that the speed of light must be approximately 186,000 miles per second. His discovery was published posthumously in 1735. Subsequent experiments have refined his calculations, now showing the speed of light to be nearly 186,283 miles per second.

This discovery was quickly seen to be the possible answer to a cosmological problem which had been interesting astronomers for sometime. It was supposed that if a light beam from an object in the heavens passed the earth at a known speed other than 186,283 miles per second, the difference would tell us whether that object was drawing nearer to the earth or away from it — and at what actual speed. By making measurements of this difference from various sources of light out there in the universe, we ought to be able to construct an accurate picture of the relative speeds of any object in space. We thus would have a meter for determining the true motions of all other visible objects and could work out what was going where — and, equally importantly, what the relative positions had been in the past. Thus by extrapolating backwards there would finally emerge a complete picture of the history of the universe, showing the precise positions of all heavenly bodies at any point as the universe evolved. All these bodies in space were viewed rather like blobs of material floating around in some kind of cosmic ocean, the substance of which had very special properties. It was not exactly like water, for obvious reasons, but it was very real. It was called *ether.*

Now it is necessary to say a word or two by way of background information regarding the concept of a supposed universal ether in which everything floated and made its circular movements in a smooth and orderly manner.

A beam of light behaves in a peculiar way. Its behaviour has led to considerable controversy as to its nature. Sometimes it is best explained by treating it as corpuscular, in which the beam is represented by a kind of shotgun explosion of small pellets called *photons* (particles of light). These photons are believed to have mass and therefore to impact any object against which the stream of photons is fired. Isaac Newton strongly favoured the corpuscular theory. Sir James Jeans speaks of the gain in weight which results when a photographic plate is exposed to light, as though some of these particles had adhered to it. And he speaks of a target that can be shown to "flinch under the impact of radiation from a bright light, just as though a bullet had been fired into it."[54] Furthermore, a light beam is bent in passing an object, the particles which compose it evidently being influenced by the magnetic field of the near body. Such findings seemed to justify the concept of some kind of material substance being involved.

But in the early nineteenth century, the work of Thomas Young in England and Augustin Fresnel of France demonstrated that a wave motion of some kind must also be involved since beams of light which coalesce or cross each other seem to interfere with each *other* or combine much as sound waves do. Since all other kinds of waves, whether sound or water, can only be transmitted through some physical medium such as air or water, it seemed natural to postulate that light waves also require a similar medium of transmission. However, this medium must be tenuous enough that the earth does not burn up as it races through it in its path around the sun, yet it must also have substance enough to permit the transmission of these waves of light. So in 1818 Fresnel revived the concept of ether, a name which was really only another word for some kind of medium with unique transmission properties like nothing hitherto known experimentally.

The virtual impossibility of reconciling the two concepts of the nature of light — whether corpuscular or a form of wave motion — has stimulated unending debate since it is difficult to see how it could be both. Stanley L. Jaki remarked:[55]

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[54] Jeans, Sir James, *The Mysterious Universe,* Cambridge (England), Cambridge University Press, 1931, pp. 48 and 56.

[55] Jaki, Stanley L., *The Relevance of Physics,* University of Chicago Press, 1966, p.92.

> It is almost amusing to recall how often either one or the other theory was declared to be definitely and finally destroyed. For there could be no truce, no compromise, between conflicting concepts like waves and corpuscles, because it was of the very essence of mechanism that conceptual explanations must reflect the unitary mode of existence of the real world, which was taken to be mechanical.

The cosmological principle

Meanwhile, various schemes have been proposed for establishing the absolute speed of the earth through this "ethereal ocean." If the earth is moving through an ocean of some kind, it ought to be possible to demonstrate it. It is essential to establish the earth's motion as a basic reference point for all other extra-terrestrial measurements of movement. If this is once done, it should then be possible (using the speed of their light past the earth as the tool) to determine the absolute motion of all other visible bodies in the universe. But the prior question that has to be answered is this, Does the ocean itself have a current of its own or is it at absolute rest? If this can be established firmly, and the speed of the earth through it, then on the basis of what is known as the Cosmological Principle the movements of all other distant galaxies might also be established. The Cosmological Principle makes the assumption that the earth is not in any unique place in the universe and therefore that what is observed of the universe from the earth would also be observed of the universe from any other galaxy. It assumes that we can safely extrapolate from our local findings and gain information about what is going on everywhere else in the universe. The important thing is to find out what the earth's motion through space really is in order to interpret the apparent motions of all other galaxies that we can observe.

