The True Scale of Atoms

Post by “Don” of December 23, 2023 at 10:26 PM

https://youtu.be/KgSGlbV0kZo?feature=shared

Post by “Bryan” of December 23, 2023 at 11:00 PM

Thanks for sharing!

Post by “Bryan” of December 24, 2023 at 1:05 AM

(excuse my slight swerve from the topic)

This is fun:

> Quote from Relativity: The Special and General Theory, 1916, Translated: Robert W. Lawson
>
> The purpose of mechanics is to describe how bodies change their position in space with "time." **I should load my conscience with grave sins against the sacred spirit of lucidity were I to formulate the aims of mechanics in this way**, without serious reflection and detailed explanations. Let us proceed to disclose these sins.
>
> **It is not clear what is to be understood here by "position" and "space."** I stand at the
>
> window of a railway carriage which is travelling uniformly, and drop a stone on the
>
> embankment, without throwing it. Then, disregarding the influence of the air resistance, I see the stone descend in a straight line. A pedestrian who observes the misdeed from the footpath notices that the stone falls to earth in a parabolic curve. I now ask: Do the "positions" traversed by the stone lie "in reality" on a straight line or

> on a parabola?
>
> Moreover, what is meant here by motion "in space" ? From the considerations of the
>
> previous section the answer is self-evident. **In the first place we entirely shun the vague word "space," of which, we must honestly acknowledge, we cannot form the slightest conception**, and we replace it by "motion relative to a practically rigid body of reference."
>
> The positions relative to the body of reference (railway carriage or embankment) have
>
> already been defined in detail in the preceding section. If instead of " body of reference" we insert "system of co-ordinates," **which is a useful idea for mathematical description**, we are in a position to say : The stone traverses a straight line relative to a system of coordinates rigidly attached to the carriage, but relative to a system of co-ordinates rigidly attached to the ground (embankment) it describes a parabola. **With the aid of this example it is clearly seen that there is no such thing as an independently existing trajectory**, but only a trajectory relative to a particular body of reference.
>
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When it is put so simply, it is easy to simply disagree with it.

Ultimately, Einstein throws away the void, and his "vacuum" is affected by gravity.

Post by “Cassius” of December 24, 2023 at 7:24 AM

> Quote from Bryan
>
> When it is put so simply, it is easy to simply disagree with it.
>
> Ultimately, Einstein throws away the void, and his "vacuum" is affected by gravity.

It's early in the morning and I am exhausted from the pace of Don's first video as i read this 😉

But rather than just pass over that I'm not sure of the final impact of post 3, I want to be sure I grasp it since you took the trouble to edit it 10 times 😉

Are (1) the illustration of dropping the penny from the train and (2) Einstein in this context, correct, or incorrect?

Post by “Don” of December 24, 2023 at 8:47 AM

> Quote from Cassius
>
> Are (1) the illustration of dropping the penny from the train and (2) Einstein in this context, correct, or incorrect?

From the point of view of the person standing on the ground, the stone dropped inside the moving train travels in a curve.

From the point of view of the person dropping it inside the moving train, the stone travels straight down.

The is no ultimate "correct" perspective. It's all relative.

That seems a good analogy/metaphor for some of Epicurean philosophy's position.

A couple mind blowing videos:

https://youtu.be/wD7C4V9smG4?feature=shared

(Train explanation at 3:00)

https://youtu.be/SrNVsfkGW-0?feature=shared

Post by “Martin” of December 24, 2023 at 11:32 AM

What is quoted in comment #3 from Lawson's "The Special and General Theory" refers only to classical mechanics. It does not throw away the void.

The theories of relativity do not throw away the void either. Epicurus made no effort to establish coordinate systems for a quantitative description of the movement of bodies. Therefore, Epicurus' philosophy is barely affected by the theories of relativity. To account for modern physics, Epicureans need to accept that the void can be filled with force fields. The sole function of the void in Epicurus' philosophy (to provide space for movement of bodies) is not affected. Epicurus' philosophy and the theories of relativity are compatible.

Post by “Bryan” of December 24, 2023 at 12:10 PM

> Quote from Martin
>
> Epicureans need to accept that the void can be filled with force fields.

Hello Martin,

Thank you for responding. Filling the void is easy to accept, but it is not easy to accept that the void is affected in any way, which (as far as I understand it) is ultimately part of his argument.

Can we interpret Einstein in way that leaves the void untouched and unaffected, but only the host of forces/matter?

Post by “Don” of December 24, 2023 at 1:56 PM

Honestly, I don't think we have to reinterpret or reconcile Epicurean philosophy with the theory of relativity or modern quantum physics, or vice versa.

