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Electromagnetic Particle-Waves
Always Travel Faster than
the Defined Speed of Light in a Vacuum

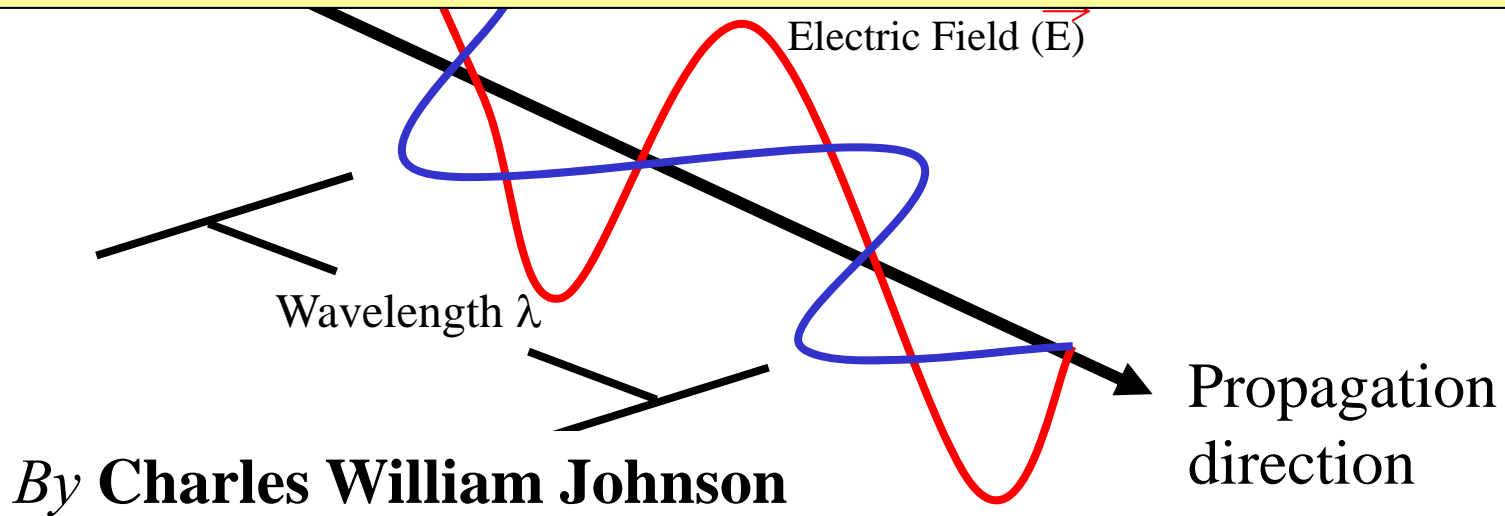
Charles William Johnson

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*Dedicated to Dr. Dean L. Sinclair,
a physicist friend of mine,
who will better explain all of this for us as of his theory of oscillators.*

*A relativist measuring the speed of light
resembles an ophiologist measuring the length of a snake
in its coiled position.*

In this essay, I present a few ideas that occurred to me during research on the special theory of relativity. It is my intention to soon present all of my findings about special relativity. For now, I offer these isolated comments about the relativist's measurement of the speed of light in a vacuum.

Generally, popular sources are given in this essay since the purpose is to understand the commonly held belief about the measurement of the speed of light. If a ray or a beam of light is emitted as a **particle-wave duality then it must be measured as such [note, at times I have inverted the traditional word-concept *wave-particle duality*]. As everyone knows, the speed of light in a vacuum is generally measured along a straight-line path from point A to point B. In my view, this represents a deficient methodology in the exact measurement of the electromagnetic wave of light specifically, and throughout the entire spectrum of electromagnetic waves in general.**

It is generally stated in the theory of special relativity that any event with mass cannot travel at or above the speed of light. In fact, it is stated that the electromagnetic wave of light, often called the photon, is massless and travels at the speed of light. This velocity, c , is deemed to be the upper limit of velocity that matter-energy can attain.

Nonetheless, it is also stated that certain kinds of matter-energy, such as the phase velocity of the electromagnetic wave of light attains superluminal velocities. But, then, immediately after suggesting the fact of superluminal velocities, relativists state that this kind of velocity over and above the supposed limit of light speed in a vacuum is meaningless as it is unable to carry a signal or communicate information.

Obviously, there are a number of deficiencies in this kind of “theoretical” reasoning. Firstly, it is stated that nothing can travel above the limit of the speed of light in a vacuum. Then, it is found that “some thing” can actually travel superluminally, but this discovery is not given its due. It is quickly brushed aside as irrelevant, not only to the theoretical interpretation of spacetime, but actually as being irrelevant to its existence in spacetime.

I find it difficult to accept this kind of immaterial reasoning about the physical and material aspects of matter-energy in spacetime/motion. Such statements, I find, are completely contradictory and inexactly stated. In my view, the known *superluminal* velocities of matter-energy cannot be brushed aside so easily as to declare them irrelevant or meaningless with the purpose of maintaining the beliefs in the theory of special relativity.

This essay treats some of the theoretical deficiencies in special relativity.

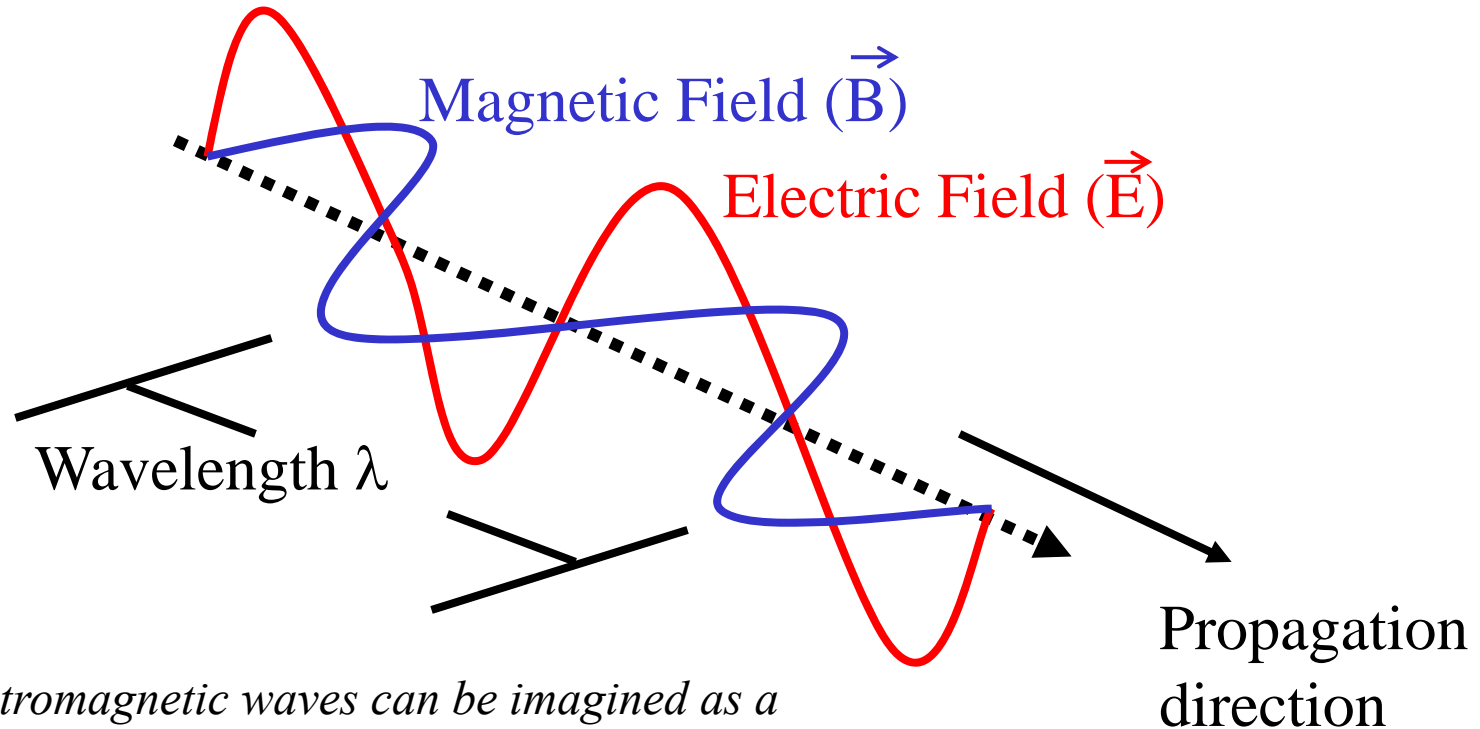
“Electromagnetic radiation is made up of electric and magnetic fields that move at right angles to each other at the speed of light.”

---Encyclopedia Britannica

“Electromagnetic radiation exhibits both wave properties and particle properties at the same time (... wave-particle duality).”

---wikipedia.com

Electromagnetic particle-waves paths of energy



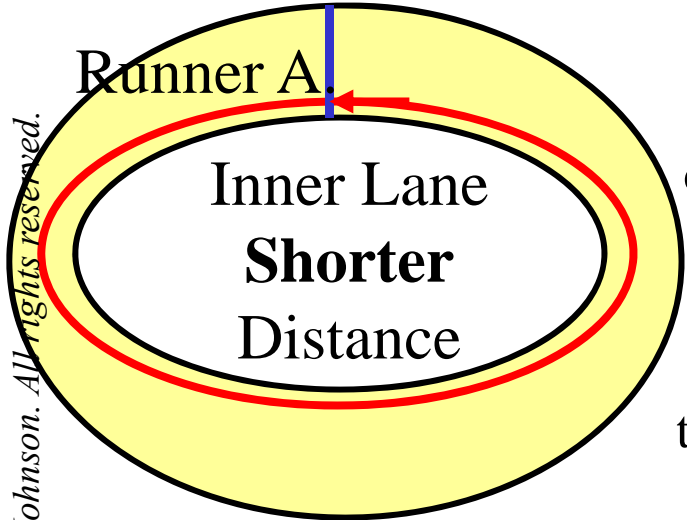
“Electromagnetic waves can be imagined as a self-propagating transverse oscillating wave of electric and magnetic fields.” ---wikipedia.com

NB: Drawings are for illustration, not to scale.

