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# Faster than Light - Part 1

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One major argument against the young-earth creationist position has been the apparent great age of distant galaxies. Those galaxies are so distant that the light that we see would have taken billions of years to reach us *at its current speed*. Therefore, the argument goes that they would have to be at least billions of years old. Obviously, this is not in agreement with the young earth/universe creation position. However, this argument is not valid if the speed of light was faster in the past.

One potential answer to this argument that has been bandied about among creationists is that the speed of light has decayed over time, and was much faster in the past. This is known as CDK (for the speed of light, "C," decay, "DK," over time: CDK). If light traveled faster in the past, it would not take all those billions of years to reach earth!

Even among creationists, this idea has had both its proponents and those who disagree with it. Scientific arguments both for and against it have been presented. In this article, we shall examine some of those arguments with the goal of getting closer to the truth of the matter.

## 1) Authority

Some authoritative modern scientists reject CDK, but not all! One scientist, João Magueijo, even wrote a book about the speed of light changing entitled *Faster Than the Speed of Light: The Story of a Scientific Speculation*. He obviously does not reject a variable speed of light. From the back cover of Magueijo's book:

> João Magueijo is a professor of theoretical physics at Imperial College, London, where he was for three years a Royal Society Research Fellow. He has been a visiting scientist at the University of California at Berkeley and Princeton University, and he received his doctorate in Theoretical Physics at Cambridge University. 1

From page 1 of the book:

> I am by profession a theoretical physicist. By every definition I am a fully credentialed scholar—graduate work and Ph.D. at Cambridge, followed by a very prestigious research fellowship at St. John's College, Cambridge (Paul Dirac and Abdus Salam formerly held this fellowship), then a Royal Society research fellow. Now I'm a lecturer (the equivalent of a tenured professor in the United States) at Imperial College. 1

Magueijo's collaborator on the variable speed of light idea was none other than Andreas Albrecht, one of the creators of inflationary theory (along with Alan Guth) and arguably a modern scientific authority who does consider variable speed of light as a possibility. Albrecht (along with Paul J. Steinhardt, Albert Einstein Professor in Science at Princeton) overcame a flaw in Guth's original inflation theory, which is a well-known theory of modern cosmology related to the Big Bang model. 2

Several other scientists have seriously considered CDK, or a nonconstant speed of light, according to Setterfield: (emphasis added)

> The idea that the speed of light *might not be a constant* has been considered in the past decades by a *number* of authors who have demonstrated that serious problems facing cosmologists could be solved by a very high value for c at the inception of the cosmos. Thus in 1987, V. S. Troitskii proposed that c was initially $10^{10}$ times c now, and it then declined to its present value as the universe aged, along with synchronous variations in several atomic constants. In 1993, Moffat published two articles that suggested a high c value during the earliest moments of the universe with an immediate drop to its present value. Albrecht and Magueijo agreed with that concept and proposed in 1999 that c was $10^{60}$ times the current speed of light at the origin of the cosmos. John Barrow agreed with the initial value proposed, but suggested it dropped over the lifetime of the cosmos rather than soon after its inception. 3

Rejection of CDK by authorities does not constitute scientific proof. Many accepted facts of science today were at one time rejected by many authoritative scientists. Examples of once-rejected science that is now accepted include washing of hands by doctors before treating patients, the value of so-called vestigial organs, and that heavier than air flight is possible.

Indeed, far from rejecting CDK, we have seen above that some authorities have suggested CDK!

## 2) Measurements of the speed of light

Amazingly, measurements show a decline in the speed of light over the past three centuries, leveling out in the latter part of the twentieth century. This has been extensively documented in a 90-page document requested by Stanford Research Institute and prepared by Barry Setterfield, an astronomer, and by Trevor Norman, a mathematician from Flinders University in Australia. 4 The data were collected over a period spanning more than 300 years, consisting of thousands of measurements and utilizing a minimum of sixteen different methods. Data indicating a change in the speed of light were also referenced by Rupert Sheldrake at the *Electric Universe Conference 2013: The Tipping Point* in Albuquerque, New Mexico. Part 1 of this talk can be seen in the youtube.com video: Science Set Free. 5

Setterfield provides many quotes from scientists regarding changes in the speed of light, 3 some of which are provided below. In 1941, Raymond Birge, physics professor at the University of California, Berkeley, while writing about measurements of the speed of light made around 1880, wrote:

> These older results are entirely consistent among themselves, but their average is nearly 100 km/s greater than that given by the eight more recent results. 6

N. E. Dorsey, of the U.S. Bureau of Standards, wrote about the data from 1874 to 1940 indicating a slowing of the speed of light:

> As is well known to those acquainted with the several determinations of the velocity of light, the definitive values successively reported...have, in general, decreased... 7

In 1886, S. Newcomb (Professor, US Naval Observatory, Washington) wrote that measurements of c from around 1740 were about 1% higher than measurements in the 1880s. 8

French astronomer M. E. J. Gheury de Bray stated in 1931 the following:

> If the velocity of light is constant, how is it that, invariably, new determinations give values which are lower than the last one obtained.... There are twenty-two coincidences in favour of a decrease in the velocity of light, while there is not a single one against it. 9

Later in 1931 he wrote: “I believe that in any other field of enquiry such a discrepancy between observation and theory would be felt intolerable.” 10

We thus see that measurement data supports CDK!

