ON ABSOLUTE SPACE AND TIME
AND NEO-PTOLEMAIC COSMOLOGY.

By

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Abstract: This paper presents a brief historical overview of the developments that led Einstein to formulate the Special Theory of Relativity in 1905, and demonstrates how the later General Theory brought about the re-introduction of the concepts of absolute time and space the earlier theory had apparently abolished, examining the consequences for modern cosmology.
Keywords: Cosmology: theory; history and philosophy of astronomy; cosmological parameters; stars: carbon; extraterrestrial intelligence.

Section 1: Introduction.

Physics in the 19th Century was firmly based on the foundation of Newton's *Principia* (Newton, 1687), and the ideas of absolute space and time contained in the Scholium to Definition VIII, Parts I and II, of that work were regarded as incontrovertible.

Another idea that was foundational for 19th Century physics was that of the 'luminiferous aether', not to be confused with the aether or 'quintessence' (fifth element) of Aristotle (see Lewis, 1964, pp.3-4, 95, 167). Maxwell (1878) assured the readers of the *Encyclopaedia Britannica* that this was essential to his field theory of electromagnetism, and Fizeau (1851) had carried out an experiment to test Fresnel's (1818) theory regarding the effect of the motion of the Earth relative to the aether – 'aether drag' – on the speed, wavelength and frequency of light in different transparent media of known refractive index.

Then Michelson and Morley (1887) published the null result of their attempt to detect any such optical effect. Seldom, before or since, has a single experiment, or a single paper describing it, had such an impact on the world of natural science.

The three ideas – of absolute space and time and the luminiferous aether – were indissolubly linked by a fourth, that of a 'preferred frame of reference', within the coordinates of which the absolute motion of the Earth relative to the aether could be determined. If there was no 'aether drag' effect, and Michelson and Morley had failed to detect one, and no discernible empirical variation in the speed of light produced by it, what, then, of the preferred frame of reference, absolute space and time? The Michelson and Morley result was reinforced by the findings of Kennedy and Thorndike (1932) and Ives and Stilwell (1938).

Section 2: Attempts to Deal with the Problem.

There were a series of attempts by scientists to deal with the problem caused by the Michelson and Morley (MM) experiment. The first of these was by Fitzgerald (1889), followed by those of Lorentz (1892, 1895, 1899, 1904), Larmor (1897) and Poincaré (1905). All of these retained the aether, but sought, by means of the introduction of a set of transformations to replace those of Galileo Galilei (1638), to account for the MM result.

Section 3: Einstein Introduces the Principle of Relativity.

The postulates on which Einstein (1905) based the argument of *On the Electrodynamics of Moving Bodies* were (1) that the laws of physics are the same for all observers located in inertial reference-frames; and (2) that the speed of light in vacuum is a constant, irrespective of the motion of its source. The combination of (1) and (2) implies that the speed of light must be a constant irrespective of the motions of its observers as well.

These two postulates together, Einstein argued, rendered the aether an unnecessary concept; it was otiose. He did not, however, argue that it did not exist. Minkowski (1909) geometrised the Special Theory of Relativity (SR), and turned space and time into 'space-time'. Milne (1933) employed what he termed the 'extended principle of relativity' in the construction of his cosmological model, extended in that he argued that, not just the laws of physics, but the appearance of the universe itself, must be the same to all such observers.

Lorentz (1910), identifying and reiterating the principle of relativity in precise form, nevertheless argued against abandoning the aether and the distinction between space and time, although without much conviction. He also held on to the concomitant of the preferred frame, namely the possibility, not merely of superluminal speeds, but *infinite* ones, as required by Newton's use of the idea of 'action at a distance' in his theory of gravitation.

Section 4: An Attempt to Do Away with the Problem.

The American Dayton C. Miller was a firm, indeed passionate, opponent of Einstein's theory, and performed numerous repeats of the MM experiment in order, essentially, to overturn its null result, publishing the findings of one such in his (1933), in which he purportedly found a positive result, thus overturning the hated SR.

This is a classic case of experimenter bias, and Miller ought to have been wary of it. His results were re-examined by Shankland, *et al* (1955), and multiple errors were exposed, all of them, either directly or indirectly, a result of his bias.

Section 5: The General Theory of Relativity and Absolute Time.

