

Philosophical Meanings of Relativity

"A man should look for what is, and not for what he thinks should be" - Albert Einstein (1879 - 1955)

Beyond the calculus algorithms of Newton and Leibnitz

Calculus mathematics involves concepts of a transcendent infinitely small and infinitely large, initially inspired by primitive sensory intuitions at the very edge of maximally sensible human experience, but yet understood nevertheless by human minds by means of thought - reasoning. Calculus mathematics therefore admits to the idea of limits where either the limit goes to zero or goes to infinity for converging series of terms. And because of the mathematically self - consistent logical constructs for limits and space - time continuities suggested by nature, the human mind is not insulted by any sort of contradiction with human experience. Thus, the inherent power of predictive mathematics is allowed by the human mind to transcend any minimal (or maximal) threshold of direct and immediate human experience. In fact, mathematics is readily accepted by the human mind beyond being merely allowed!! Therefore, the atomic theory in quantum science was predicted by the infinitely small differentials [to be considered as continuous variables in and of themselves] constructed by the infinitesimal analysis of the calculus where the derivative is the quotient of two related differentials such as time and space, thereby giving the "point properties" of a curvilinear function. However, in the modern calculus the ratio of two related but somewhat distinct differentials is more regarded as a single quantity owing finally to the mathematical acceptance by means of rigorous logic and analysis of the concept of continuous limit of a converging infinite series of real number ratio terms. Likewise at the macro - level for the universe, relativity theory is made possible by the modern calculus. In summary, all of mathematics is philosophy, but not all of philosophy is mathematics, where the modern calculus is truly a magnificent humanist achievement in the history of human thought!

More Philosophically

Let's all accept that there exists both an external physical world and an internal world of the human mind. Also, let's examine all too briefly what does or does not exist in the external physical world: essentially only two salient things exist in the external world and these are physical bodies and perceived relative motion of these same physical bodies. In other words, think to yourself as to what appears salient to the mind of your doggie or pussycat. Yes, I know ... love and food. But seriously, only physical bodies and perceived relative motion of these bodies are what essentially matters to the mind. Beyond that, all else is an invention of the human mind. For example, music. Musical notes and bars do not exist in the external physical world, do they? Rather these are invented by the human mind and then translated into a mathematical system of notes and bars which in turn are given further expression by human - invented musical instruments. Straight lines in nature? Do straight lines actually exist in the external physical world? How about points? Or circles and triangles? How about squares and rectangles? Have you ever seen or touched a straight line? A pure circle? In nature? In the real physical world? Yes, you have seen straight lines and pure circles drawn on pieces of paper but these have been expressions of human imagination. In truth, none of these "things" exist in the real world. They are ideas in the human mind which in turn are given expression by means of mathematical notational symbols. I mean, try yourself to describe in words only what is a point or a straight line. You can do it, but it definitely lacks the clarity, precision and power of further using mathematical notational symbols.

Philosophic Considerations of the Human Condition

The Relativistic Photon Rocket demonstrates how time and distance judgments are different for photon rocket astronauts and earth observers for the same ultimate star or galaxy destination. Even more importantly owing to the "human dimension" of all this relativity mathematical physics, is the fact that we humans live at the most 80 - 90 earth - years [most of which is taken up with socialization, education, etc.] and yet the distances even within our own Milky Way space are so tremendously vast, that astronauts travelling at even 50% the speed of light would not live long enough to do anything meaningful on some other planet circling whatever distant star to which they were aiming. In other words, there's the 4th dimension of relativity, probably even a 10th or 11th quantum dimension, but the entire matter of the "human dimension" is what ultimately will limit direct human exploration of interstellar and intergalactic regions of the cosmos. And this is neglecting for the time being any biologic revolution necessary for such galactic travel thru radiation fields, dark energy fields, and so forth. But should we humans be enthusiastic for interstellar exploration of Milky Way space? Definitely yes!! But it must first be accomplished by means of instruments and robotics, not human folks. And, finally, these relativistic photon rocket equations should make all humans further aware how deeply important is planet earth for human survival as even the nearest of the stars are presently beyond human reach.

