HOME

Time and Space – The Sequel

by

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Summary

To obtain increasing precision, time and distance are being defined in terms of atomic transitions or the electromagnetic radiation which they generate. This raises questions about fundamental uncertainties of physics: the nature of light and the existence of a medium of space. The paper considers the consequences of a particulate theory of light, including rotating electromagnetic dipoles, from the particle's origin in atomic bonds to its transmission through space. It proposes that distance-intervals are surveyors' tools devised by man for his purposes, whereas time-intervals measure the transmission of electromagnetic radiation from system to system, which must happen in all natural processes. In this case it is vital to know whether the attenuation of the frequency of electromagnetic radiation, that is astronomical redshift, is caused by the velocity of the emitter, which the analysis shows is unlikely, or by interaction with the medium of space i.e. the difference between clock time sent and received. The discovery of new phenomena, especially in space, could be missed.

A. Introduction

A theme running through previous papers in this series almost from the beginning has been that the theory of relativity is based on a misunderstanding. The papers showed that time and distance could not dilate, because they did not exist; they were not 'things' but concepts (1). To demonstrate this, a clock was devised based entirely on the numbers of sparks emitted by radioactive materials. The clock showed that the 'observer' effect postulated in relativity could not be valid, because such sparks are independent events with no connection between them. Thus there was nothing to dilate, and so all observers see the same sparks, whatever their so-called 'time-frame' (2). Time in the Universe was simply the time-interval taken for light to travel from the system which produced it to another system which intercepted it. In other words it was a function of the speed of light *in vacuo*, which is the fundamental constant that never changes (3). The conclusion was that space-time was a misconception, and that physics should treat space and time as orthogonal variables i.e. they could be varied independently. Space is just the cube of distance, and so it obeys the same rules.

All this showed that a return to a non-relativistic or Newtonian model was plain common sense. The mysterious phenomena which originally led to the devising of relativity required alternative explanations. Papers in the series proposed what these could be, including a new theory of light.

However, there is a feature of modern physics which remains to be resolved. Time-intervals and distance-intervals, which are fundamental measurements, are both being defined in terms of light, or more accurately electromagnetic radiation, because of the extraordinary precision which this offers. The danger is that measurements of space and time may interact through the shared properties of light, in spite of the arguments made above.

This paper analyses time and distance at the most fundamental level, and shows that the objections to the theory of relativity are valid. The orthogonal model is correct. However, using the same phenomenon for both measuring and evaluating is potentially confusing, because whatever varies in the environment must also vary in the measurements, so that differences are disguised. For example, if some unexpected phenomenon caused a length measured in metres apparently to increase when measured in a particular environment, it could also have the same effect on the length of the standard metre used to measure it, so that the change would not be detected. This could be particularly important in space and in astronomical measurements.

B. Light

The analysis begins with the new model of light developed in the papers. The current model of light is that it is an electromagnetic phenomenon with dual forms. It seems to be a progressive electromagnetic wave because it has the property of diffraction in which peaks and troughs cancel each other out. Thus light can be characterised by its wavelength, which is undoubtedly a very convenient description. However, Einstein himself showed that light also has the properties of particles; it acts like missiles knocking electrons out of orbits, as in digital cameras. Whether as waves or particles, it still travels at the constant speed of light *in vacuo*. Einstein hedged his bets and first called these particles ‘wavicles’, but then adopted the more dignified name of photons. What it really means is that ascribing dual identity to light shows that we do not actually understand light at its most fundamental level.

The new theory of light described in this series of papers develops a model which accounts for both particle behaviour and the phenomenon of diffraction by going back to the source of the emission (4). A light particle is ejected from a body by the acceleration of a particle of matter, for example an electron in a bond, in the form of an electromagnetic ‘disturbance’ like a whirlpool in the medium of space. The whirlpool is a rotating electromagnetic dipole or RED which travels away from the source at the speed of light by electromagnetic induction of the medium of space as it goes, progressing like a short length of spiral because of its speed. The rate of rotation corresponds to frequency in the wave model. The hypothesis is that there is a medium of space, even *in vacuo*, and that it has susceptibility to electromagnetic induction, not unlike the ether which was abandoned as a concept a century ago. The RED travels as a coherent entity i.e. a ‘particle’, and deflection of REDs by each other accounts for the phenomenon of diffraction.