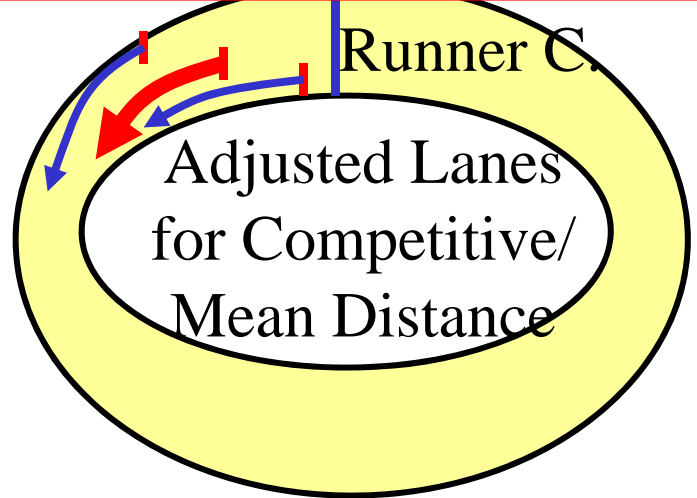
Field & Track: Basic Math

*15 mph = competitive
4-minute mile*

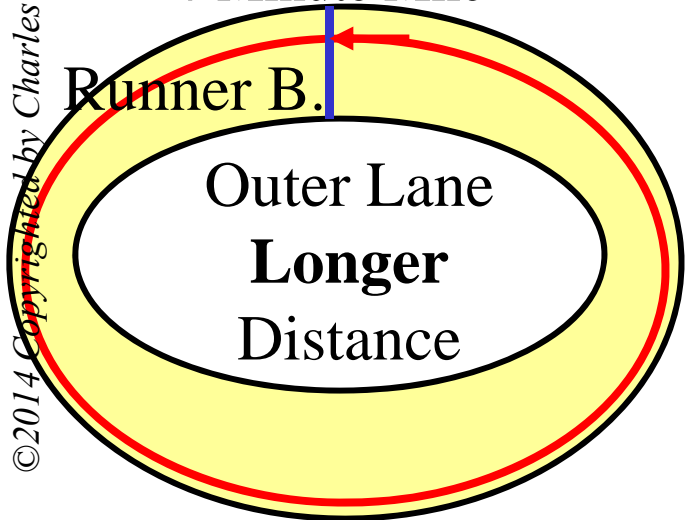
4-Minute Mile



In this hypothetical example all runners complete the course in four minutes. But, each one takes a different path & therefore must vary the speed in order to complete the course in four minutes.



4-Minute Mile



The wave-like path of runner-D is the longest of all. Runner-D must run at a much greater speed, in order to cover the zig-zag path in four minutes.

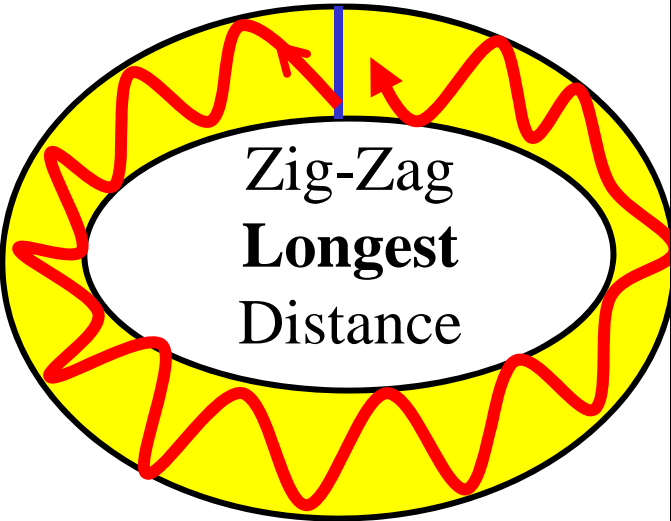


*>15 mph = zig-zag
4-minute mile*

**? Mph = zig-zag
4-Minute Mile**

What does the four-minute mile have to do with the speed of light in a vacuum?

Runner D.



4 runners run four different paths in same four-minute time period = 4 different speeds

One does not need to be a scientist in any discipline to understand that a runner on a zig-zag path as shown needs to run much faster than the runner taking a straight-line path in order to also be able to reach the end of the race in 4 minutes.

The timed measurement of the zig-zag four-minute mile applies similarly to the abstracted method of measurement required by scientists in their *definition* of the speed in light in a vacuum.

However, relativists overlook the zig-zag path of energy of the electromagnetic particle-waves in their measurements. The electromagnetic wave of light follows a similar indirect path.

A comment on a premise in the current theoretical conception of spacetime.

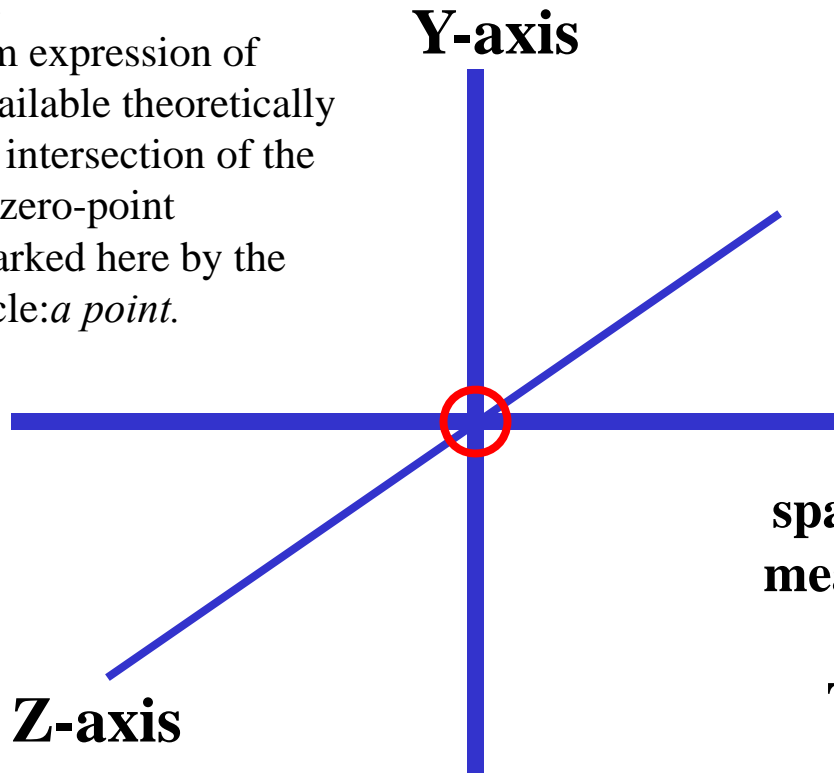
“Electromagnetic information about the charge travels at the speed of light.” ---wikipedia.com

x,y,z Dimensions of Space

The 3 lines represent a theoretical, minimal expression of spacetime.

The minimum expression of spacetime available theoretically would be the intersection of the three axes at zero-point gradation, marked here by the small red circle: *a point*.

X-axis



Z-axis

Timeline

The x,y,z axes traditionally employed to denote the three dimensions of space as theoretically abstracted straight lines with numerical gradations.

These do not exist in spacetime/motion, but are theoretically imposed upon the spacetime/motion coordinates of selected forms of matter-energy.

In many studies of the physical sciences, the 3-1 split of the spacetime dimensions take on more meaning than they actually enjoy in reality.

The measurement of the speed of light *in vacuo* is a case in point.

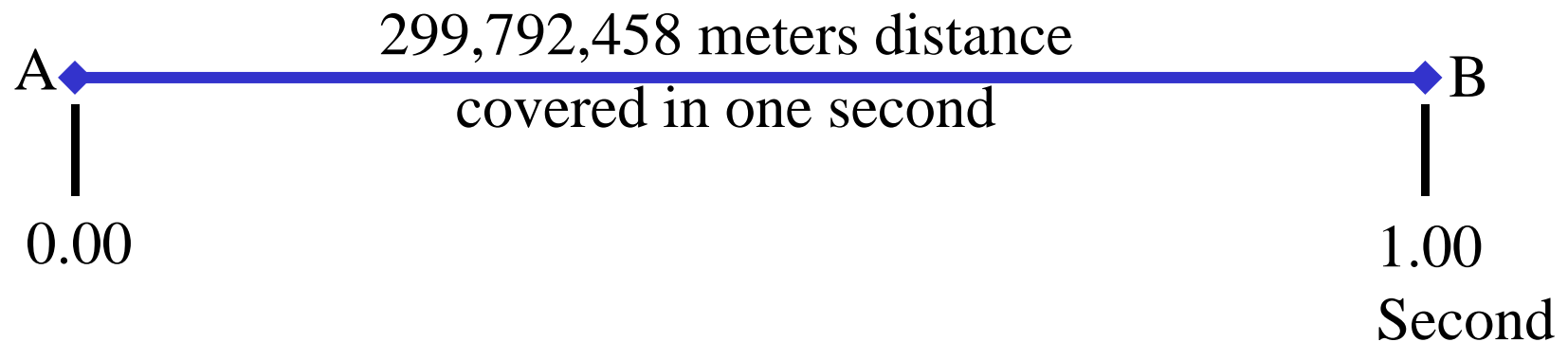
The x,y,z nomenclature is arbitrary, as are the lines, the gradation, etc.