The situation is, however, further complicated by the fact that we appear to be living in an expanding universe. The distance between other galaxies out in space and our own seems to be increasing as the perimeter of the universe is enlarged. This increase in distance between us and them could mean that we are chasing these remote galaxies but losing the race, like a dog chasing a car. On the other hand, it could mean that they are really chasing us, while *we* are making *our* escape. A third alternative is that we are *all* flying apart like fragments flung out from some prior explosion in an ever widening circle. In any case, both they and we are moving and the distance between us seems to be increasing. But we don't know which of these three possibilities is really occurring. If the ether exists and is stationary, we should be able to discover the precise nature of all these movements by trapping the light from any given star as it passes the earth or as it impacts upon it and comparing its velocity with our own known speed through the ether.

The Michelson-Morley experiment

Such in principle was the prospect up to the time of the second (and more famous) Michelson-Morley experiment conducted in Cleveland, Ohio, in 1887. It was a crucial experiment because it finally disproved the hypothesis of a universal luminiferous (i.e., light carrying) ether. And the problems it posed turned out to be the pabulum for Einstein's theory regarding the relativity of Time. The background of this experiment is, very briefly, as follows.

If we know that the velocity of a wind is 30 miles per hour and we run towards it and find out by a wind meter that it has increased to 36 mph, we know we ourselves are moving towards it at 6 mph. If we run with the wind and the wind meter shows that it is now passing us at only 24 mph, we know that we are still moving at 6 mph — but in the opposite direction. If our meter shows 30 mph, we know we are either stationary or running *across* its course, neither into it or away from it.

This is a principle which could be used to determine the speed of the earth through the ocean of ether, especially if the ether has a current of its own. If the ether is not stationary, the movement of the earth through it is analogous to the individual who runs into the wind or away from the wind or across the wind. All we need is a meter that will read what our speed is in the three situations. It is also a principle that could be used with modifications to find the relative velocity of the stars, for the velocity of the earth around the sun could be added to or subtracted from the speed at which a beam of light from any particular star is coming towards us. Knowing our own speed around the sun, we could then determine whether the star was moving towards us or away from us, and at what speed — since we know what the speed of light is. We merely add or subtract our own speed from that of the beam of light reaching us from that star. The earth's velocity through space, detected by either an addition or a subtraction of the speed of the beam of light, would indeed be very small; but it was believed that with sufficiently accurate instruments a useful measurement might be made. There are other complicating factors, but the only object at the moment is to demonstrate the basic principle involved.

Towards the end of the last century two men in particular became involved in an attempt to settle the question of the earth's speed of passage through the supposed ether. They were Albert A. Michelson (1852 - 1931) and Edward Morley (1838 - 1923). It is not necessary to describe here how they went about it: what is important is to note one unexpected result from their experiments.

Their first experiment was undertaken in 1881. It seemed to demonstrate that there *was* no ocean of ether through which the earth was moving, but the results were challenged on the grounds that their experimental procedure was faulty due to vibration from local traffic. In 1887 with improved equipment, a location largely free from such vibrations and with a sophisticated mounting for the instrument that dampened any vibrations there might be, they fully verified their previous findings and convinced the scientific world that the earth was not moving through any kind of medium such as the ether was supposed to be.

But they did discover something else. They found that a light beam trapped in their instrument took the same time to traverse the course whether the instrument was moving towards, or across, or away from the source of light. This, of course, is theoretically impossible! If light has a fixed speed (as was assumed) and we move towards it at some measurable velocity, the light must impact us at a velocity equal to the two speeds combined. But although the instrument in its refined design was fully capable of detecting the theoretical increment in speed that was predicted, no such increment was observable. Writing in the British science journal, *Nature*, R. S. Shankland summed up the experimental evidence by saying:[56]

> The work with this apparatus continued from 1886 until July 1887 and was conducted in buildings on the adjacent Case and Western Reserve campuses. The definitive null result obtained in these experiments led to profound changes in the development of physics. . . . It is needless to say that the most direct and now universally accepted explanation for the Michelson-Morley experiment. . . is provided by the Special Theory of Relativity given by Albert Einstein in 1905.