## 3) Energy conservation and the speed of light

One argument against a faster speed of light in the past is that it would violate energy conservation. The claim is that a larger c in $E = mc^2$ would increase energy, E, meaning energy is not conserved. This is dealt with in another article, “Does changing speed of light violate energy conservation?” 11 However, here I can briefly summarize this to say that the physics causing the change in c would *also* change m in such a way that energy E remains constant. For a mathematical derivation, see the above-mentioned article.

## 4) Atomic clocks and the speed of light

One recent tool that has been used in measuring the speed of light is atomic clocks. It has been argued that these accurate, precise measurements show c to not change. However, per at least one cosmology, the same physics that changes light speed also affects atomic clock frequencies, making it impossible for atomic clocks to detect changes in c. 12

Data also indicate that the rate of atomic clocks has not been constant with respect to the motion of astronomical objects. See Figure 1 13 for graphical data on this for the orbit of planet Mercury. The reference to “planetary ephemerides” in the quote below refers to tabulations “of positions and velocities...of an orbiting body at specific times.” 14

## 5) Image

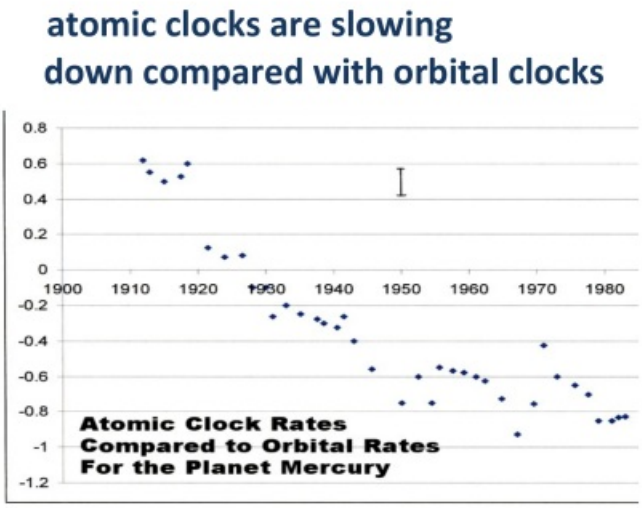


Figure 1. Atomic clock rates (y-axis) compared to orbital rates for the planet Mercury from 1910 to 1995. Data from Masreliez, replotted in Setterfield BJ, Setterfield HJ (2013), 155.

C. J. Masreliez reported measurements showing changes in atomic clock rates:

> Recently, several independent investigators have reported discrepancies between the optical observations and the planetary ephemerides [based on the atomic clock]. The discussions by Yao & Smith (1988, 1991, 1993), Krasinsky et al. (1993), Standish & Williams (1990), Seidelman et al. (1985, 1986), Seidelman (1992), Kolesnik (1995, 1996), Poppe et al. (1999) indicate that [atomic clocks had] a negative linear drift [slowing] before 1960, and an equivalent positive drift after that date. ... A paper by Yuri Kolesnik (1996) reports on the positive drift of the planets [orbital

> clocks] relative to their ephemerides [atomic clocks] based on optical observations covering thirty years with atomic time. This study used data from many observatories around the world, and all observations independently detect the planetary drifts. 13

Thus, the "yardstick" itself has been changing. (In this analogy the yardstick is the atomic clocks, and measurements by such a changing yardstick cannot be absolutely trusted.) Those atomic clock changes have not been taken into account by those claiming that atomic clocks show c is constant over time, to my knowledge. At any rate, atomic clock data cannot be used to show the speed of light to be constant over time, unless these changes in the rate of atomic clocks is taken into account.

## 6) Fine structure constant

One argument against CDK is the apparent constancy of the fine structure constant.

The equation for this constant is:

$$\alpha=\frac{e^2}{\epsilon}\frac{1}{2hc}$$

where α is the fine structure constant, *h* is Planck's constant, and *c* of course is the speed of light. $\epsilon$ is the electric permittivity of free space, and $e$ is the charge of the electron. (The further explanation of the other components of the fine structure constant is outside the scope of this article.) It can be noted that if *h* and *c* are both changing, while $\alpha$ is not changing, this suggests that *h* and *c* are inversely proportional.

