

Clive Tickner B.A. BSC;  
Diploma; theoretical physics; Stanford University  
[clivetickner@aol.com](mailto:clivetickner@aol.com)

### **The Question of “Timeless Photons”**

#### ABSTRACT

Professor Brian Cox, for example, has explained to audiences that light experiences neither time nor space. For a photon, he suggests, the universe is compressed into an infinitely thin pancake: it leaves and arrives in the same instant.

Such imagery is vivid, but it cannot be reconciled with observation. If light truly traversed space instantaneously, then the light we see from Andromeda would present that galaxy “as it is now,” not as it was 2.5 million years ago. The finite travel time of light is an established and essential fact of astronomy. To claim otherwise is to negate the basis of cosmological observation itself.

#### KEYWORDS

Professor Brian Cox. Andromeda. Relativity. Quanta. mathematical formalism. material reality. rest-frame. finite coordinates. emission and absorption. causal order. electromagnetic processes. Frequency. oscillatory behaviour. Wavelength.

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### The Question of “Timeless Photons”

Professor Brian Cox, amongst others, has explained to audiences that light experiences neither time nor space. For a photon, he suggests, the universe is compressed into an infinitely thin pancake: it leaves and arrives in the same instant.

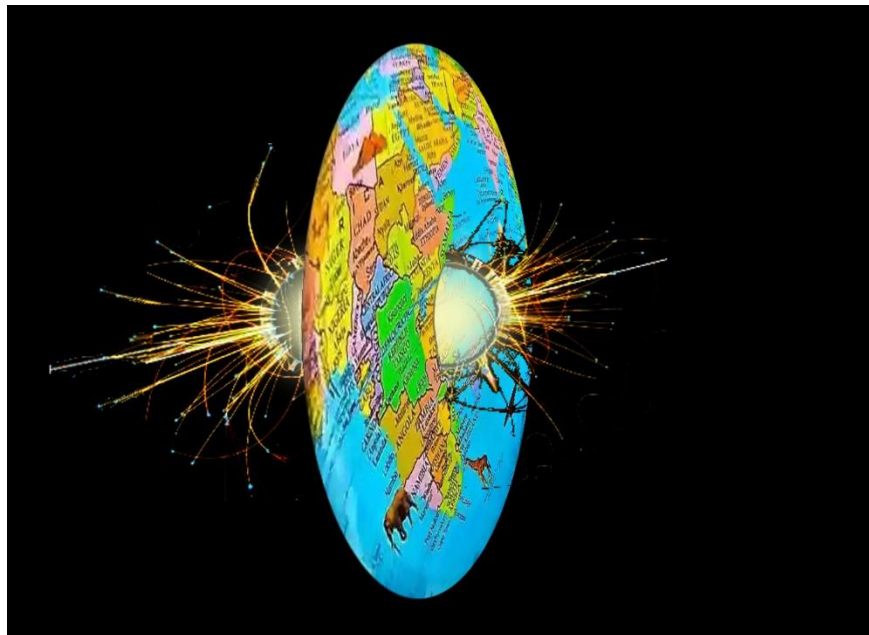
Such imagery is vivid, but it cannot be reconciled with observation. If light truly traversed space instantaneously, then the light we see from Andromeda would present that galaxy “as it is now,” not as it was 2.5 million years ago. The finite travel time of light is an established and essential fact of astronomy. To claim otherwise is to negate the basis of cosmological observation itself.

The statement that photons “experience no time” rests on a disingenuous misunderstanding. Photons are not observers; they have no rest-frame in Relativity, and no sense in which “experience” can be applied. They are

*quanta* propagating at a finite speed, subject to well-established travel times. To speak of them as ‘timeless’ entities is to step from physics into metaphor.

Therefore, this claim should not be mistaken for a literal description of a certainty. The notion of light having no experience of time or space is an interpretation of the mathematical formalism, definitely not a proven physical truth. It relies on extending the equations of Relativity beyond their legitimate domain — a move that, while intellectually stimulating, cannot reflect material reality. In this respect, Cox’s metaphor succeeds as a way to provoke wonder and curiosity, but it remains open to being demolished by philosophical and theoretical challenges.

The image of the universe flattened into an ‘infinitely thin slice’ may therefore tell us more about the limits of our theories than about the nature of light itself. It reminds us that our current frameworks, however elegant, might not fully capture what light “is.” Whether or not light actually exists, outside time and space, is still a question that sits, like the photon itself, on the edge between mathematics and mystery.



