

Title: Slow light

October 20, 2024

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Despite the impression you might have gotten from reading stories in the news about scientists "slowing down" the speed of light – a photon is massless, meaning it exists as pure energy; therefore individual photons cannot be slowed in the sense of true motion. Thus, we see here and there 'slow light' referred to as “slow light”, and correctly so.

When scientists speak of slowing light for modern applications, what they are actually referring to is the vector slowing – due to intentional quantum interference – of light inside a condensate.

Two laser beams traveling perpendicular to each other through a particular condensate, as well as other methodologies, create quantum interference which affects the probability of photon absorption by – and transmission from – the condensate material due to the canceling effects of the interference.

Each time a photon is absorbed, kinetic energy is lost to the condensate material. The material then emits a photon with its intrinsic kinetic energy restored. There is time-delay involved.

A light pulse is simply slowed as an overall vector quantity as long as it is in the condensate. A vector's magnitude is a 'point to point' quantity, not the sum of the magnitudes between the end points.

As mentioned, a photon itself is not slowed in the classic sense of true motion. There is no interference within a photon. It has no interior space. Thus, the nature of light is not changed.

The effect of such interference in a condensate is in the same broad category as the vector slowing of light in a solid material absent of intentional quantum interference. It's also in the same broad category as the vector slowing and curving of light in a gravitational field. Energy must be absorbed by the gravitational field or the speed of the light pulse would not be reduced. The net loss of energy is portrayed as curvature in the geometrical model of spacetime. See: [spacetime curvature](#)

Any light that escapes the condensate will travel at the usual speed.

Another topic in the news is the claim that positrons travel backward in time,[1]

and in a completely different fashion, [crackpots?] have found solutions to Einstein's field equations of GR that they claim indicates that traveling backward in time is possible. Rather, it simply shows the limitation of the theory.

Traveling backward in time is immediately self-contradictory.

Some physicists and journalists are eager to present things in glamorous ways, which are attention-getting. Neither traveling backward in time nor [spacetime](#) are physical realities. We have freedom of movement in space, but we do not have freedom of movement in time. "t" has a completely different status from that of "x, y, z". Small wonder that spacetime adherents fail to resolve, by way of employing spacetime diagrams, a paradox of their own making. It's time-keeping (i.e., clocks, whether of a chemical, biological, mechanical or electromagnetic nature), that change – not historical time.

Kinematical time-keeping is strictly dependent on the absolute nature of light. It is that simple, as we diagram in: [Symmetry of measure in relativity](#)

1. The notion that positrons (opposite-charge version of electrons) violate causality doesn't add up to backward time-travel in a universe where everything else is moving forward in time.

At the level of elementary particles, "cause and effect" is different from the "cause and effect" that emerges from the soup. That is, emergence applies, and still in a probabilistic manner of course. The possibility of "cause and effect" violation becomes vanishingly small as scale increases and becomes dominant. Relativistic effects, as we experience them, depend on emergence.

As with "cause and effect", "time-keeping" at the level of elementary particles is different from what emerges. "Backward or forward in time" are mere labels at the level of elementary particles.

See [sitemap](#) for my other articles:

Symmetry of measure – Journal article preprint

Fallacy of strict relativism – in relativity

Replacing Einstein's postulates

Einstein at Leyden – Standards for clocks and rods

Spacetime curvature - Why it works in GR

Computing GR and SR time-keeping dilation – with discussion

Spacetime – is a mathematical construct

Twins paradox animation – and simple equation

Citation and annotation for the book *Relativity Trail*