Light is an Electromagnetic *Particle|Wave Duality*

The Speed of Light in a Vacuum is defined as

299,792,458 meters/second

“Electromagnetic radiation in a vacuum always travels at the speed of light, relative to the observer, regardless of the observer’s velocity.” ---wikipedia.com

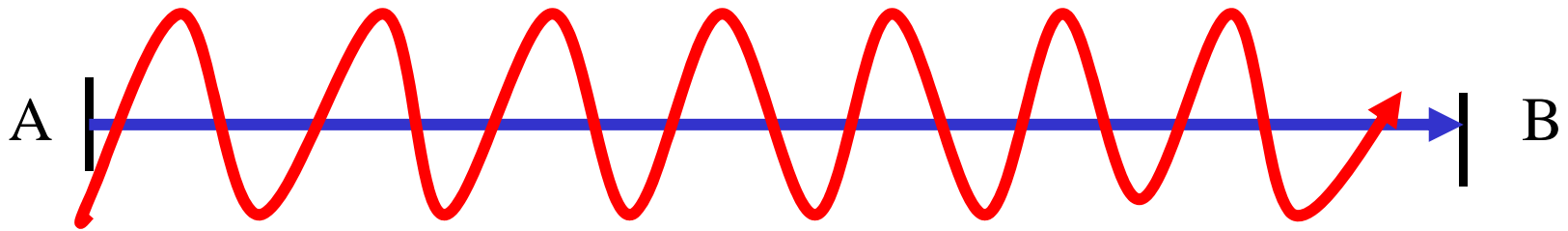


Visible light:
*frequencies $4-7.5 \times 10^{14}$ Hz; wavelengths:
750-400nm*

Relativists measure the wave-particle of light in a vacuum along a selectively defined straight-line of flight of travel between two chosen event points during one second of time [blue line].

The defined measurement of the speed of light in a vacuum is represented as a theoretically abstracted *longitudinal axis* between two event points in spacetime: the blue line.

It is said that the emission of light in a vacuum is measured from point A to point B, and on its return from point B to point A in order to obtain the mean.



For the purposes of illustration, only a single wave-line is drawn.

The electromagnetic particle-wave red line may represent a flat sine wave or a three-dimensional spiral curvilinear wave. Suffice it to understand that it is an oscillating wave.

If the straight blue-line path is 299,792,458 meters in length, then what is the length of the curvilinear red line wave?

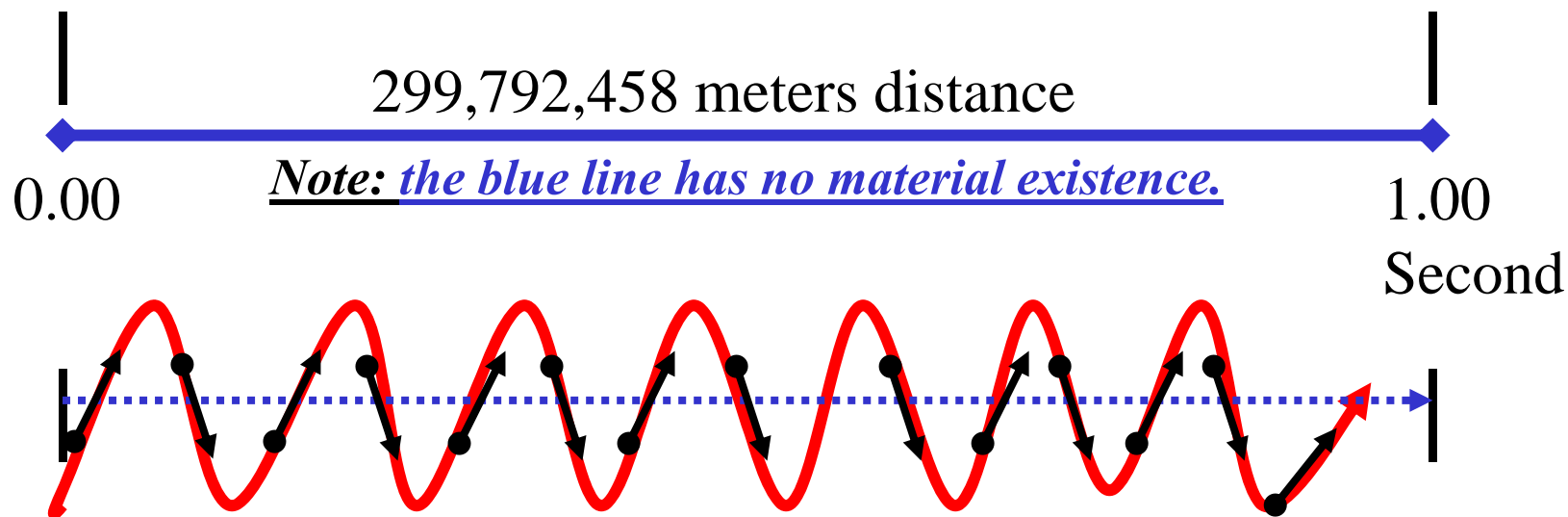
Albert Einstein's "On the Electrodynamics of Moving Bodies", 30 June 2905
Einstein's essay on the Theory of Special relativity

Einstein, in his much-cited 1905 essay was concerned with a conjecture about *"that light is always propagated in empty space with a definite velocity of c , which is independent of the state of motion of the emitting body"*. He also *"further assume[s] the quantity... to be a universal constant ---the velocity of light in empty space"*. In that regard Einstein takes into consideration *"the principle of the constancy of the velocity of light"*. There are no comments about superluminal velocity regarding "communications of information" as many relativists attribute to his writing.

Einstein does emphasize the thesis that *"Velocities greater than that of light have... no possibility of existence"*. *This statement, in my view, derives from Einstein's conceptualization that the speed of light in vacuum is measured as of the abstracted straight-line longitudinal axis. This is easily understood as of the examples that Einstein offers about a straight-line analysis of a ray of light between two points A to B and return from B to A in spacetime.*

The the so-called special theory of relativity may be called into question, as is the case in this essay, as the speed of the electromagnetic particle-wave of light in a vacuum always travels in excess of the defined speed of light in a vacuum .

In order for the electromagnetic wave|particle of light to complete the 299,792,458 meters along the one-second course, it must travel along its curvilinear path of energy at a speed greater than the self-defined 299,792,458 m/s pertaining to the blue line.



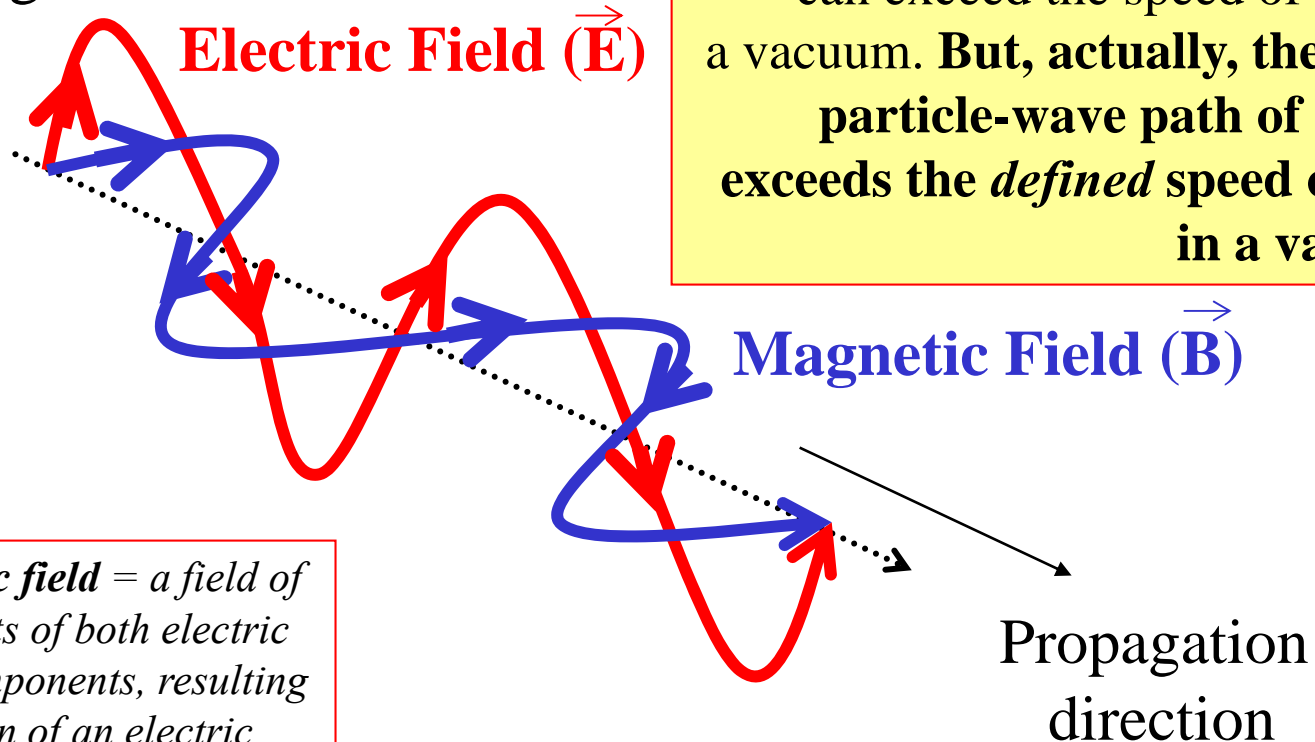
For the purposes of illustration, only a single wave-line will be drawn.