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Insofar as the human condition is existentially subject to the laws and equations of the external world, we humans will never know instantaneously what is occurring in the farthest portions of the cosmos simultaneous to events co-terminus to our immediate experience. This fact of human existence is owing precisely to the unquestionable fact that the speed of light as well as other electromagnetic propagations of information is finite and hence not instantaneous. Although Plato never imagined this conundrum when he postulated his cave for human knowledge, it is undoubtedly also true that we humans live in a sort of "experiential bubble" and that our greatest means to expand our knowledge of the external world to whose laws and equations we are subject, lies in mathematical physics and the equations of chemistry. All other means of knowing and understanding the external world are bogus and only express inner human needs of emotion. See: "[Language, Truth, and Logic](#)", by A.J. (Alfred Jules) Ayer, first published V. Gollancz, Ltd., London, 1936; still now available from Dover Publications, Inc. ISBN: 0486200108

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Finally, as far as the human condition in the cosmos is concerned, it is truly existentially tragic. Even when we humans make contact with other intelligent beings in the cosmos, all is doomed no matter what. Why? Because of the expansion of the cosmos beyond and into the Ultimate Void on the other side of the cosmic horizon. So, as the cosmos expands and becomes ever more and more distant from earth observers, we humans and any other intelligent beings in the cosmos will increasingly see a flattened - out light wave of whatever is "out there" - i.e., in other words, we humans and any other intelligent beings will see less and less until we will finally see nothing. A flattened - out light wave will contain zero energy and hence zero amount of information. The focal length of any telescope will have to equal in physical length the diameter of the entire expanded cosmos in order to see anything which, by definition, will be impossible by any stretch of engineering! Hence, the night sky goes black since all cosmic matter will have achieved the speed of light and thereby becomes pure energy on the other side of the cosmic horizon; no telescope will ever be built to capture the flattened - out

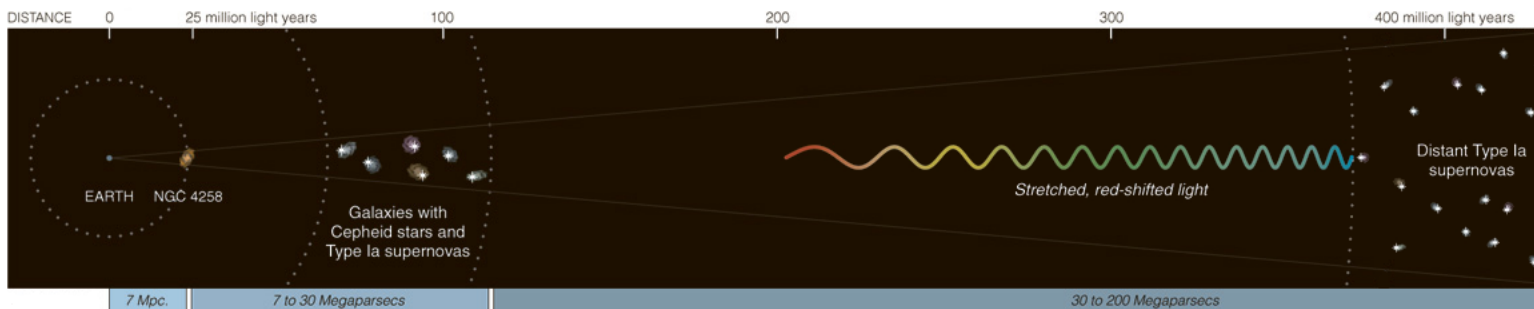
light wave; all energy in earth's vicinity is completely and totally dissipated; and, finally, the ideas of velocity, distance and time will disappear from human understanding as there will be no need to measure infinite blackness with infinite nothingness to observe!! This then is the tragedy not only of human existence in this cosmos but also the tragedy of other intelligent life in the cosmos. In the physical external world, that is.

But long, long before this eventual cosmic end, our sun will burn up and with it earth itself will burn up from the supernova that the sun will become in some 4 billion earth - years, plus or minus a 100 million earth - years here or there.

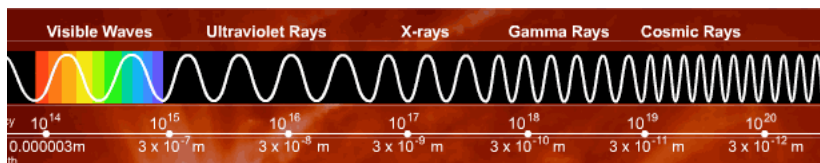
Cosmological Consequences

One cosmological and perhaps philosophical consequence of these equations is how as the universe inexorably expands outwards at ever unimaginable velocities, that for some future intelligent cosmologists the night sky goes completely dark in The Big Freeze.