J. W. N. Sullivan commented on the significance of what they had found regarding the uniform speed of light in the following words:[57]

> [The *Michelson-Morley* Experiment] has been repeated many times. In principle it is very simple. If the earth is moving through a stationary ether, it can be shown that two rays of light, the one moving in the direction of the earth's motion and the other at right angles to it, should take unequal times to cover the same distance. But although the experiment has often been repeated, no

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56 Shankland, R. S., "Michelson, A. A., 1852-1931", *Nature,* vol. 171, 17 Jan., 1953, p. l02. p. 70.

57 Sullivan, J. W. N., *Limitations of Science,* Harmondsworth (Eng.), Pelican, 1938, p.69.

> difference has ever been found, though in some of these experiments the apparatus has been so delicate that a difference a hundred times less than the difference expected could have been measured. . . .
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> The dilemma thus created is a very real one and the way out, which was shown by Einstein in 1907, is an effort of genius of the highest order. Einstein asserted that *the velocity of light is always the same whether we measure this velocity from a system which is in motion or a system that is at rest.*

Consider what this implies. If the light beam from a flashlight travels through the air at 186,283 miles per second, the speed of the beam of light is not accelerated one iota by switching the flashlight on when it is in rapid movement in the same direction as the beam. Were we to shoot the flashlight from a gun with a high muzzle velocity and switch the flashlight on by remote control in mid-flight and then measure the speed of the beam of light emerging from it, we would find it still was traveling at 186,283 miles per second — and no more! Even more surprising is the finding that if the flashlight itself is stationary and we fly into the beam as fast as we can possibly go, we shall still find that the beam of light is coming towards us at precisely the speed it does when we are not moving at all, namely, 186,283 miles per second!

William Hudgings put it this way.[58]

> Einstein's declaration is that if two observers are on opposite sides of the rotating earth, one revolving away from the sun and the other towards it, the instruments of each observer will indicate that the rays are traveling past him at exactly the same speed. . . regardless of whether he is traveling towards or away from the sun. This phenomenon has been referred to as Einstein's *Principle of Constancy*. It means simply that light impacts an object at a uniform velocity regardless of whether the object is moving away from or towards the source of light at any speed less than the speed of light.

Let me repeat this once again by using an analogy. If you stand up in an open car and are driven towards me at 20 miles per hour and I throw a baseball towards you at 30 mph, the ball will meet your hands at 50 mph (the sum of the two

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[58] Hudgings, William, *An Introduction to Einstein's Theory of Relativity*, Girard, Kansas (U.S.A.), Haldiman-Julius, 1923, p.23.

speeds) and the impact will be very painful! If you are driven away from me at 20 mph and I throw a baseball to you at 30 mph, it will strike your hand at only 10 mph (the difference between the two speeds) and you'll feel no pain at all in catching it. Thus your speed towards or away from the ball which is thrown towards you always at the same speed makes a profound difference on the force of the impact with your hand. But one of the results of the Michelson-Morley Experiment was to demonstrate that this is not true with a beam of light. Though it does have a measurable velocity and does actually impact when it strikes something, it makes no difference to the force of the impact — no matter what the speed of the receiver is, whether traveling towards or away from the source of light. Nor does it make any difference at what speed the object is moving that emits the beam of light to begin with.

Time: the fourth dimension

Einstein offered a deceptively simple explanation. The speed of anything has to be measured with a clock, and the clock which is moving towards the source of light is ticking off one kind of seconds-interval and the clock which is moving away from the source of light is ticking off another kind of seconds-interval. Each clock is actually running at a different rate. In the case of Hudgings' two observers, one on each side of the globe, one moving towards and one away from the sun, two clocks were involved *and they were keeping different time.* They may have been synchronized when the two observers met together on one side of the globe before the experiment, but by the time they had parted company and were standing on opposite sides of the globe, each traveling at up to a thousand miles per hour in opposite directions (depending on where they were positioned), their clocks no longer kept the same time. *It is not that they were operating in a* different time zone, it is rather that the hands of their clocks were moving around *at different speeds.* Accordingly, their measurements of the speed of the impact of the light beams were different.

Taking into account the difference in the rate at which the two clocks were running, the logical contradiction of any such experiment can be resolved. Each clock marks the passage of time at a rate dependent entirely upon its movement through space, and since the observer travels with it he is quite unaware of this flow rate of time. Time is not merely subjectively relative in its rate of flow past the observer, but it is also *objectively different* for the two observers.