Given the particle-wave nature of the electromagnetic light event, the path of energy of light, the red curvilinear sine wave must necessarily cover its greater distance at a greater speed than that of the abstracted blue line in the stipulated one second. *For this reason some relativists identify the phase velocity of a particle riding on the wave as always traveling superluminally.*

The Paths of Energy of An Electromagnetic Particle-Wave

“By definition, the electromagnetic spectrum refers to electromagnetic waves of varying frequencies. In a vacuum, they all travel at the same speed.” ---wikipedia.com

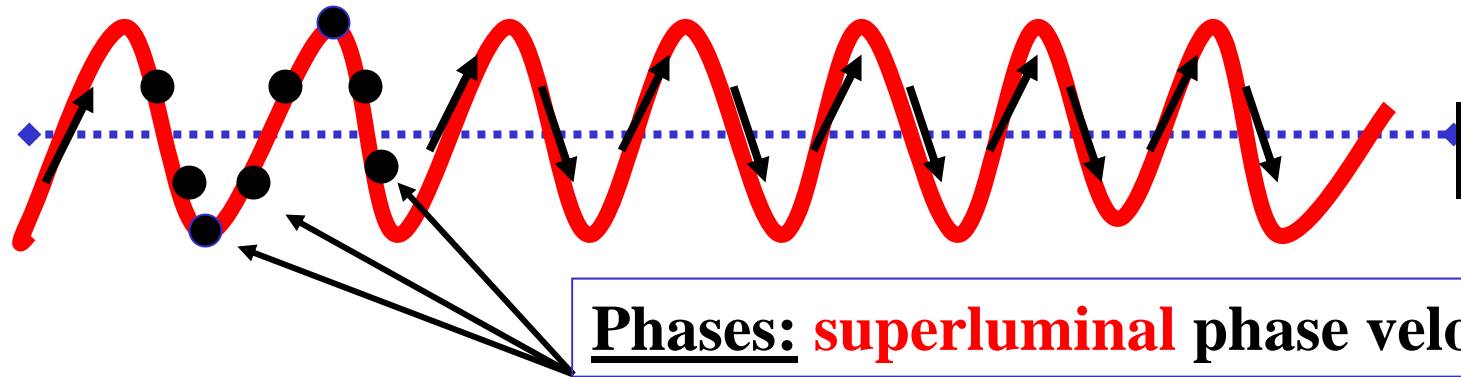
Electromagnetic wave



Relativists affirm that any phase can exceed the speed of light in a vacuum. **But, actually, the entire particle-wave path of energy exceeds the *defined* speed of light in a vacuum.**

“**Electromagnetic field** = a field of force that consists of both electric and magnetic components, resulting from the motion of an electric charge and containing a definite amount of electromagnetic energy.”
---A common dictionary definition

Scientists recognize that the **phase velocity** measured on the red particle-wave line always or at times exceeds the defined speed of light in a vacuum. **Yet, they assign it no meaning, since according to them, “it cannot carry a signal or communicate information”.** With that, they supposedly maintain that special relativity is not violated and superluminal speed is impossible. Even after identifying superluminal speed in matter-energy phenomena, they deny its possibility based on a self-defined caveat.



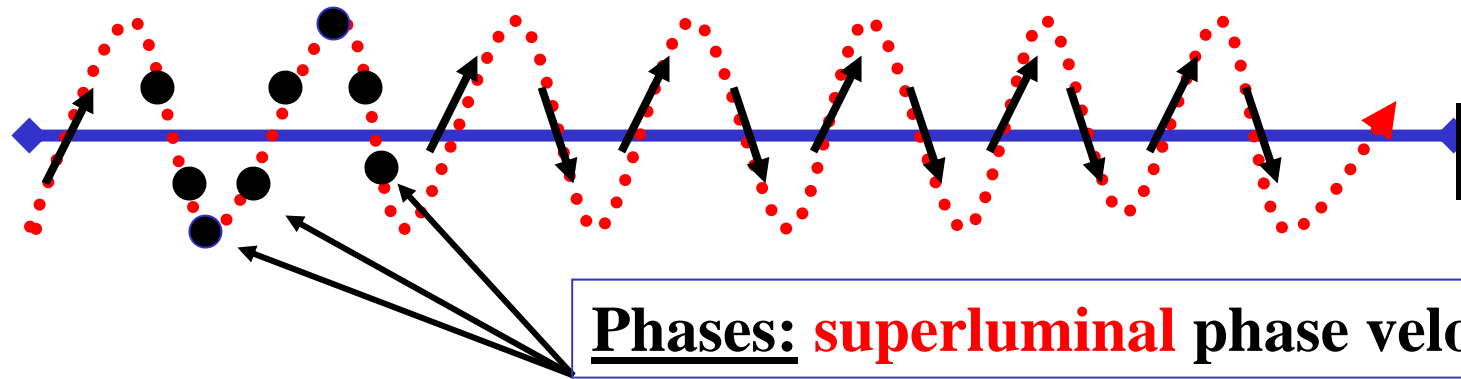
For the purposes of illustration, a single wave-line is drawn.

Just because someone affirms that a spacetime/motion event is *irrelevant or meaningless* does not mean that event is materially *non-existent* in spacetime/motion.

The red particle-wave line *is* the signal, the path of energy, upon which the electromagnetic particle-wave of light exists. Remember, nothing runs along the blue line, not even the so-called *wave front*.

... “Since the particle speed $v < c$ for any particle that has mass (according to special relativity), ...

***the phase velocity of matter waves always exceeds c
The superluminal phase velocity does not violate special relativity, as it carries no information.***”. ---wikipedia.com



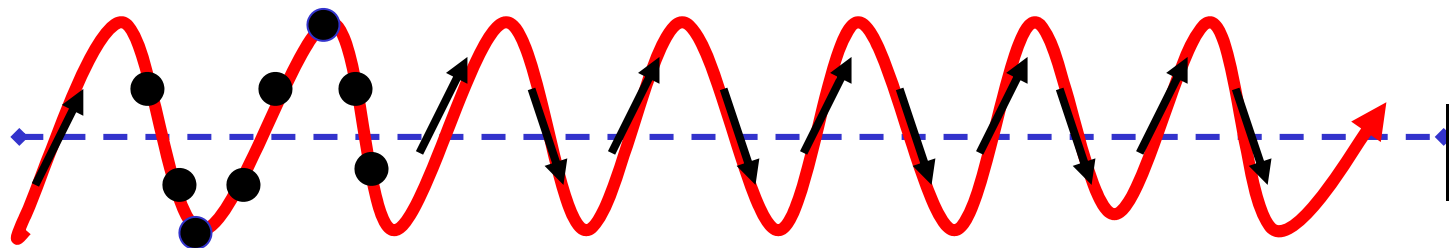
Phases: superluminal phase velocity.

For the purposes of illustration, only a single wave-line is drawn.

***Catch-22: “Nothing travels faster than the speed of light in vacuo.
But whatever travels faster than the speed of light in a vacuum does
not really mean anything because it does not counter the conjectures
of the theory of special relativity.***

So anything that travels faster than light is meaningless.”

The Electromagnetic Particle-Wave of Light Has Been Determined to Exist as an Ondulating Oscillatory Wave-Particle Spacetime/Motion Event

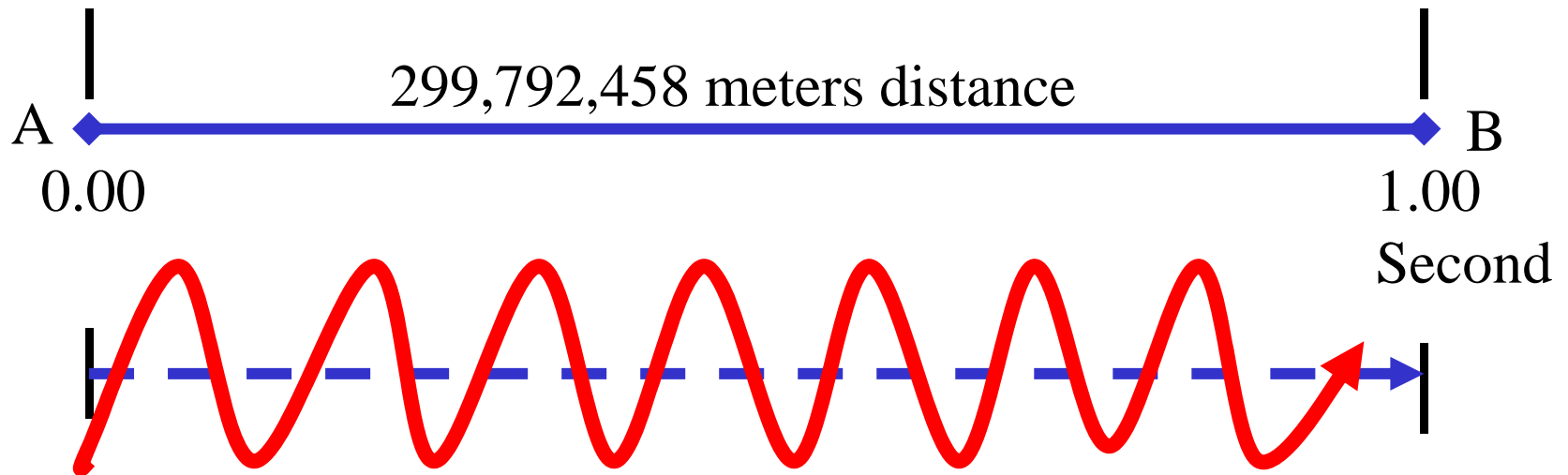


For the purposes of illustration, only a single wave-line will be drawn.

No signal, no nothing exists upon the theoretically abstracted blue longitudinal axial line. No spacetime/motion event travels along the blue straight line. The blue straight line is employed as an abstracted unit of measurement for the speed of light in vacuo.

The blue line is never physically manipulated, only the path of energy, the red particle-wave line, enters into spacetime/motion relations with other spacetime/motion events.

The curvilinear red particle-wave line represents the path of energy (**the velocity of the propagation of energy**) and represents a greater distance than the defined abstracted blue line.



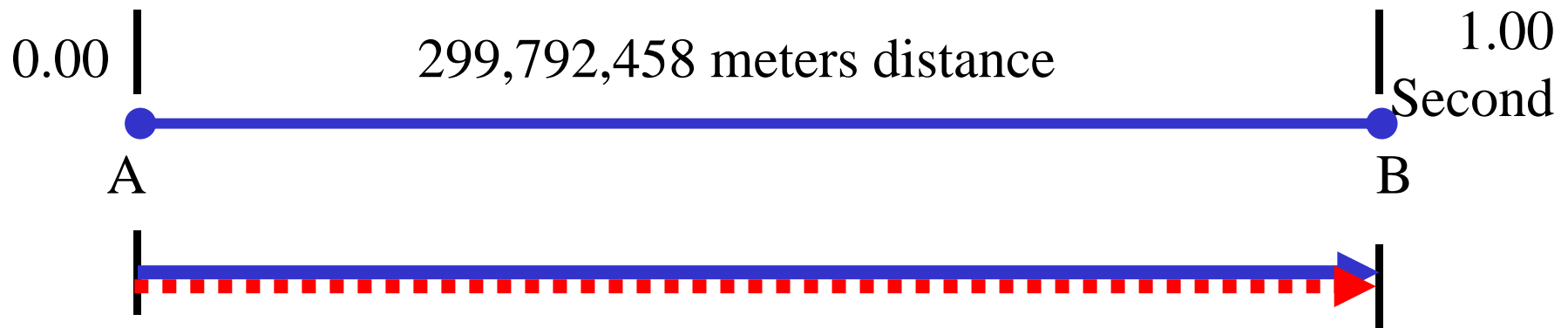
For the purposes of illustration, only a single wave-line is drawn.