The analysis which follows does not depend on the RED theory, but particles make it easier to present. So what of time and distance? Distance is considered first because it makes the analysis of time simpler to follow.

C. Distance

The simplest way to consider the concept of distance by using electromagnetic radiation is to shine a light from one particle of matter A to a second particle of matter B in deep space, that is *in vacuo*. The two particles of matter are at rest with respect to each other i.e. they have zero relative velocity. At its most fundamental then the distance from A to B is the number of rotations of a RED travelling at the speed of light *in vacuo* from A to B divided by the number of rotations of the same RED in a standard metre as defined, also travelling at the speed of light *in vacuo*. Particle A could send REDs in any direction, but the one which concerns us for our purpose is the one which travels in a straight line to Particle B.

When the RED has left Particle A, it has no further interaction with that particle. Neither does it have any interaction with any RED which left Particle A before it on the same line, or with any RED which left Particle A afterwards, because they all travel at the same speed, the speed of light, and so keep their distance. The RED cannot be detected from Particle A after it has left because it is travelling away from the particle at the speed of light, so that no information could be sent back by the RED, even if it wanted to. Neither can it be detected at Particle B, because the information cannot reach Particle B faster than the RED which is travelling at the speed of light. Moreover, it cannot be detected by an observer out of the line of travel.

In fact the RED has no physical interaction of any sort with any other particle of matter until it is seen by an observer, which means it strikes the detector and causes some change to announce its arrival. While it is en route, it might as well not exist as far as the rest of the Universe is concerned.

Of course we do not see it like that. We want to know how many rotations of the RED have occurred between particle A and Particle B. We solve this problem by placing a tape measure between the two particles of matter, so that we can read off the distance from the calibrations on the rule which could be in centimetres or wavelengths appropriate to the RED. In other words the distance becomes apparent only when we join in the process of measurement. The path of the RED is in one dimension. The introduction of the metre rule shows it for our benefit in two dimensions. The process is reversible without loss; we could send the RED from Particle B to Particle A and read off the same distance.

Distance is therefore essentially a stationary concept. It is important to us and no other part of the Universe. We need it to plan or keep accounts or as a surveyors' tool. We need it to substitute in equations when we try to interpret the processes of the natural world, but in the absence of acceleration produced by gravitational, electric or magnetic interactions it has no way of expressing itself in nature. As far as particles of matter are concerned, no particle of matter knows whether the next particle of matter is close or a long distance away; each lives in the immediate environment which is given to it. In this sense the concept of distance is therefore a human artefact which we use to investigate our surroundings, in this particular instance through electromagnetic radiation with its constant velocity *in vacuo*. We can set distance to any value we like. It is time which determines the consequences.

D. Time

If distance is the number of rotations of a RED between two particles of matter, time can be considered as the number of rotations of a RED travelling at the speed of light between two events. Both time and distance are based on the speed of light *in vacuo*, but time measures the period which elapses during transfers between processes i.e. the time-interval. The difference between time-intervals and distance-intervals is the dynamic situation inherent in processes.

For the purposes of analysis we can use a parallel procedure to that used for distance. Let us suppose that independent events are happening at Location 1 and 2, where an event is a snapshot of a process. The essence of a process may conveniently be called a system. Thus we have System 1 operating at Location 1 and System 2 operating at Location 2. When System 1 ejects a RED in the direction of System 2, the RED is independent of all other REDs and all other systems, as above. The difference is that System 2 is undergoing a process during the transit of the RED from System 1 to System 2.