[Here is the essential cosmological paradox](#): any future observer of the universe will observe a shrinking amount of the universe since it takes more and more time for the distant edges of light to reach an observer's eye in an ever more greatly accelerating and expanding fabric of space - time universe!! In other words, any future observer of the sky's universe will see less and less of an ever more expanding universe!



One main reason is because the wavelength of whatever light is received from the farthest edges of the cosmos (the cosmic horizon at about 13.7 billion \approx 14 billion light - years distance from earth) will exceed the diameter of the observed universe. And, since it will be impossible to ever build a large enough telescope to receive an infinite wavelength of such light due to Doppler Effect and extremely attenuated energy and frequency of this light, it will, by any sort of cosmological mathematics, be impossible to see such light!!



Hence, the light goes out in the known observable universe for any sentient intelligent observer still alive in approximately 1 trillion earth - years, plus or minus another 100 million earth - years!!

In this situation also, [the observed universe](#), if such a thing is even possible, will be flat since all observed wavelengths of whatever electromagnetic propagation will equivalently be observed as being essentially non - sinusoidal or flat. Just simply imagine looking at a drawn - out string without any crest - to - crest wavelength due to extreme Doppler or redshift and hence no frequency; this, then, will be whatever "light" reaches an observer's eye or telescope -- neither the observer's eye nor his telescope will see anything due to infinite wavelength and extreme Doppler or redshift!

Additionally, any intervening ionized interstellar dust or gases will bounce any incoming electromagnetic propagation of extremely low energy content (light, x - ray, whatever) away from an observer's eye or telescope similar as to how presently earth's ionosphere bounces AM radio waves back to earth at much longer distances than otherwise straight - line distances on earth would allow.

In other words, all observers and their telescopes would be "seeing" and "living" from within a black hole: an inside - out black hole!!

Finally, because there will be no stellar objects to see with everything having gone black for both "night and day", there will be no need for the human mind to create an accounting for the motion of bodies, which is precisely [what time is](#)! In fact, distance and velocity will no longer be calculated since these mathematical quantities will no longer be required in this eventual and ultimate world of physics.

The mathematics of Doppler, the law of energy conservation, Hubble's equation and the inexorable expansion of the universe dictate this ultimate fate.

And there is absolutely no escaping this ultimate cosmological fate!!

It's called [The Big Freeze](#).

The Philosophic Meaning of Minkowski's Spacetime Geometry

Mathematics and the physics of the external world to which it attempts to best explain nature in terms of symbolic logic, is the human mind's premier tool for understanding physical reality. Yet, admittedly, mathematical physics will always be a work - in - progress for discerning "ultimate truth", whatever that is. Therefore insofar as Einstein's spacetime relativity mathematics and Minkowski's spacetime geometry are concerned in describing physical reality, we are now more intellectually informed than from any previous period in human intellectual history that as any body or object travels at a significant fraction to the speed of light, the body itself will be significantly "twisted" or rotated in the geometry of spacetime!

In other words, the body or object will undergo spacial rotation and time dilation (expansion, units of time expand), both of which will be manifest in the deformation of the geometry of spacetime. This result is actually quite amazing, notwithstanding defying ordinary common sense.

That is, as velocities significantly increase, the geometry metric as to what constitutes a unitary measure of space - distance is altered and the physical axes of direction comprising the inertial (non - accelerating) frame of reference are rotated as well as what constitutes a unit measure of clock time is dilated; all of which is demonstrably shown by Minkowski's light sphere of geometry!!

More philosophically, our human perceptions of external reality can tell us only a limited amount of truth regarding the external world. At a deeper level of understanding, therefore, it is only by means of philosophic and mathematical inquiry that an observer in S and S' can relate their "experiences" to each other beyond what their respective naïve perceptions will tell them. To the observer in S there is one sort of angle of velocity motion but to the other observer there is another, but different, angle of velocity motion, whereas neither would realize that their respective angle of velocity motion differs from the other except by deeper philosophic and mathematical inquiry.

Conclusion: Euclid is therefore wrong: there is no such thing in nature for absolute straight (or parallel) lines at significant fractional velocities approaching the speed of light!! Additionally, because of Minkowski's spacetime geometry, we humans live in a 45 - degree "light cone" of knowing" since that is the maximum angle between any axis of physical reality and the 4th - dimensional axis of time!