The question then arises, Which of the two clocks is running at the proper speed? Einstein's answer is, "Both" and "Neither": there is no such thing as an absolute speed for the passage of time. The passage of time is entirely relative and its rate of flow is established by each observer in each situation for himself. As soon as I take my clock into his particular situation it promptly keeps his time, but I am not aware of any speeding up or slowing down that has occurred because my clock has now changed to his time rate. Since we are both in the same situation, the clocks synchronize. It is therefore impossible to discover the "error" in a clock, if one can speak of an "error" in such a situation. In some way Nature has contrived (sometimes the word *conspired* is used) to make it impossible to discover any absolute rate of the passage of Time. Until we state *where* the time is to be measured, in what part of the universe and under what circumstances, we cannot say with any certainty at what rate it is flowing. Thus Time is bound up with *movement through space*, and it becomes *a* fourth dimension.

The clock paradox

Experiments have since demonstrated that any clock which is moved through space either at an accelerated rate or in an arc (and this applies to the clocks held by Hudgings' two observers) will slow up.[59] How much it slows up depends upon the rate of acceleration. It thus happens that if a man were to be shot into space in a circular arc which would bring him back to his starting point, and if when he began his journey he synchronized his watch with his wife's who stayed at home, when he got home he would find that he was younger than he ought to be by just the amount that his watch had been slowed up in his journey. His wife, being stationary, would have experienced "normal" time, while he would have observed a slower passage of time and would accordingly have aged less in the interval. It is believed that all the chemical reactions in his body would also have been slowed up so that his greater youthfulness would not merely be the result of the difference in the two clocks.[60]

This slowing up with the right kind of motion is a real effect and not merely a theoretical one. It is born out by the fact that certain radioactive substances (whose normal life is known) have an increased longevity when they are moved at high rates of acceleration. J. Bronowski observed in this connection:[61]

> For example, we know by observation how long a meson of one kind survives from the instant of its creation to its disintegration if it remains at rest. We also know by observation how long the same kind

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[59] On this see Robert Walgate, reviewing J. G. Taylor, *Special Relativity* in *New Scientist*, vol. 67, 24 July, 1975, p.223.

[60] Rothman, Milton A., "Recent Events in Relativity" in *Annual Report of the Smithsonian Institute*, 1964, Publication No. 4613, p.397.

[61] Bronowski, J., "The Clock Paradox," *Scientific American*, vol. 208, no. 2, Feb., 1963, p.136.

> of meson survives when it is travelling at high speed. The travelling meson lives longer, *in our time,* than the meson at rest [my emphasis].

Now this "clock paradox," as it is called, is not a conundrum dreamed up to intrigue the public or challenge budding philosophers, but is a clearly predictable and recently demonstrated fact. The universe really is so constituted that clocks behave in this baffling way. A physicist (Joe C. Hafele of Washington University in St. Louis) and an astronomer (Richard Keating of the US Naval Observatory) have verified the reality of the paradox.[62] In October of 1972, using four extremely precise atomic clocks, they set off on two successive round-the-world plane trips in opposite directions. On the east-bound trip they travelled with the earth's rotation and therefore added their airspeed to the earth's speed of rotation relative to a "stationary" clock back in Washington University. On the west-bound trip they subtracted the earth's speed of rotation from their airspeed. Thus the difference in speed along a circular path would be magnified between the two planes with respect to the stationary clock in Washington University. Since the clocks were synchronized at the start, certain divergencies in time ahead of or behind the Washington University clock were predicted.

The results of the experiment bore out the predictions. According to the theory, the clocks should have lost 40 billionths of a second on the east-bound trip and gained 275 billionths of a second on the west-bound. In actual fact the results were only 5% off the predicted value in the east-bound and 30% in the west-bound.[63]

Such discrepancies may seem far too small for validation, but it was evident that there was a real difference in time in each direction, and in the one case it was remarkably close to expectation. Moreover, in both cases the divergence was in the predicted direction. It may be wondered how such small divergencies could possibly be measured accurately. But it is necessary to bear in mind that the time-keepers were atomic clocks, governed not by the natural frequency of a balance wheel with, say, four reversals per second, but a cesium atom which when electrically excited vibrates precisely with a resonance frequency of 9,192,631,770 cycles a second. This frequency represents in effect nine billion ticks per second or 540 billion ticks per minute, and therefore 32,400 billion ticks per hour. Assuming the planes took several hours to make the round trip, this could easily involve a total of half a

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[62] See "Clocking Einstein," report in Science Section, *Tim*e Magazine, 27 March, 1972. See also Milton A. Rothman, "Recent Events in Relativity" in *Annual Report of the Smithsonian Institute*, 1964, Publication No. 4613, p.397.