Hence, the electromagnetic particle-wave of light *always travels faster than the defined speed of light in a vacuum*, as it travels a greater distance in one second than the self-defined measured straight blue-line distance A-B.

Yet, generally in the science literature this **superluminal speed** is denied in order to maintain the idea of the theory of relativity that the speed of light in vacuo is a limit to the velocity attainable by matter-energy.

Scientists define the speed of light in a vacuum as of the selected blue straight line within one second of time of flight.

*The definition is thus presented as though the **blue line** were actually the **red line** in terms of the measurements defined as an arbitrary distance between two selected event points.*

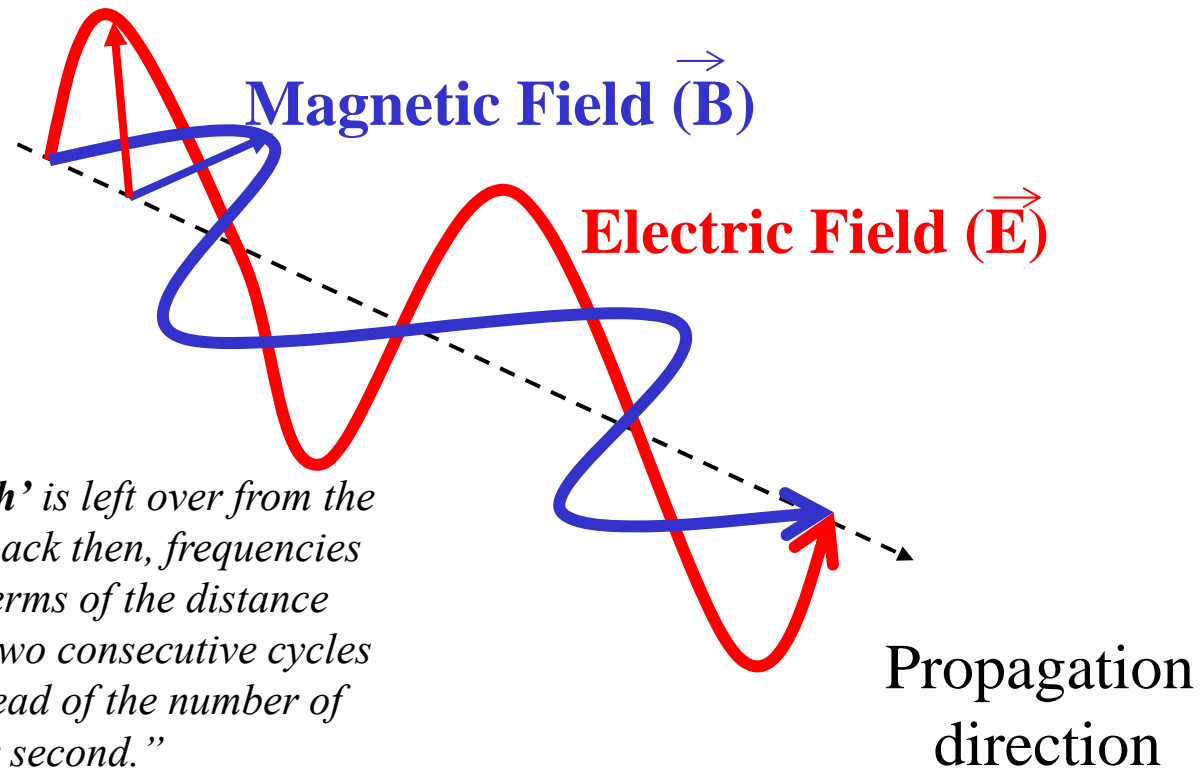


Relativists present the defined speed of light in vacuo as though it represented a straight line itself, as though it actually *was* the x-axis.

The manner in which the red path of energy occurs as an electromagnetic particle-wave event is thus rendered irrelevant by their definition based on the abstracted straight-line. With that, the nature of the particle-wave is ignored.

Even though the electromagnetic particle-wave of light is identified as *two perpendicular interlocked sine waves*, the actual distance covered by *the paths of energy of the particle-wave duality* are often not considered, much less measured.

Two perpendicular electromagnetic particle-waves interlocked



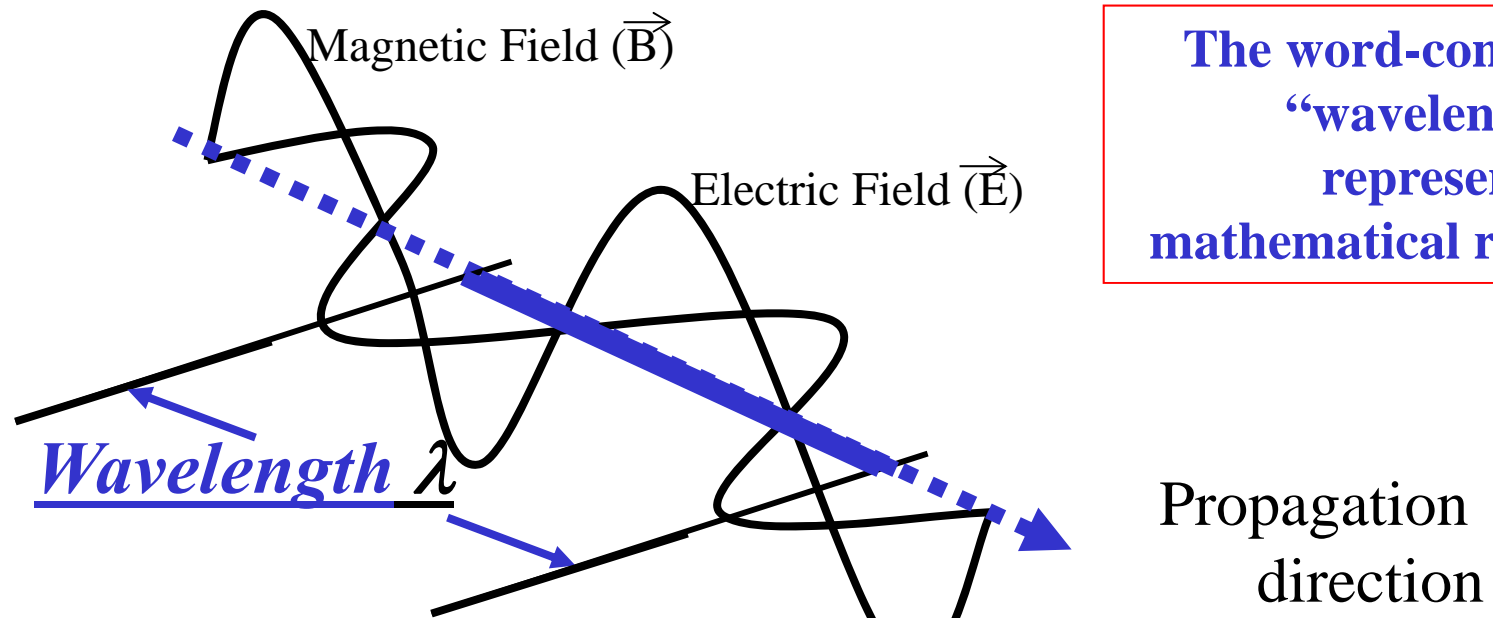
“The term ‘wavelength’ is left over from the early days of radio. Back then, frequencies were measured in terms of the distance between the peaks of two consecutive cycles of a radio wave instead of the number of cycles per second.”

---Universal Radio Research

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The fact that scientists ignore the wavepaths of energy of the electromagnetic particle-waves may be further confirmed in their *misleading definition of the word-concept wavelength*. The straight-line definition of “wavelength” is a theoretical abbreviation of spacetime/motion. It reflects a non-existing abbreviation of the path of the energy of a particle-wave.