This process means that the RED does not know where and when it will interact with a receptor while it is in transit from System 1 to System 2. System 2 may contain many potential receptors. The eventual receptor may approach the RED during this time, in which case the RED will strike sooner, or it may recede and be struck later. Alternatively the receptor may rotate, so that when the RED arrives, it strikes a different particle of matter from the one which was in line of sight when it set out i.e. a different receptor. Or the system may simply have exploded and the receptor been knocked out of line. By the same token, this process is not reversible. If we send a RED back from System 2 to System 1, System 1 will have changed by the time the RED arrives. What we measure with electromagnetic radiation is the time-interval between emission and absorption of a RED during which change occurs.

These are the processes of the Universe which continue *ad infinitum* without our involvement. We do not feature in the exchanges at any stage, unless we are one of the systems. In more general terms, the outputs of all systems become the inputs of all others. Time changes in one direction only, because outputs must precede inputs. The time-interval between individual outputs and the inputs into other systems is the number of rotations of a RED travelling at the speed of light in any convenient unit of measurement. It cannot be predetermined because the speed of light is not infinite, and so there is always a time-interval during which changes can occur. This is the real operation of the natural world, rather than some idealised concept.

The corollary is that time measured by this methodology cannot be specified exactly; the future cannot be predicted with absolute certainty. When the RED will arrive is a matter of probability. The time which elapses between emission of the RED by System 1 and reception by System 2 decouples the two systems by providing an interval during which each can carry out its own processes without intervention by the other.

The number which represents the time-interval depends on the constant velocity of light *in vacuo*. If time is to dilate, the velocity of light *in vacuo* must therefore dilate. But its constant value was the origin of the whole relativistic thesis, and so the theory of relativity contains an internal inconsistency.

E. The redshift effect

The light from almost all stars is shifted towards the red end of the spectrum. We know this because every atom of every element emits that element’s characteristic pattern of spectral lines. When the light from a star has that pattern, it must therefore be from the same element on the star that we see on Earth. However, for almost all stars the pattern occurs at longer wavelengths i.e. the spectral lines are moved towards the red end of the spectrum. This is the redshift.

When Hubble first observed redshift he concluded that it was caused by the stars' rapid recession away from Earth, which stretched out the light waves by analogy with the Doppler shift for sound. He also believed that the further away the star was from Earth, the bigger its redshift and the greater its velocity. In fact most measurements of redshifts apply to galaxies, not single stars, but his conclusion was the same: there must have been a point at which all matter was concentrated in a sort of kernel, and it was thrown out in all directions by an explosion to form our Universe: the 'Big Bang'.

There are a number of objections to this theory of redshift. By what mechanism does redshift occur if light is not waves but takes the form of particles? How can the velocity of the emitter affect the frequency of the particle of light emitted? Where does the reduction of frequency occur? The comparison with the Doppler effect in gases is false, because particles of gas are atoms and molecules which interact with each other mechanically i.e. they exert force on each other, hence pressure. It is this which gives rise to the Doppler effect. By contrast as shown above, particles of light cannot interact in transit through the free space between particles of matter because they all travel at the same speed, the constant speed of light *in vacuo*. Nor do they have momentum. In fact what the current theory does is to apply the theory of Newtonian mechanics to a phenomenon to which it is irrelevant.

Electromagnetic radiation is emitted when electronic transitions occur in an atom as a result of stimulation, say by heat. These are the same electronic transitions which occur during the reaction of atom with atom, which we call chemistry, and they are each associated with a particular energy level. In fact the fundamental hypothesis of science is that atoms and their combination into molecules, which we call chemistry, are the same everywhere in the Universe at all times. Anything else would be unsustainable.

So if we went to notional planet near the star Proxima Centauri, we would find that stimulation of a helium atom produced exactly the same electronic transitions and gave spectral lines with exactly the same pattern and wavelengths as on Earth. This is what the observer would see on the laboratory bench on that planet, and we would expect it to be the same further out into space, say at the top of a mountain or even out in the planet's 'ionosphere'. We would also expect it to be the same if the observer got closer to the electronic source, even to the locus of emission of the photon. But the light would still be redshifted when we observed it from Earth. So where did the change of wavelength occur?