Larmor (1927a & b) was one scientist who continued to insist that absolute, Newtonian time was essential to astronomy. Following on from the introduction by Einstein (1914) of his General Theory of Relativity (GR), a number of scientists began to work out its cosmological implications, especially in the light of the observation of the expansion of the universe by Slipher (1917) and Hubble (1929). These included Friedmann (1922), Lemaître (1927), Einstein and de Sitter (1932), Robertson (1935, 1936) and Walker (1937).

The resulting 'FLRW' model of the cosmos, which is now the standard model of cosmology, and the metric it is based on, which is an exact (i.e., mathematically exact) solution of the field equations of GR, is based on the assumptions of the homogeneity and isotropy of the universe. Gödel (1949) pointed out that the FLRW model and the Einstein-de Sitter model (which is the same as the FLRW model, but for ‘flat space’ only) re-introduce an absolute time coordinate at cosmic scale.

Gödel also pointed out what happened when one attempted to do without such an absolute cosmic time. He produced his own exact solution to the GR field equations, which corresponded to a universe that was homogeneous, but *anisotropic*, having an absolute rotation about a ‘compass of inertia’. This, he argued, was a necessary implication of the absence of a cosmic time, and it resulted in a universe with ‘closed time-like curves’ (CTCs), where it would be possible to time-travel into the past. Time-travel into the future is permitted by both SR (because of the Lorentz transformations, see Lorentz, 1904, op. cit.) and GR, and in the Lorentz aether theory, but past-directed time-travel results in violations and paradoxes of causality (the so-called ‘Grandfather Paradox’, e.g.) and the Second Law of Thermodynamics.

If we must re-introduce absolute time, t_C, at the cosmic scale, if not the local one, then what of absolute space? If the speed of electromagnetic radiation, including visible light, in vacuum, c, is a constant, then any length $l = ct_C$; but there must still be a preferred frame of reference to make the concepts of absolute rest and motion meaningful. However, it is unsurprising that Kühne (2002) insists that absolute space and time are essential to GR.

Section 6: The Preferred Reference-Frame and Privileged Observers.

The principle of relativity asserts, as we have seen, that the laws of physics are the same for all observers in all inertial reference-frames. Milne (op. cit.) extended and modified this by adding that the appearance of the universe was the same for all such observers.

Popper (1935, 1959) points out the fallacy of so-called ‘inductive reasoning’, and argued that we cannot reasonably infer any universal conclusion from a proposition concerning the particular, no matter how many times the latter is verified. Famously, he illustrated his point with the example of swans: no matter how many white swans we see, we are not at liberty to conclude that ‘all swans are white’: the species *Cygnus australis* is black. He also refuted the position adopted by Hume (1748, S.4, pp.18-29) that the basis of justifiable induction is probability, as in ‘These swans are white, therefore it is probable that all swans are white.’ He went on to argue, on the basis of his rejection of induction, that no theory may rightly be called ‘scientific’ unless it is possible to falsify it by empirical means.

If Popper is correct, and that is the present author’s belief, then the principle of relativity is not a scientific theory, and cannot be legitimately regarded as a law of physics, because it is not possible – even in principle – to falsify it. We do not, and cannot, know that the laws of physics are the same for all observers in all inertial reference-frames throughout the universe, because we can never visit, or observe in sufficient detail, all parts of the universe, either to confirm or refute that. Nor do we know, as opposed to believe, that there are any other observers in the universe (see Mayr, 1995); we might well be the only ones. If so, we would be very privileged observers indeed, contrary to the ‘Copernican (or Cosmological) Principle’ that there are no such observers, founded on the principle of relativity.

Our status as privileged observers is emphasised by the extreme fine-tuning of the ‘triple-alpha’ process required for the stellar nucleosynthesis of carbon identified by Hoyle (1954) and the ‘cosmic coincidences’ discussed by Dicke (1961) and summarised in the ‘weak anthropic principle’ of Carter (1974). But if our position in the universe is privileged with regard to time, then it follows, given what was argued in Section 5, p.4, that our position is privileged in *space* as well.

Our universe is usually depicted, geometrically, as being part of the surface of an expanding (1,3)-pseudo-hypersphere; it is far more accurate to depict it as a (4)-ball, whose radius, R, is given by ct_C, and whose volume, V_4, is given by $\pi^2 R^4/2$. If $ct_C = ct_0$, where t_0 is the present age of the universe, then:

$$R_0 = ct_0 = c\tau_0 = \frac{2GM}{c^2} = R_S \,, \tag{1}$$

where G is the Newtonian gravitational constant, τ_0 is the current value of the Hubble time, the reciprocal of the Hubble parameter (see Hubble, op. cit.), M is the mass of the (observable) universe and R_S is the universe's Schwarzschild radius (Schwarzschild, 1916). M is given by:

$$M = \frac{M_P^4}{m_p^2 m_e} = \frac{M_P^2}{\alpha_G m_e} = 8.804353 \times 10^{52}\ \text{kg}\,. \tag{2}$$

Here M_P is the Planck mass, m_p and m_e are the masses of the proton and electron respectively, and $\alpha_G = Gm_p^2/\hbar c$ = the gravitational fine-structure constant.