Electromagnetic **wavelength** word-concept

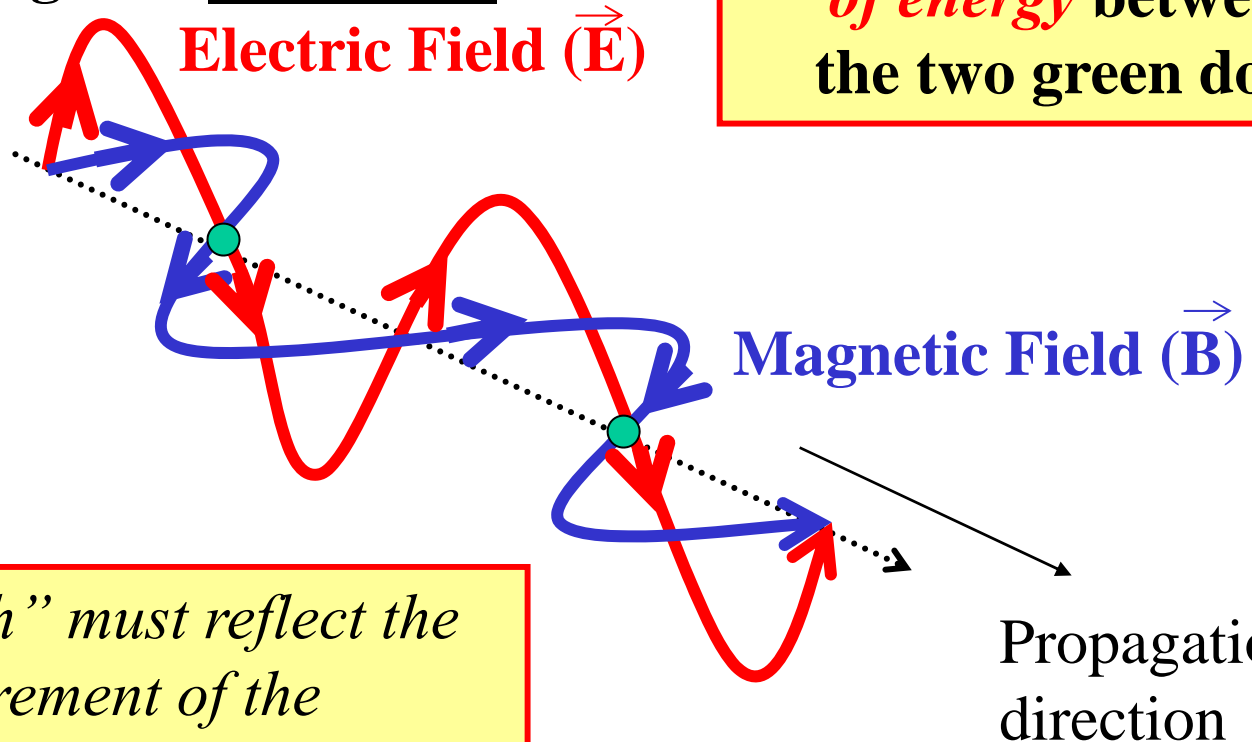


The word-concept
“wavelength”
represents a
mathematical ratio.

They do not measure the *length of the particle-wave along its path of energy*. They measure “wavelength” as of the abstracted horizontal axial blue line.

The Wavepaths of Energy of An Electromagnetic Particle-Wave

Electromagnetic wavepaths



Electric Field (\vec{E})

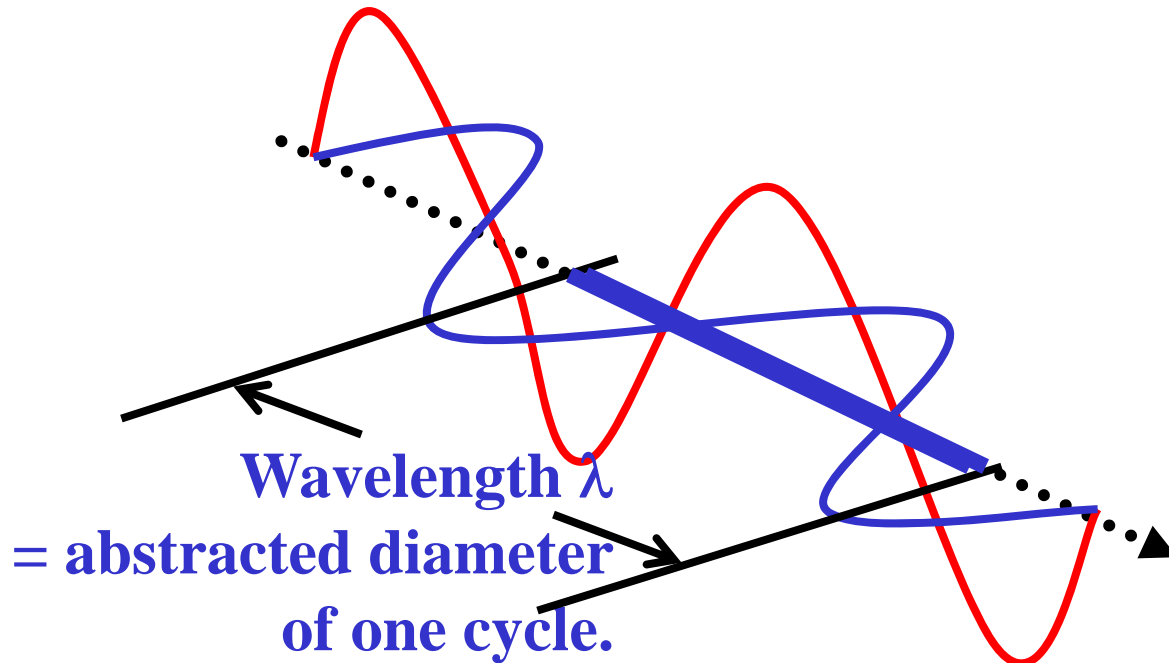
Magnetic Field (\vec{B})

*One cycle equals the distance of the **paths of energy** between the two green dots.*

*“Wavelength” must reflect the measurement of the **length of the wave along the path of energy** of the electromagnetic particle-wave.*

“Wavelength” is often defined as of the abstracted **diameter** of a theoretical circle|sphere along the longitudinal axis.

Traditional Electromagnetic “wavelength”
Indirect measurement of wavepath of energy.



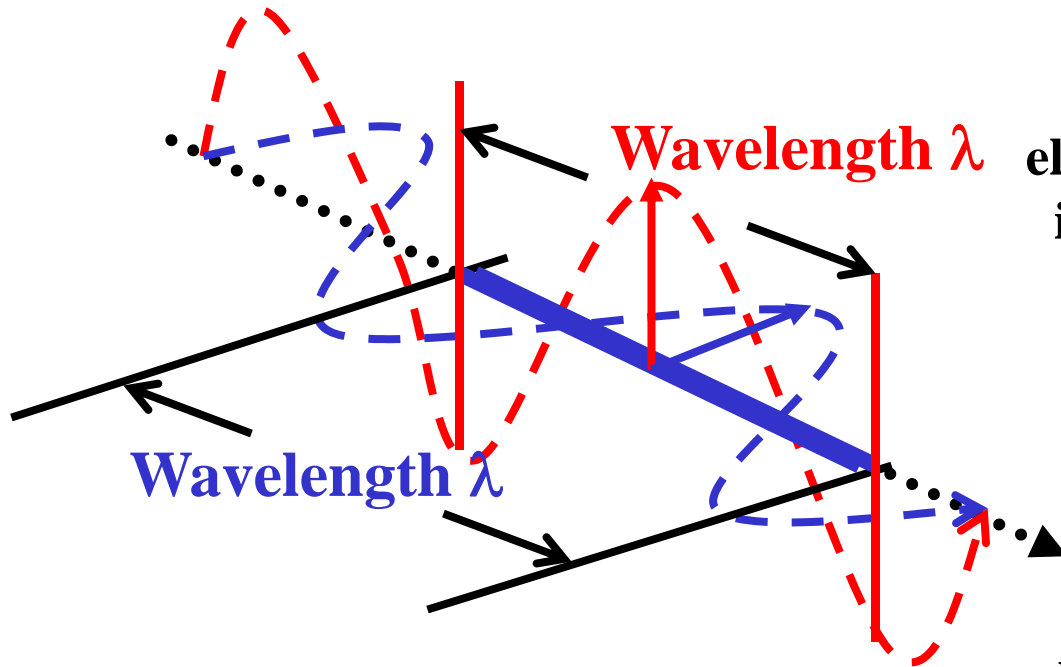
The word-concept “wavelength” represents an abstracted proportional relationship to the path of energy, the sine wave-particle. It does not represent a form of matter-energy in spacetime/motion. It is a factor that stands for and is employed as a ratio.

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The length of the curvilinear wave along the path of energy represents the abstracted circumference of a circle|sphere. Its measurement is often ignored in relativist theory.

Traditional Electromagnetic “wavelength”

Indirect measurement of the wavepath of energy.



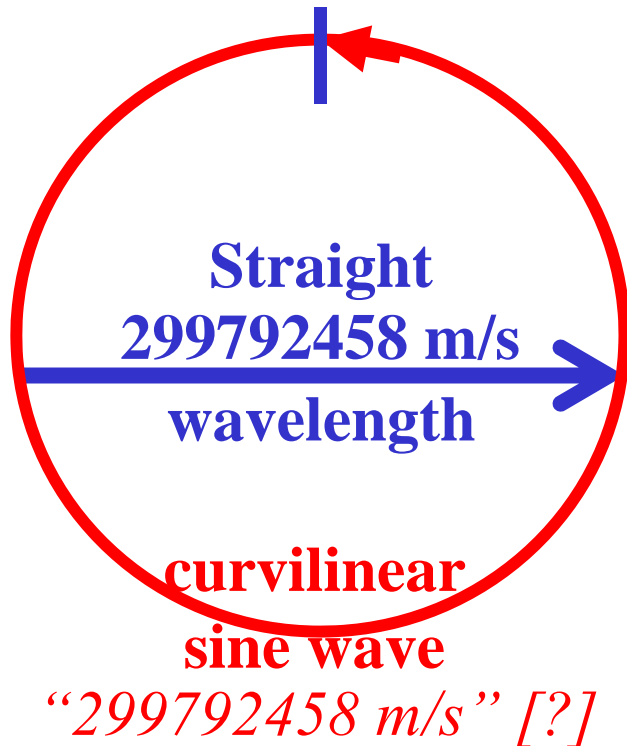
By employing the abstracted relational wavelength of an electromagnetic particle-wave, in a sense a *constant* has been produced in the comparative measurements of different particle-waves and their *minima|maxima* aspects. The “wavelength” then acts as a constant of measurement in comparative analyses of particle-waves.

With the current definition of “wavelength” based on the abstracted longitudinal blue line, particle-waves of different frequencies have the same wavelength.

This practice represents an indirect measurement of their wavepaths of energy.