The papers in this series proposed that redshift occurs not because of the velocity of the emitter but because wavelength increases during transit through the medium of space to Earth. It is not easy to envisage how a single photon changes its wavelength, because it is not clear where the information about wavelength resides in such a particle. In fact it is not easy to see how a single wave which it is supposed to represent could do the same. However, the 'wavelength' associated with a RED would increase if its rate of rotation slowed down as it travelled through the medium of space. Since the rate of rotation is equivalent to frequency, then according to Planck the RED appears to lose energy in transit. If so, where does this energy go? The explanation in the papers is as follows.

The primary RED generates a secondary RED by electromagnetic induction, the same phenomenon which gave rise to the RED in the first place. Since the energy of the complex remains constant, the increased frequency of rotation of the secondary RED is compensated for by a reduced frequency of rotation of the primary. At any point in transit, the decrease of the frequency of rotation of the primary RED is proportional to its frequency of rotation. This results in an exponential decline in the rate of rotation, which is equivalent to an exponential increase of ‘wavelength’ from source to observer. Redshift would certainly be an indication of distance, but a star would appear to be much further away than it actually is (5).

In view of this, it may be necessary to re-examine measurements of distance and time. This is easier to describe in ‘wavelengths’ than in frequencies of oscillation or rotation.

If the arrows represent a wavelength of light sent from A to B, the total distance is the number of wavelengths multiplied by the length of a wavelength, represented by an arrow. It does not have to be a continuous line of waves; it can just be one wave moving from position to position across the page (Figure 1).

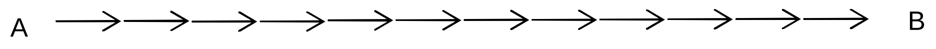

Figure 1. Progress of a wavelength with no redshift

This is the ruler or surveying tool with which we measure a metre in wavelengths and then multiply it up.

However, if we are sending a RED from A to B, a redshift occurs, because we are dealing with a process. The progress of the single RED in ‘wavelength’ terms looks more like this:

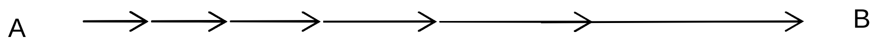

Figure 2 Progress of a RED with redshift

The light or RED does not move any further or faster than used in the distance calculation, since the speed of light *in vacuo* is constant, but the apparent wavelength increases exponentially because the rotation of the RED slows down as it travels through the medium of space. The velocity of the RED remains at the speed of light.

The process is reversible in the sense that we could send an identical RED from B to A and the redshift on arrival would be the same. However, we can no longer calculate the distance from A to B by multiplying a wavelength by the number of wavelengths, because the length of a wavelength is changing throughout. Nor can we use the average of the initial and final wavelengths because the increase is not linear. We need to take account of the exponential curve, and to do this we need to calibrate its parameters by some exogenous technique.

F. Conclusions

Originally seconds and metres were certainly independent variables. The second was defined in terms of the length of a specific year in which there were, say, three hundred and sixty five and a quarter days by observation, and twenty four hours in a day, sixty minutes in an hour and sixty seconds in a minute by definition. The second was the time-interval which exactly filled the year according to these criteria. In effect it was based on the orbit of the Earth around the Sun in that particular year. It was necessary to stipulate a particular year, because at this level of precision the length of a year oscillates slightly from year to year.

The metre, on the other hand, was the length of a particular rod of material. This distance-interval was supposed to be a fraction of the arc of the Paris meridian. In fact it was not, but that did not matter.

The passage of time could be measured or described in seconds, days, years etc without involving distance-intervals. For its part, the metre was not in the least affected by time-intervals. It could be measured and described in distance-intervals quite independently of time-intervals. In statistical terms they did not interact, they were orthogonal, they were not confounded.