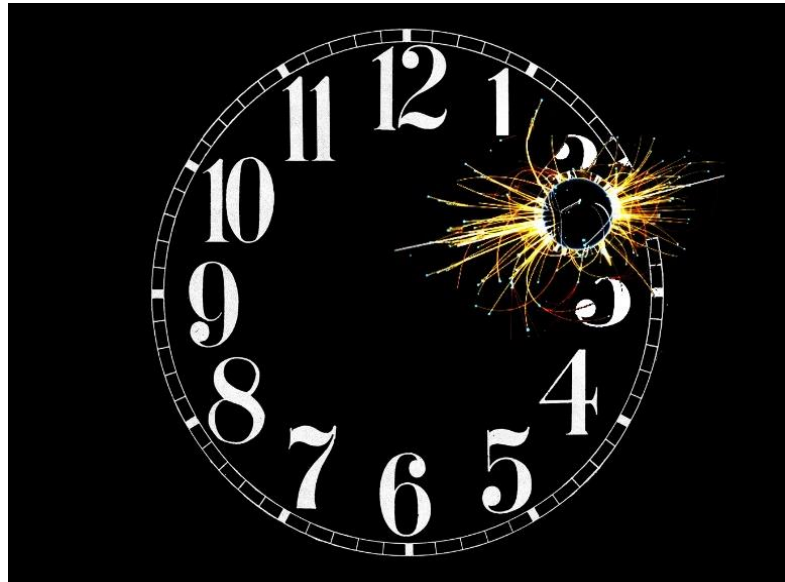
Does the belief in an “infinitely thin pancake” for a photon mean that the ‘Flat-Earthers’ are correct?

A photon cannot possess a rest-frame, because a rest-frame would require us to assign finite coordinates to something that never stands still. Thus, to speak of a photon’s “experience” or “perspective” is to step outside the domain of Relativity entirely.

Cox’s proposition arises from extending Relativity beyond its valid range and mistaking coordinate effects for physical reality. The idea blurs the crucial distinction between what the equations describe, and what nature actually does.

Light is *not* timeless, nor does it live outside space. It defines the unity of the two. It is the unchanging measure against which all motion and all timing are compared.

If photons genuinely took *no time* to travel from one point to another — not just as a mathematical convenience, but as a physical truth — several profound contradictions would immediately appear in both theory and observation.



A photon's clock?

### 1. Causality would collapse

If a photon took zero time to go from A to B, then the emission and absorption events would be simultaneous in *all* frames of reference. That would mean there is no causal order between them — no “before” or “after.” The photon could not be said to *travel* at all, because travel implies a finite interval of time. This would destroy the distinction between cause and effect for electromagnetic processes, contradicting the observed fact that light transmits information and energy *over time*.

### 2. The speed of light would be meaningless.

Speed is defined as distance divided by time. If the time is zero, any non-zero distance divided by zero becomes infinite — implying that light would *truly* move instantaneously, not at a finite velocity ‘*c*’.

Yet all measurements show that light’s speed is finite and invariant: approximately 299, 792, 458 m/s. If light really took no-time to cross space, Maxwell’s equations and the entire Relativistic structure built around ‘*c*’ would collapse, since ‘*c*’ itself would cease to be a meaningful constant.



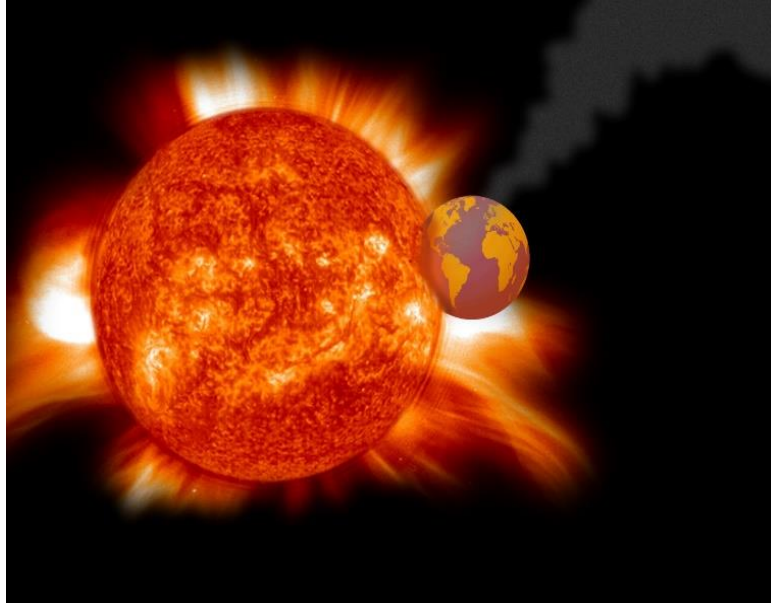
Both 'before' and 'after'. Cause and effect- concurrent.