Both Epicurus and Einstein were doing thought experiments with the knowledge and information they had available at the time, 3rd c. BCE and early 20th c. CE, respectively.

Epicurus's idea of a material universe composed of uncuttable "atoms" moving in a "void" was revolutionary. Einstein's discoveries of general and special relativity were groundbreaking. As scientific discoveries advance, we should not be tied to the literal texts but to their spirit. Epicurus himself was a proponent of waiting for evidence to come to a "final" decision. We can do the same and still think of ourselves as Epicureans.

The important takeaways from Epicurus's "atoms and void" are:

1. We live in an understandable, material universe.
2. The universe does not have a secret, supernatural undiscoverable "governor" controlling or creating it.
3. There are an innumerable but not infinite number of particles that make up the universe, constantly being reused and recycled into new bodies.

Post by “Cassius” of December 24, 2023 at 2:42 PM

Yes to the post in general but as to this part:

> Quote from Don
>
> There are an innumerable but not infinite number of particles that make up the universe, constantly being reused and recycled into new bodies.

Slight tweak: Isn't it an infinite *number* of individual atoms but not an infinite number of *types* (or sizes)- in that an infinite number of atoms is needed to offset the infinite extent of the void?

With the limit on number of sizes required because there can't be atoms that are infinitely large (or that would itself take up all the space in the universe)?

Post by “Don” of December 24, 2023 at 2:53 PM

Yes, tweak agreed to! Good catch. 👍

I would only add that the possibility still could be that the number isn't infinite but could just be "infinite" relative to us. The difference between $10^{100,000,000,000}$ or $10^{1,000,000,000,000,000}$ or more makes little difference to me.

Jury is still out on that as far as I'm concerned, but it doesn't keep me up at night.

Post by “Martin” of December 25, 2023 at 5:55 AM

> Quote
>
> Can we interpret Einstein in way that leaves the void untouched and unaffected, but only the host of forces/matter?

The speed of the measured object in the reference system of the observer, a gravitational field or an accelerated reference system affects the "void" such that results of dimensional measurements in the "void" depend on that speed, the gravitational field or the acceleration. This is the only way how the "void" is affected, not more and not less. As a consequence, the

absolute space which was conceivable in classical mechanics is lost. I guess it is that counter-interintuitive loss which is disturbing with the theories of relativity. I felt this disturbance, too. When I was an undergraduate student of physics, homework included calculations with the special theory of relativity. These calculations helped to make my intuition catch up with the rational understanding. Solving partial differential equations with boundary conditions can help with sharpening the intuition, too.

Alternatively, we might consider the existence of a not affected master space, which we identify with the "void", within which the geometric space is deformed by speed differences, the gravitational field and acceleration. However, that master space would have no empirical base. But if it helps to wrap our mind around the quirks of the theories of relativity, it might be a useful auxiliary construct.

Post by “Bryan” of December 25, 2023 at 1:55 PM

> Quote from Martin
>
> I guess it is that counter-interintuitive loss which is disturbing with the theories of relativity. I felt this disturbance, too.

Thank you Martin, yes that gets to the heart of my objection.

Allow me to press a little farther: I wonder if the calculations for relativity fit together because they are self-referential and constructed with their own set of rules.

For example: it is my understanding that the speed of light has not been measured -- even if we grant that round-trips have been calculated -- the idea that light moves at a consistent speed is only a convention, is this correct?

Yet the assumption of this constancy of the speed of light is at the basis of his subsequent propositions.

Post by “Don” of December 25, 2023 at 2:53 PM

It appears that it's "the speed of light for something with mass is constant in a vacuum."

https://youtu.be/pTn6Ewhb27k?feature=shared

Post by “Don” of December 25, 2023 at 4:30 PM

Also... To boggle everyone's mind a little more...

Per this one... It's not "the speed of light", it's the "speed of causality"...

https://youtu.be/msVuCEs8Ydo?feature=shared

Post by “Martin” of December 26, 2023 at 12:03 PM

> Quote
>
> the idea that light moves at a consistent speed is only a convention, is this correct?

It is correct in the sense that the equality of the one-way speed of light and the two-way speed of light is a convention as explained in the video linked to in comment #13.

Only the Galileo transformation is compatible with an absolute space. However, electrodynamics proves that instead the Lorentz transformation is correct as explained in the video linked to in comment #14.

The special theory of relativity gets the Lorentz transformation independently. Therefore, electrodynamics is implicitly relativistic.

Different conventions than the equality of one-way speed and two-way speed have the constraint that the result must be compatible with the Lorentz transformation.

Therefore, a different convention might somewhat modify the special theory of relativity but not in a way which would show different experimental results.

None of the possible different conventions would save the absolute space.