Philosophic Inquiry of the 'Human Condition for Knowing'

Here's one last thing to think about: if the speed of light was instantaneous and not at a given finite speed, we humans could then "know" everything about everything instantaneously from the light that comes into our eyes! We humans would be instantaneously connected to the furthest parts of the cosmos in our knowledge of what transpires in the cosmos. Nothing would be hidden from either our view or our knowledge of the universe. But this is not true. In fact, we intelligent beings live in a "light cone of knowing" due to the fact that the speed of light is finite, even though at a universal constant.

Actually to be strictly solipsistic, we humans exist - or rather glide along - precisely on this 45° "Lightlike space" worldline!! This is called "Proper time". And any ideas of "future" or "past" is strictly an invention of the human mind!! Which is ok since it allows us humans to manipulate the external physical and time (spacetime) world to the greater benefit of our own species survival.

So, we humans as intelligent beings cannot "know" everything around ourselves at all times and for all places in the universe.

Also, look at this fact of human existence this way: there are all sorts of magnetic and electric fields around us, practically all the time. But we only "know this" by turning on a television or radio in order "to know" this reality. Otherwise, we humans "know" very, very little about what surrounds us and, in truth, what affects us! Until we turn on the radio or television!!

What If? ... The Speed of Light Is ...

The Speed of Light is Instantaneous

For $c \rightarrow \infty$, speed of light instantaneous

$$\left. \begin{aligned} x &= \frac{x' + vt'}{\sqrt{1 - \frac{v^2}{c^2}}} \\ y &= y' \\ z &= z' \\ t &= \frac{t' + (v/c^2)x'}{\sqrt{1 - \frac{v^2}{c^2}}} \end{aligned} \right\} \text{ Lorentz Inverse Transformation Equations}$$

becomes

$$\left. \begin{aligned} x &= x' + vt' \\ y &= y' \\ z &= z' \\ t &= t' \end{aligned} \right\} \text{ Galilean Inverse Transformation Equations}$$

and

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \implies m = m_0, \text{ proper mass for observer at rest}$$

$$l = l_0 \sqrt{1 - \frac{v^2}{c^2}} \implies l = l_0, \text{ where sometimes } l_0 = l', \text{ proper length for observer at rest}$$

$$E = mc^2 = \overbrace{m_0c^2}^{E_0} + \overbrace{\frac{1}{2}mv^2}^{\text{k.e.}} \implies E \rightarrow \infty \text{ and all velocities } v \rightarrow \infty, \text{ pure kinetic energy!}$$

$$m = \frac{E}{c^2} = 0, \text{ all mass disappears into pure kinetic energy!}$$

We humans exist only as pure energy, if that!!

Furthermore, if you think about it, in this situation where all light is propagated instantaneously, all light, everywhere, becomes instantaneously available to all "eyes" in the cosmos and hence everything is blindingly white without any shadows cast by any sort of matter!! If you think this is not true, sometime just look up at the night sky and begin imagining!

The Speed of Light is zero, nonexistent

For $c \rightarrow 0$, speed of light goes to zero or nonexistent

$$x = \frac{x' + vt'}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{x' + vt'}{\sqrt{-\infty}} = \frac{x' + vt'}{\sqrt{-1}\sqrt{\infty}} = \frac{x' + vt'}{i\infty} = \frac{-i(x' + vt')}{\infty} = 0$$

$$y = y'$$

$$z = z'$$

$$t = \frac{t' + (v/c^2)x'}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{t' + (v/0^2)x'}{i\infty} = \frac{-i(t' + \infty \cdot x')}{\infty} = \frac{-i \cdot \infty}{\infty} = -i$$

or indeterminant out in Elsewhere, beyond Minkowski's spacetime Light Cone

and

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{m_0}{\sqrt{1 - \frac{v^2}{0^2}}} = \frac{m_0}{\sqrt{-\infty}} = \frac{m_0}{i\infty} = \frac{-im_0}{\infty} = 0, \text{ where}$$

dilated mass disappears

$$l = l_0\sqrt{1 - \frac{v^2}{c^2}} = l_0\sqrt{1 - \frac{v^2}{0^2}} = l_0\sqrt{-\infty} = l_0\sqrt{-1}\sqrt{\infty} = l_0i\infty = \infty,$$

where dilated length goes to imaginary infinity

$$E = mc^2 = \overbrace{m_0c^2}^{E_0} + \overbrace{\frac{1}{2}mv^2}^{\text{k.e.}} \implies E \rightarrow 0, \text{ all velocities } v \rightarrow 0, m_0 \rightarrow 0 \text{ or indeterminant}$$

$$m = \frac{E}{c^2} = 0, \text{ all mass disappears or indeterminant}$$

We humans exist only as nothingness in pure darkness, if that!!