[63] For a fuller report on this, see Nigel Calder, *Einstein's Universe*, New York, Viking Press, 1979, p.31.

million billion ticks during the interval. It requires pretty sensitive monitoring to detect such a tiny departure from expectation but it is not by any means beyond present competence. Hafele said afterwards, "The experiment was successful beyond our best expectations."

Time: no independent existence

So time has no set pace. Under different conditions it travels more slowly or more quickly. There is no such thing as absolute time. Moreover, time has no existence at all, independently of matter, because it has no independent existence apart from motion. Consider what would happen if all motion in the universe were reduced to zero. On this subject Thomson King makes the following observation:[64]

> As the rapidity of movements were everywhere reduced, events would occur more slowly compared with their present rate, *but not as compared with each other* [my emphasis]: for I am assuming that all motions would be reduced at the same rate. A "year" would be longer than our year, but a clock would tick the same number of beats as in normal years. Light would travel the same distance in a second, for seconds would be longer. When all motion was reduced to zero, time would disappear.
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> When the galaxies and the molecules ceased to move, when electrons no longer spun, when radiation (losing both frequency and velocity) ceased to be energy, nothing could happen; there would be no change, no events. There could be no flow of time; everything would be frozen in an eternal present.

In a spiritual world of which space was essentially non-material, time would be non-extensible in some as yet unrealized way. It would, in fact, become eternity. Everything would be present. It would make reality more real, not less real; for we recognize, even now, that in our world everything is constantly changing, nothing abides unchanged. But in a world in which change *per se* would no longer be necessary since everything is perfect, then time can be no more. We slip out of time into eternity when we pass out of this order of changing things into a new and perfect order that is as unchanging in its perfection as God is. As Augustine in his *City of God* expressed it: "If eternity and time were rightly distinguished by this, that time does not exist without some movement and transition, while in eternity there

[64] King, Thomson, "On Time as a Product of Motion", *Scientific Monthly*, vol. 67, October 1948, p. 290.

is no change, who doesn't see. . . that God, in whose eternity. . . is no change at all, is the Creator and Ordainer of time. . . ."[65] A truly remarkable anticipation.

A little later he wrote with profound insight:[66]

> Not in our fashion does He look forward to what is future, nor at what is present, nor back upon what is past; but in a manner quite different, and far and profoundly remote from our way of thinking. For He does not pass from this to that by transition of thought, but beholds all things with absolute unchangeableness. . . .

We really have no concept of what a changeless world would be but we can usefully explore some of the consequences of what timelessness might mean to *us* when we leave this vale of tears. And meanwhile we can answer the first question we asked, "How fast does time pass?" by saying that time has no absolute rate of passage and is almost certainly as transient a reality as the physical world in which we live. The real world is the world which is just beyond our vision, and it is an eternal world. In the present world, as Henri Bergson said, the only thing that is unchanging is change itself. Absolutely nothing is permanent. In the world which is to come we shall discover permanence in a new way and in a new form. Once we step outside this present world, the flow of time as we now experience it will cease to exist for us, even as it had not existed until God began his creative activities. There will be no conscious waiting, no "marking" time, no longing for that which is yet future, no wondering "if" or "when." We shall dwell as God dwells, "in eternity," where the past or the future can all be experienced in the present the moment we wish so to experience them — for *"time"* shall be no more (Revelation 10:6).[67]

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[65] Augustine, *City of God*, Bk. XI. 6.

[66] Augustine, *City of God*, Bk. XI. 21.

[67] I do not think it likely that the proposed alternative rendering of the word *time (chronos* in Greek) by the word *delay* is anything more than an attempt to obviate the difficulty that the average reader has in comprehending a "world without time." It is only rarely used in classical Greek in this secondary sense. Certainly it is not the primary meaning for the word and only comes to have this secondary meaning when the accompanying verb specifically indicates it — as, for instance, "begging for time," or deliberately "causing a delay" to serve one's purposes.

When God became man, the eternal was somehow wedded to the temporal, and time slipped easily in and out of eternity. In the next chapter we shall explore one critical occasion upon which this occurred for the Lord Jesus Christ.

☞ PROCEED