The inner surface of this (4)-ball is, then, an event horizon, and not a mere particle horizon, to employ the terms introduced by Rindler (1956, p.663). In fact, it corresponds exactly with that of the 'Big Bang' singularity.

380,000 years closer to us, at the 'epoch of re-ionisation', when protons and electrons were able to combine into hydrogen atoms once the cosmic temperature had cooled to 3,000 K, lies the source of the Cosmic Microwave Background (CMB) radiation, covering the entire sky (see Bouchet and Puget, 2003; Tanabashi, *et al*, 2018).

It is this background radiation that Szostek and Szostek (2018) use as the preferred frame of reference in their aether theory, where they confirm that the aether and CMB reference-frames are equivalent, and by means of which they are able to calculate the absolute velocity of the Solar System, and thus of the Earth, with respect to the CMB, and produce a result which corresponds closely with that of observation (Bouchet and Puget, op. cit.; Aghanim, *et al*, 2019, p.6; Table 3, p.7). According to Aghanim, *et al*, basing their assertion on the Planck satellite's measurement of the Solar dipole anisotropy, ~3.36208 mK (p.6), the Solar barycentre's motion with respect to the CMB is in the direction of the constellation Crater, near its border with Leo, at 369.82 ± 0.11 km s^{-1}. The equatorial coordinates are Right Ascension (RA): 11h 12m 48.2s; Declination (DEC): –6° 50′ 6″, current year (2020). Szostek and Szostek (op. cit.)

have the speed as 369 ± 3.3 km s^{-1}, and the direction of Leo, equatorial coordinates RA: 11h 13m 58.8s; DEC: –6° 57′ 24″, same year.

Section 7: Conclusion.

It would appear, then, that Einstein's attempt to jettison the concepts of absolute space, time, motion and rest in SR were not the last word, and he himself was responsible for that, opening the way through GR to a re-introduction of absolute time, and everything that follows from it.

If there are privileged observers, and we on Earth are those observers, and if there is a privileged, absolute inertial frame of reference – the CMB being a proxy for the cosmic event horizon, or inner surface of the Hubble sphere – then it follows that our universe is not Copernican, but neo-Ptolemaic, and we are, at the very least, near its centre. The Earth is not at rest, so cannot be at the precise centre of the universe, which is at absolute rest, but none of its peregrinations round the Galaxy, or the Galaxy's own movements in relation to other nearby galaxies in the local cluster, can take it far away from that centre, in terms of cosmic scale.

It follows from equation (1) on p.5 that our universe is an enormous black hole, and that although the universe was expanding, it *is* doing so no longer, and *can* do so no longer, but has reached a maximum limit of expansion. (As Milne, 1933, op. cit., 1935 argues, it is not space that expands, but the matter in it that does so.) Consequently, the observations of Riess, *et al* (1998) and Perlmutter, *et al* (1999) that indicate the universe's expansion is accelerating, must be in error. More recent observations, by Eitner, *et al* (2020) and Kang, *et al* (2020), have cast serious doubt on their crucial assumption that Type Ia supernovae can be used as 'standard candles', thus undermining the basis for their conclusions.

Finally, Szostek and Szostek (op. cit.) argue in favour of a constant two-way speed of light (electromagnetic radiation) in vacuum, independent of the direction of its propagation, and of the motion of the observer in relation to the 'universal' (i.e., preferred) reference-frame.

It should be noted that these claims are valid only to the degree that they are subject to falsification, and therefore cannot be extended beyond the bounds of possible observation.

Attempts to measure the *one-way* speed of light have returned mixed results (see, e.g.: Krisher, *et al*, 1990; Cahill, 2006), primarily because of the difficulty of avoiding the clock synchronisation procedure from Einstein (1905, op. cit.).

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[1] Abbreviations used (not indicated in text): BibCode = Bibliographic Code; DOI = Digital Object Identifier; pbk. = paperback; ISBN = International Standard Book Number.

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