The Philosophical Moral of this Story

Aside from the obvious fact that in order for there to be velocities and hence time, not to mention bodies of ponderable mass, we need finite light speed; but more importantly, finite light speed provides for life's opportunity to exist!

And the "Goldilocks Zone" for our carbon - based human existence is existentially associated with the "Anthropic Principle" exemplified by the "fine - structure constant", where the Anthropic Principle still stands as the unifying mathematical statement as to why everything exists as it does:

$$\alpha = \frac{e^2}{4\pi\epsilon_0\hbar c} = 7.297352568(24) \times 10^{-3}, \text{ where}$$

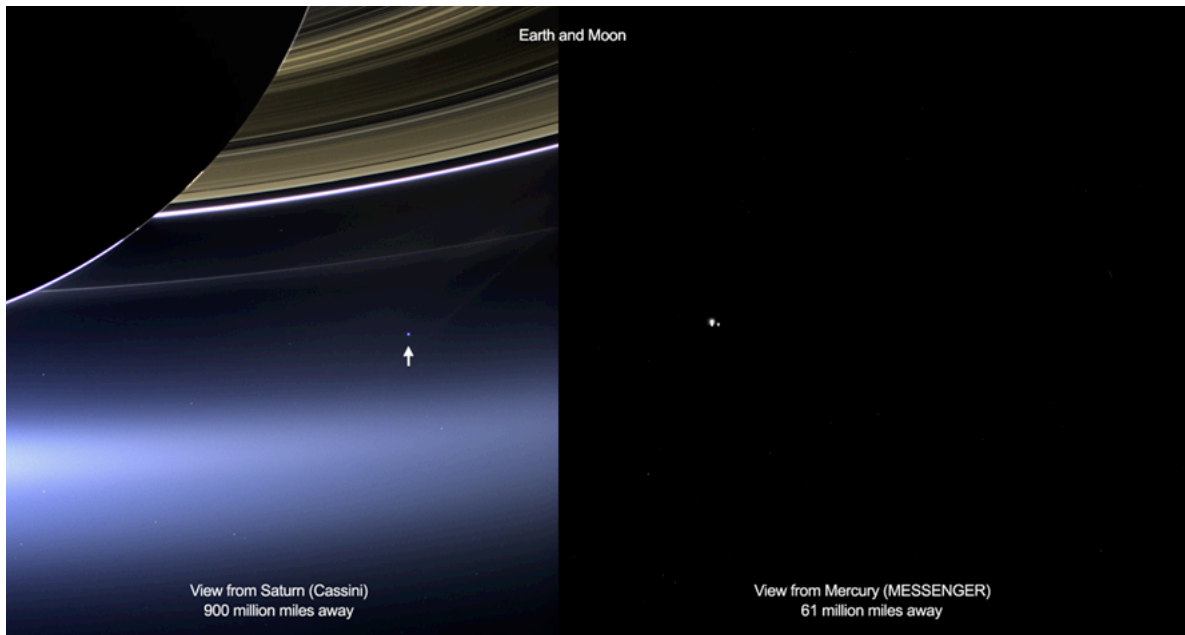
$$e = 1.60217653(14) \times 10^{-19} \text{ C (coulomb), elementary charge is the electric charge carried by a single proton (or its negative carried by a single electron)}$$

$$\hbar = \frac{h}{2\pi} = 1.05457168(18) \times 10^{-34} \text{ Js (joules - second), Dirac's Constant or Planck's Reduced Constant}$$

$$c = 299,792,458 \text{ ms}^{-1} \text{ (meters per second), speed of light in vacuo}$$

$$\epsilon_0 \approx 8.854187817... \times 10^{-12} \text{ Fm}^{-1} \text{ (farad per meter), permittivity of vacuo space - i.e., the ability of free empty space to transmit force fields}$$

Notice, by the way, the role of the finite speed of light!



NASA: Cassini spacecraft, published July 19, 2013

Earth's humans are literally inconsequential in the Grand Scheme of the Cosmos except to ourselves - Relativity Science Calculator

"Only two things are infinite, the universe and human stupidity, and I'm not sure about the former" - Albert Einstein (1879 - 1955)

The Great Cosmic Tragedy *is that all intelligent life in the universe is ultimately doomed - Relativity Science Calculator*