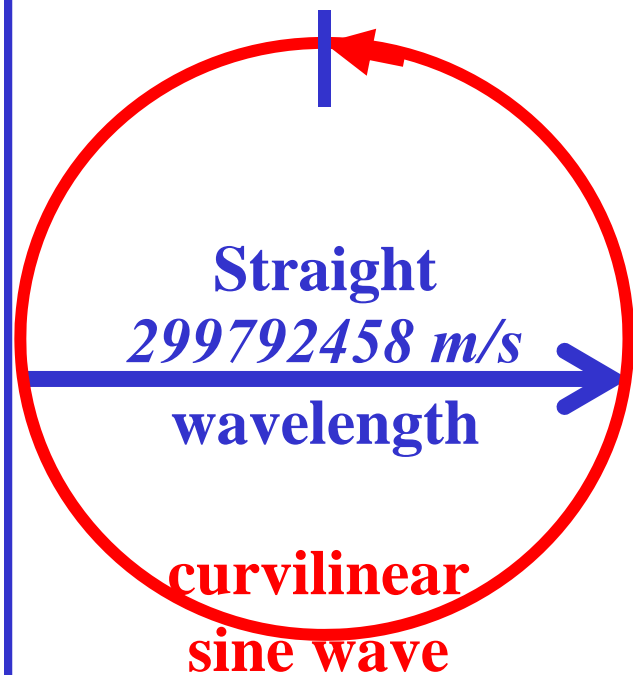
299792458 m/s times pi equals 941,825,783.7 m/s

The “wavelength” of a sine wave is often conceptualized in the science literature as the abstracted diameter of a theoretical circle|sphere along its longitudinal axis. The **curvilinear sine wave** is often conceptualized in the science literature as the circumference of the circle|sphere.



For the red curvilinear sine wave line and the blue straight diameter-like line to cover the 299792458 m/s in one second as defined by scientists, the abstracted red curvilinear sine wave must necessarily travel at a greater speed than the straight blue line. In this case it would be pi-times greater (3.141592654 times greater)

For the purposes of illustration, only a single wave-line is drawn.



“941,825,783.7 m/s”

Superluminal speeds will vary as of the variation in the nature of the sine waves.

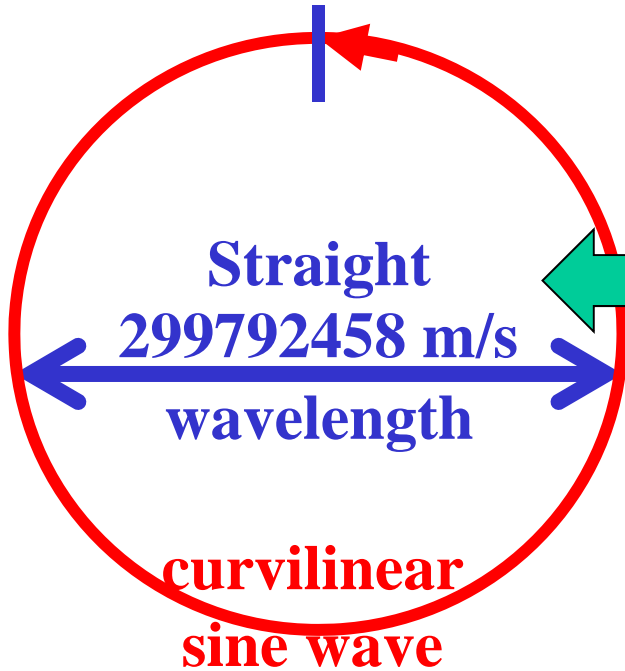
Both numerical measurements presented here exist in relation to one another as of the selected example. Variations exist as of the structure of the sine wave, the minima|maxima of the electric & magnetic fields interlocked sine waves, etc.

This example is only one abstracted case.

$$299,792,458 \text{ times } \pi = 941,825,783.7$$

When the electromagnetic particle-wave of light is measured along an arbitrary straight line between two eventpoints, the measured speed of light *in vacuo* obtains: **299,792,458 m/s**. Correspondingly, the selected abstracted electromagnetic sine particle-wave of the measured light when represented by a near perfect circle [circumference] derives the speed of light *in vacuo* as **941,825,783.7 m/s**

Idealized sine wave based on a circle and its diameter often found in the science literature.

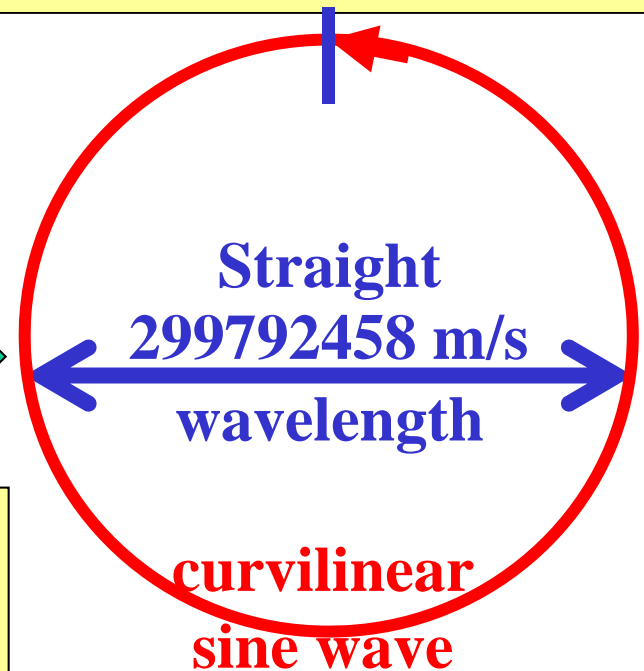


Mathematically and physically it is impossible to conceptualize the electromagnetic sine wave as the *circumference* of a sphere in relation to its corresponding *diameter* represented by the longitudinal axis of the wave *and* derive the same value of **299,792,458 m/s** for both representations.

"299792458 m/s" [?]

299,792,458 times pi = 941,825,783.7

The case may be that sub-particle physics behaves in strange and exotic ways, but this essential law of spacetime/motion matter-energy events appears to exist throughout all levels of the Universe.



"941,825,783.7 m/s"

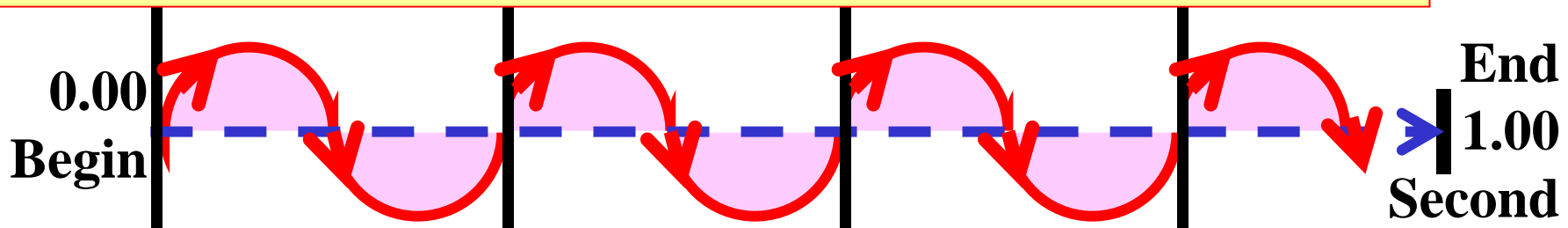
Example of a Unit Circle for Electromagnetic Sine Particle-Wave Measurement of the Speed of Light *in Vacuo*

When the electromagnetic particle-wave of light is measured along a selected straight line between two event points, the self-defined measured speed of light in vacuo is 299,792,458 m/s.



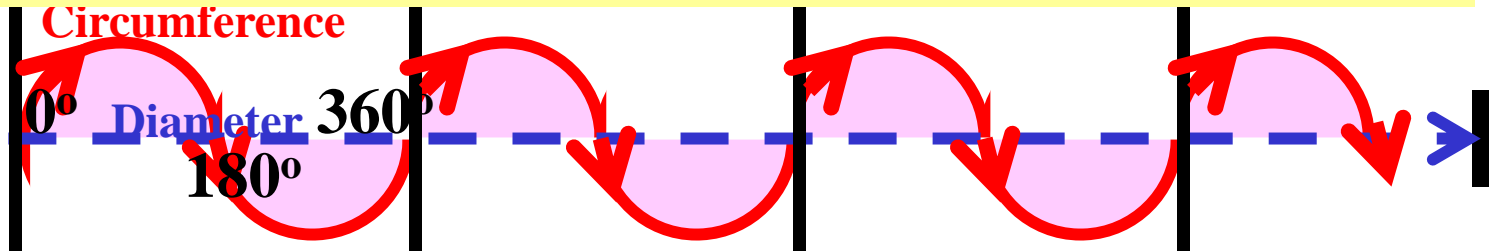
Simultaneously, the selected abstracted electromagnetic sine particle-wave of the measured light when represented by a near perfect circle, then has the corresponding speed of light *in vacuo* measured as 941,825,783.7 m/s

941,825,783.7 m/s Measured along path of energy: red line.



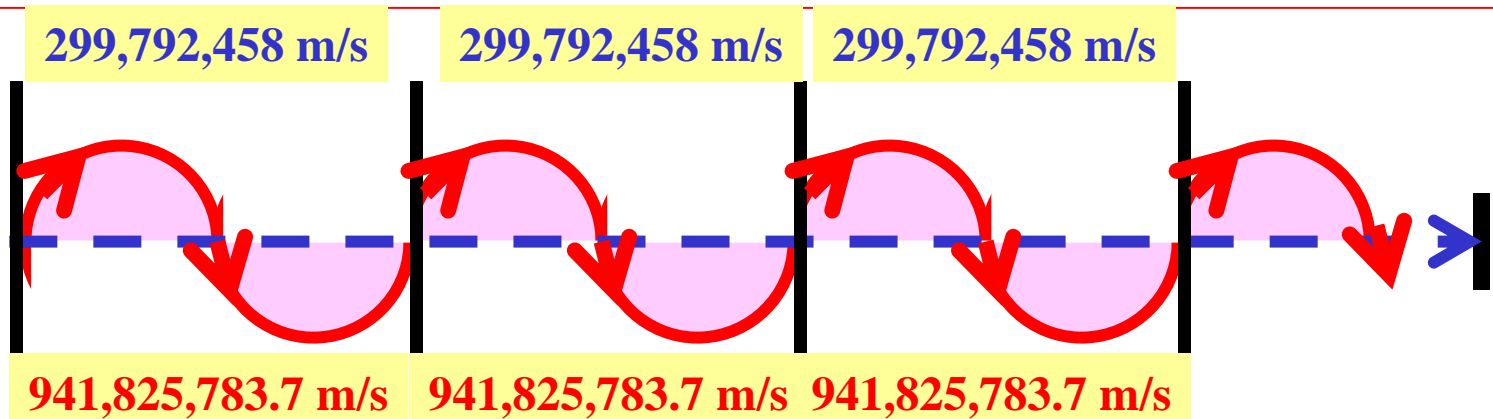
Frequency not to scale. For the purposes of illustration, only a single wave-line is drawn.