And actually, while both *h* and *c* have been measured as changing, their product *hc* has been measured to be constant to within parts per million. 15 If the measured data are correct and *hc* is constant, as it appears, then the fine structure constant cannot invalidate CDK: even with CDK, the fine structure constant should not change!

## 7) CDK violates relativity; or does it?

It is well known that light actually travels slower in many media. In fact, this is so well known, it is used in the definition of the index of refraction, which is the ratio of the speed of light in a vacuum to its speed in some medium/material. Thus, light travels slower through glass and water than it does through air, and slower in air than it does through a vacuum!

The relevant point here is that the vacuum of interstellar space, and even intergalactic space, is itself not really a complete vacuum, but in a sense a medium through which light travels.

The claim in relativity is that the speed of light in a vacuum is constant. We have learned more since 1905 about the vacuum. The vacuum is now known to be filled with virtual particles and energy. In a sense, the "vacuum" of space is not really a vacuum.

If this vacuum energy, along with the virtual particles, were less dense in the past, we might conceivably expect light to travel faster through this less dense medium, even as light travels faster through the less dense medium of the atmosphere than it does through the denser medium of water. Therefore, I see no problem with relativity with respect to CDK.

There are, as many know, two views of light: it is a wave and it is a particle. Which is correct? You may have heard that both are correct or that neither is correct. Someone said that all models are wrong, though some are useful. In some situations, one model or view of light seems to fit better. This was one major reason the debate over whether light was a wave or particle waged for so long. There was evidence on both sides. Here, we shall invoke both views for help in understanding this aspect.

Per the particle view, light particles, photons, are absorbed and then re-emitted by electrons in the medium through which light is traveling. The time taken for this absorption and re-emission slows the light.

One question arises: wouldn’t the emission be in random directions, so that light should spread out? We don’t see this happening. To answer this, we can appeal to the wave view of light. I refer you to a video describing why light travels slower through a medium, utilizing the wave view. See https://youtu.be/CUjt36SD3h8.

The video points out a problem with the particle view. When evaluating results of some experiments, there may seem to be problems regardless of which view one takes. For example, the famous double slit experiment gives results sometimes that are inconsistent with the particle view, and other times inconsistent with the wave view. The apparent inconsistencies notwithstanding, modern scientists generally accept that both views are more or less correct some of the time, or in some situations, at least. So, let's resist the temptation to reject the model due to apparent inconsistency with either a wave or particle view! In reality, whatever is happening in the medium, ***something*** is happening to slow down light. And, the relevant point here is that the vacuum of space, empty as it seems between the galaxies, stars, and planets, is not really empty. The mere existence of measurable values of magnetic permeability and electrical permittivity suggest this, though to explain why gets beyond the scope of this article.

Now, having considered both views, the in-a-nutshell explanation is that in the vacuum, there exist virtual particles. These particles can have electrical charges that are affected by light, like electrons in the atoms of a glass lens, and produce other electromagnetic waves, which combine with the light wave, and slow down the light. Or you can think of these virtual particles that can absorb light and re-emit the light, like electrons do in the atoms of a glass lens, slowing the light traveling through the lens. In either view, the light waves traveling through space, interacting with the vacuum - really the virtual particles in the medium of the vacuum - slow. If the vacuum contained fewer virtual particles in the past, due to a less dense vacuum energy, then light could have traveled faster in the past.

CDK agrees with a cosmology model that answers puzzling questions, without resorting to ad-hoc rescue-device complexifying assumptions, and results in a simpler model. For example, galactic radial rotation rate gradients have been a puzzle, for which dark matter has been invoked as a solution. One cosmology model at least, resolves this conundrum, predicting the rotation curves which can be calculated and seen to match well with observation. 16 This model includes and requires CDK. This is just one simplifying aspect of this CDK model. Another factor in favor of this CDK model is that it provides a simpler explanation for pulsars as well as explanations for multiple solar anomalies. However, a discussion of these anomalies is beyond the scope of this article.

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# 1) Summary

In this short article, we have briefly looked at some common objections to CDK. We also looked at a few arguments in favor of CDK. It was seen that even modern scientific authorities seem to be beginning to consider CDK as a real possibility. Although in this short article we could not cover every objection or aspect related to CDK, we have seen that CDK is not invalidated nor disproven by the arguments examined, and quite to the contrary, CDK is rather well supported by theory and by observation. Of course, we need to avoid bias and be open to evidence about this. And the young-earth creationist position also is not invalidated, at least not by the arguments against CDK examined above. There is more that could be said; for more see the follow-up part 2 of this article, which examines 3 arguments against CDK 17 and shows them to be based on several assumptions which are not valid; the result being that those 3 arguments therefore fail to invalidate CDK.

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