When the precision of these units was insufficient, attention turned to the properties of electromagnetic radiation, essentially because the speed of light *in vacuo* was constant. Given the above definitions of the metre and the second, light always travelled at $3x10^8\ ms^{-1}$ *in vacuo*. Using this value, any interval between bodies could be expressed in two forms. Either it was a distance-interval, in which case the time-interval was given and the distance calculated by substituting a value for this in the speed of light, or it was a time-interval in which a value for the distance-interval was given, and time of transit calculated from the speed of light *in vacuo*. This methodology fails when both intervals are calculated from the same measurement, and neither is given, since each depends on the other. They become statistically confounded.

All we can observe when measuring time-intervals and distance-intervals is the various properties of light. The fundamental definition of velocity is distance travelled in a known time, but it is not practical to time pulses of light over distances which are long enough, because it travels too fast. For the same reason, we cannot accurately measure a long distance except from the time taken for light to travel it. In practice we have to use light to measure both distance travelled and the time which light takes to travel it.

The solution is to use the other property of light that it is composed of wavelengths or frequency of oscillation to which it must be related through the speed of light. If we know the wavelength, we can calculate a distance effectively in terms of wavelengths with the precision of half a wavelength, and convert these into a more precise definition of the metre. From the wavelength and the speed of light *in vacuo*, measured in the laboratory, we can calculate the frequency of light which is the number of oscillations per second. Since electromagnetic radiation is emitted by transitions in the electronic structure of atoms, a particular transition of a particular atom, for example caesium-133, then gives a more precise definition of the second. These are in effect the surveyor's tools described above.

In the world outside the laboratory, electromagnetic radiation travels from one location to another as part of the eternal processes of the Universe. The velocity of this light *in vacuo* does not change, but the wavelength does, as observed in the phenomenon of redshift. The light's wavelength is longer and the frequency of oscillation is lower than that which was emitted. Cosmologists claim that this results from the stretching of distance due to expansion of the Universe, but this raises the question of where exactly the change of wavelength occurs, quite apart from the Universality of chemical reactions, as argued above. The RED theory of light proposes that the rotation of the RED simply slows down with its transit through space. Either way the number of wavelengths gives a misleading estimate of distance. Distance-intervals are for planning and substitution in equations at this level of precision, but in processes they have to cover distance by definition, and this leads to wavelength change.

Time on the other hand can be measured without significant translation of electromagnetic radiation through space i.e. in one place. The oscillations of the standard transition used to define the second must be the same everywhere irrespective of velocity, if the chemistry is to mean anything. Hence atomic clocks. (We cannot say the same about acceleration by this argument – that may need a little more thought).

However, the precise value of the time-interval which is relevant to processes depends on how it is communicated to the user, because that is its only purpose i.e. the clock has to be read to be meaningful. If the output is a wavelength or a frequency of electromagnetic radiation, it is subject to the same qualifications as the distance-interval. Nevertheless, it does have the value of relating to actual processes rather than imaginary particles of matter. The time-interval between processes decouples them, so that they can operate independently of each other while the RED is travelling between them. It also means that the time-interval is uncertain because processes are always changing during its transit.

The corollary is that it is important in physics, especially astrophysics, and cosmology to discover whether redshift does in fact occur during transit through space, and if so, whether it is an exponential decrease and what are its parameters. If it is true, the distances estimated by Hubble's equation could be seriously overestimated, in which case the visible Universe would be much smaller than currently calculated. If not, someone has to explain why and how chemistry varies from location to location in the Universe.

What is more, the cosmic microwave background radiation may be explicable by a mechanism other than one unique ‘Big Bang’. It could be remnants of the progressive reduction of REDs’ rotational speed on their nearly infinite journey around the Universe, starting with high frequency at emission down to microwaves and then radio waves and eventually perhaps wavelengths which we cannot detect at present. Such radiation could be generated by explosions occurring stochastically in an infinite Universe (6).

There is the further thought that electromagnetic radiation is not the only means of communication between particles in the Universe. There are also gravitational attraction, electric charge and magnetism.