The **941,825,783.7 m/s** measured numerical value lies along the wavepath of energy if the sine wave represents a perfect unit circle|diameter.



Any variation in the minima|maxima of the two perpendicular interlocked electromagnetic particle-waves of light will produce accordingly distinct numerical values.

Any variation in the structure of the particle-wave will vary the speed.
Theoretically derived as of one cycle per one second; particle-wave frequency is not taken into account for this illustrated idea.

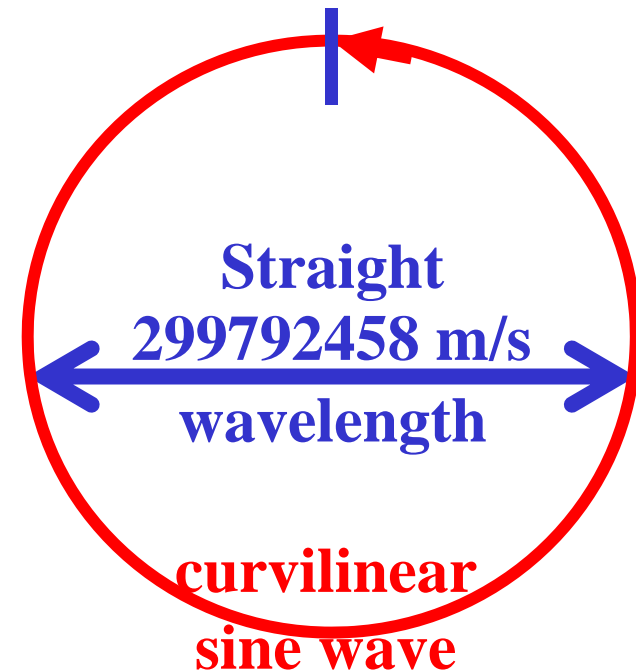


The *time-of-flight* of the speed of light in a vacuum is measured between two selected points, A-B, in both directions. It is measured to be exactly 299,792,458.0 meters *for one second of flight time*, denoted symbolically as c .

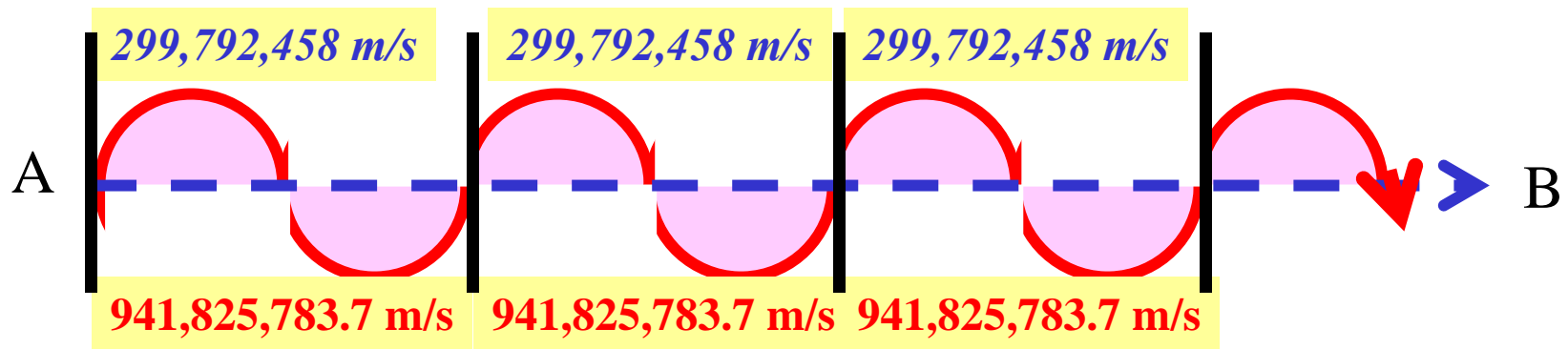
Now, specific phase velocities of a given particle on the *wavepath of energy* have been measured or computed to be above the defined c -measurement. Specifically, it has been stated that phase velocities *always travel at superluminal speeds, $> c$* . However, surprisingly, these superluminal velocities have been deemed to be *meaningless and irrelevant to the theory of special relativity* because they do not carry a signal or communicate information.

The very material point of the nature of matter-energy in spacetime/motion, **the wavepaths of energy of electromagnetic waves**, is being consciously disregarded with this kind of science discourse.

To continue to define the speed of light in a vacuum, c , as the supposed upper limit of travel for matter-energy in spacetime/motion, knowing quite well that this is *not* the case, defies logic and requires serious theoretical analysis.



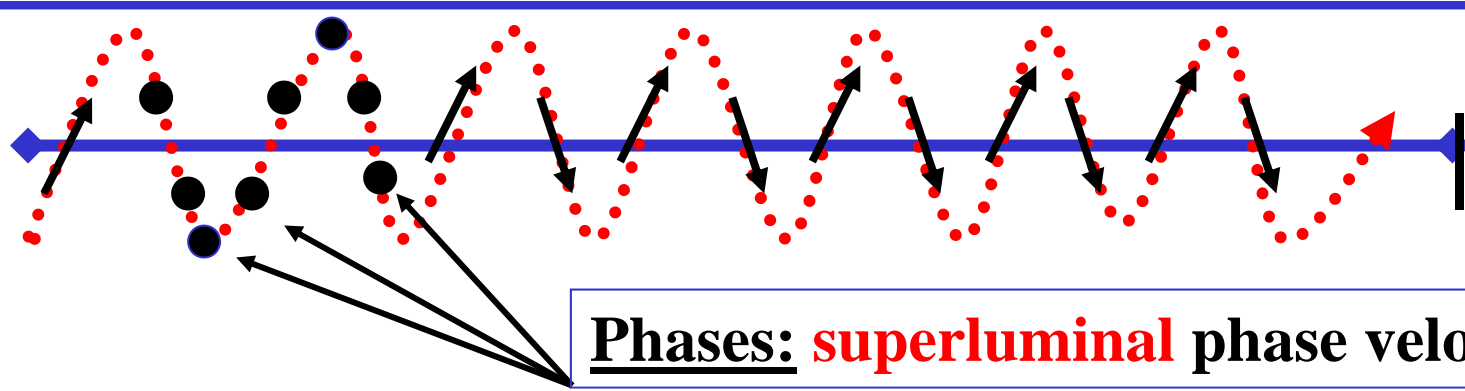
“941,825,783.7 m/s”



In this essay, I have offered a basic example with *hypothetical* numerical values based on a perfect circle representing a sine wave. What is required is to compute the actual numbers regarding existing matter-energy events in spacetime/motion. Obviously, this can be accomplished only with the proper scientific and technological equipment of measurement; none of which I possess.

No doubt, one can take the *begin-moment* and *end-moment* of the flight time of c , and derive a *working definition* [299,792,458 ms/], which is what exists in today's popular definition of the speed of light in a vacuum. But, the fact that this particular definition disregards the nature of the electromagnetic particle-wave itself that is being measured cannot be ignored.

The defined measurement of c between two points is how the speed of light in a vacuum has been measured for a couple of centuries now. It is time to break out of that theoretical *anachronism* and consider the meaning of the phase velocities of not only the electromagnetic wave of light, but of the entire electromagnetic spectrum.



Phases: superluminal phase velocity.

For the purposes of illustration, only a single wave-line is drawn.

In summary, the question whether a certain mass may travel faster than the speed of light in a vacuum is misleading. The defined speed of light in a vacuum is methodologically incorrect. The scientifically identified electromagnetic particle-wave duality itself travels at velocities greater than the *defined* speed of light in a vacuum.

Relativists still wonder whether mass may attain superluminal velocities. However, one needs to recognize and identify theoretically| practically the velocities of electromagnetic particle-waves as they exist along their paths of energy.

Obviously, the electromagnetic light particle-wave does not travel faster than itself. Rather the superluminal velocity of the electromagnetic particle-wave has not been recognized for what it is: *a velocity above the traditionally defined speed of light.*

The electromagnetic particle-wave of light and the entire electromagnetic spectrum travel at velocities above the defined speed of light in a vacuum.

These need to be computed and derived fully and exactly.

By their own admission in their science writing, relativists have identified *superluminal* velocities of matter-energy above their self-defined limit of the speed of light in a vacuum. However, **they have been reluctant to admit such discoveries because somehow they believe that would weaken or invalidate their special theory of relativity.**

Certain theses within special relativity have become a theoretical straight-jacket from which scientists know not how to escape. **The idea that the speed of light in a vacuum represents an unattainable limit by matter-energy should have been discarded by the relativists long ago once they derived phase velocities of the electromagnetic wave spectrum.** But, they have chosen the road that when faced with their own questionable knowledge have decided to rationalize its non-existence. The theoretical contradictions of stating that “*nothing travels faster than light speed*”, and then having to state that “*there are instances of faster-than-light speed*” in spacetime, but that “*these instances are meaningless*” represent glaring deficiencies in the theoretical physics of relativity.

There is a definite difference between the meaning that superluminal velocities have for spacetime/motion *and* the resistance to recognize that meaning. Being unable to recognize that meaning does not cause the event to have no meaning [relationship] in spacetime/motion. The possible meanings must be made explicit, which is the subject of my upcoming book on special relativity.

Electromagnetic Particle-Waves

**Always Travel Faster than the Defined Speed of Light
in a Vacuum**

By **Charles William Johnson**

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