### 3. Energy and momentum would vanish.

Photons have no rest-mass but they do have *energy* and *momentum*. If their transit time were literally zero, then their oscillatory behaviour — their *frequency* — would *also* be undefined, because frequency requires the passage of time. Without frequency, there is no wavelength, and thus no energy or momentum. A photon that takes no-time *cannot oscillate, vibrate*, or even exist as a *wave-packet*. It would be physically nothing.

### 4. Observational contradictions.

We can observe photons arriving at measurable intervals — from radio pulses of pulsars, to the 8.3 minutes light takes to reach us from the Sun, to the billions of years it takes light from distant galaxies to arrive here. These are not illusions of “observer dependence”; they are consistent physical measurements in a shared time-framework. If photons truly took no-time, all electromagnetic signals would arrive instantaneously, making the universe appear everywhere-lit at once, with no delay between cause and observation — which is clearly not the case.



The disadvantage of sunlight taking no time at all to each us

#### 5. The structure of 'spacetime' would break down.

Cox's notion does not comply with Relativity itself, which defines 'spacetime-intervals' between events as either 'time-like', 'space-like', or 'light-like'. A confusion, therefore, arises when a 'light-like' interval (which applies to photons) is asserted to have a zero-spacetime separation — but *that* does not mean the photon takes no-time to travel in the material sense. It simply means that the mathematical geometry of 'spacetime' treats its path as one for which the metric interval equals zero.

Obfuscating this geometrical fact with an instantaneous physical process leads to impossible paradoxes — such as a universe in which all light sources and all observers are in instantaneous contact.

Unfortunately, also predicated upon this impossible notion is the dubious certainty of a *physical* effect. If photons take no-time at all to travel, then an astronaut, approaching that speed, similarly approaches no-time for travel, as their time slows right down.

#### Conclusion.

To claim that photons "take no time at all" to go anywhere converts a geometrical shorthand into a physical absurdity. It confuses a *mathematical interval* (zero proper time) with a *quantifiable duration*. The result is a universe with no causality, no finite speed of light, no energy-bearing radiation, and no meaningful structure in spacetime.

In short: if photons truly experienced no-time, light as a process — as a wave, as a signal, as a quantum particle — could not exist. The "timeless photon" is therefore not physics but a metaphor stretched beyond reason.

## Addendum

'Spacetime' is a misused word, responsible for many unsubstantiated extensions, expansions, and additions. These have all been predicated on Einstein's original hypothesis, whereby General Relativity describes Spacetime as a "smooth, continuous fabric".

Whilst Spacetime is currently considered to be successful as a theoretical framework, it is still an *abstraction*, rather than a reflection of *fundamental reality*.

And this is because Spacetime is *only* the word used to refer to the *values* in the field equations of General Relativity, which are considered to be able to predict the degree of curvature of paths based on the strength of the field *relative* to the mass, momentum and vector of a moving object.

But Spacetime cannot 'move'; it doesn't *do* anything at all, because it is only a *metric*; it does not exist as a *physical* field. Spacetime is not a tangible, physically *real* thing. It serves as a *context* our imaginations must conjure, so that we can *visualize*, and think about, the existence and motion of *real* objects. But it is common, for physicists and mathematicians, to *conflate* ('reification') the Spacetime metric with *the field of action* being measured by that metric.

Since then, the word "metric" has been dropped from the discourse, allowing for these very misleading phrases like "the curvature of Spacetime", as if it is Spacetime that is being curved by the gravitational field, when it is just - *imaginary lines* - that objects, *moving in gravitational fields*, are considered to follow. Spacetime cannot curve; we can't curve an idea.

So Spacetime is theorized, yes. But detected, no. Spacetime is merely a talking point; we could dispense with it completely and nothing in our toolbox of predictive equations would change.

Unfortunately, any opposition to the hypothesis has been sidelined by the physicists who insist on claiming impossible / implausible, circumstances for Spacetime, e.g. as a malleable fabric able to be distorted by Gravitational waves.

CT; 14/11/2025