If none of these causes or results in change, there is no reason to take them into account in distance or time, because as far as particles are concerned, they simply form the environment in which the particles find themselves. However, if gravitational attraction, or electric or magnetic attraction/repulsion are changed by or cause motion, there must be a velocity at which these phenomena also propagate change. More specifically, there must be a velocity at which change of gravitational attraction by the motion and especially acceleration of bodies spreads from its source, since it is not possible for it to permeate the whole Universe instantaneously. This velocity must be the velocity of light *in vacuo*, because anything else would cause insuperable anomalies. The reason according to this series of papers is that it uses the same polarisation effect of the microgranules of the medium of space. Similar reasoning applies to electric charge and magnetism (7).

However, these phenomena are unlikely to have wavelengths or frequencies which can be attenuated by transit through space. There is no gravitational equivalent of redshift because there are no gravitational ‘whirlpools’ in the medium of space, not at least with dimensions comparable to the wavelengths of light. These phenomena propagate by electromagnetic induction which reorients the medium of space without energy, in the same way that REDs or photons do not consume energy in transit. The likelihood is that they simply spread like electromagnetic radiation at the speed of light. That does not mean that ‘waves’ could not be generated on a stellar or galactic scale by the interaction of different sources of disturbance, which is a different type of effect on a much larger scale.

According to the model of this paper the wavelength of light inputs into a system is always likely to be less than the wavelength of the source. In fact this decrease might be a necessary requirement of absorbing a RED, because there seems to be no reason why REDs with identical rotational frequencies to their receptors should be absorbed rather than immediately re-emitted. Something of the sort may happen in emitting gases, or else much less light would get out of the gas cloud than expected.

The relativistic ‘dimension’ of space-time is neither necessary nor valid. It simply confuses two versions of the speed of light, one in static applications and the other in processes. There is also the potential for confounding when time-intervals and distance-intervals are both based on the constant speed of light, if transmission through the medium of space is involved. This could lead to the failure to discover new phenomena. Finally, if the RED theory of light is confirmed, astronomical distances and their interpretations may need to be re-assessed.

There are potentially a number of measurements which could be made to test this analysis, and these are listed in the Appendix at the end of this note.

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Appendix to Time and Space – the Sequel
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i. Reflectors have been left on the Moon by astronauts to measure its distance from Earth by timing a laser light there and back. The reason for choosing the Moon is that it is the nearest to an astronomical distance which we can measure with certainty. It might be possible to measure change of frequency as well as elapsed time. Any decrease of frequency would confirm that redshift occurred in transit there and back. It could not be caused by the radial velocity of recession of the Moon from the Earth, because this is virtually zero. This experiment was proposed in a previous note.

   (Redshift – a Suggested Experiment A.C.Sturt, 4 December 2001. www.churingapublishing.com/moonflect.pdf which is part of the paper:

   The Origin of Quanta – A Proposed New Decomposition of the Phenomena of the Physical World A.C.Sturt 17 March 2003 www.churingapublishing.com/quant_1.htm)

ii. The same technique would also apply to other satellites of Earth, but it would have to be by reflection of the beam of light. Emission would not have the same effect. See:

   (Reflection, Emission and Doppler Effects of Light Particles A.C.Sturt 10 March 2010-10-10 www.churingapublishing.com/finrecondoppler.pdf).

iii. Another possibility is to measure the wavelength of light received on Earth from distant explosions, and compare it with the same light reflected off, say, gas clouds in a different location, which would have a much longer transit through space – two sides of a triangle. The exploding star might have a velocity which would affect redshift according to current theory, but it would be the same for both the original light and the reflection. Any difference of redshift would be attributable to the different path lengths through the medium of space i.e. different lengths of transit of the same REDs.

iv. The theory of light as REDs formed by electromagnetic induction suggests that redshifted light from a star should have two components, primary and secondary. It might be possible to detect this by separation of primary and secondary REDs received on Earth. These would have two identical wavelength patterns, because they are from the same atom, but one should be redshifted more than the other.

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