

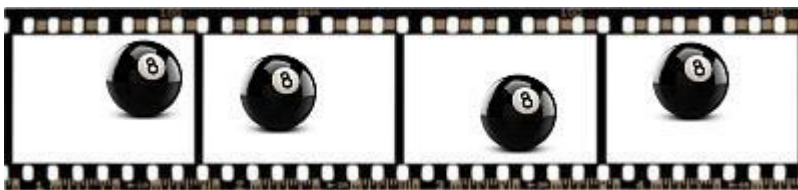
What is the fabric of spacetime made of?

Dimi Chakalov, [Quora](#), 24 November 2019

Surely “what is the fabric of spacetime made of?” is the billion dollar question. One cannot paint a picture without its canvas, but there is no ‘background’ (dubbed Aether) in General Relativity, resembling bare colorless nails. The [Riemannian manifold](#) is by definition *perfectly* smooth: any finite in size area, no matter how small, will contain *infinitely many* (non-denumerable) “points”, whereas the “colorless” Aether cannot have any “points” whatsoever. It is just dimensionless.



We only know what the “colorless” fabric of spacetime is *not* made of. If we imagine the drawing below as [matter affected by gravity](#), the fabric of spacetime is not made of the physical stuff in the right-hand side of Einstein’s field equations, nor from the geometric presentation of spacetime in the left-hand side. The grin of the Cheshire cat *without* the cat has no “points”.



Read p. 21 in [Brain-Controlled Cold Plasma](#) (BCCP) at [chakalov.net](#). As we know after the negative result from the [Michelson-Morley](#) experiment, the Aether is not compatible with the theory of relativity: there can be no motion *in relation to* the Aether ([Albert Einstein](#)). There is no “window” toward the Aether in the *physical* spacetime (the grin on the face of the *physical* cat) made exclusively by consecutive ‘billiard balls’: we cannot even imagine two geometric points along a finite spacetime interval, fixing the *width* of the dark strips in the drawing above, and hence talk about motion *in relation to* the Aether. There is no ‘background Aether’ in the *physical* world. The 4D spacetime continuum is **perfect**.

We can observe, by physical observations, only *colored* physical stuff – the 4D billiard balls above – whereas the ‘colorless’ film reel, including the dark strips separating consecutive 4D instants ‘here and now’, must be *completely* eliminated: the so-called ‘speed of light in vacuum’ is sheer metaphysics. Physically, this “vacuum” or Aether does not emit or reflect light, so its [energy](#) must be *perfectly* “dark”.

But how could we even speak of ‘the fabric of spacetime’ if the latter is “colorless” and hence UNSpeakable? It would “look” to us like **one single** mathematical “point” stretched to infinity!

Read p. 21 in BCCP above. Plato suggested the answer many centuries ago.

Note

The operational definition of ‘time’ is “what a clock reads” ([Wikipedia](#)). Try to imagine a caesium atom in its ground state at a temperature of *exactly* **0** K. Why? Because the official SI definition of ‘one second’ is as follows ([Wikipedia](#)):

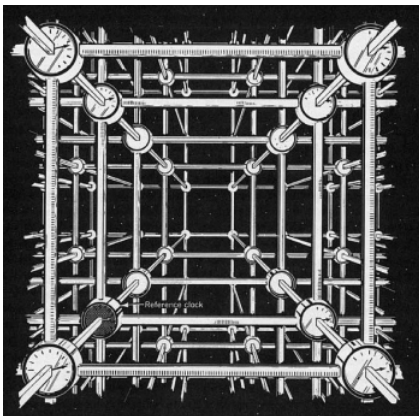
The second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom.



The operational definition of ‘one meter’ ([BIMP](#)) is “the length of the path travelled by light in vacuum (**Sic!** – D.C.) during a time interval with duration of 1/299 792 458 of a second.”

These are, of course, just “operational” definitions in metrology. Nobody asks the question how come nothing goes wrong during the *process* of fixing ‘one second’ and ‘one meter’ by Nature. The “rate” of time would have to be ‘one second per second’, which makes no sense. If we look at the billiard balls [above](#), we may not say that **X** number of tiny little instantaneous snapshots could assemble *exactly* ‘one meter’. Ditto to ‘one second’ from the *invariant* “[speed of light](#)”.

Here’s more: look at Fig. 9 in *Spacetime Physics*, by E.F. Taylor and J.A. Wheeler, reproduced below (source [here](#)).



As the authors acknowledged: “We assume that *every* clock in the latticework, whatever its construction, has been calibrated in meters of light-travel time.”

Calibrated? By *what*? By the billiard balls [above](#)? Or maybe because, as we know from thermodynamics ([Wikipedia](#)), if you open the window in your kitchen in a freezing winter day, your kitchen will get cold, not the other way around? Check out the **matrix** at p. 7 in [BCCP](#).

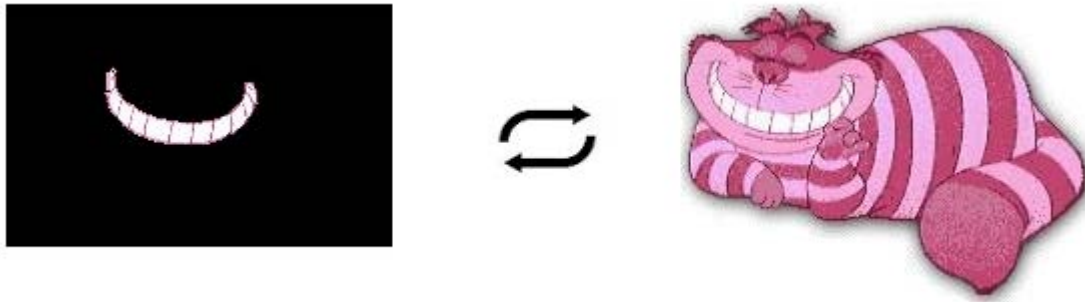
This is why we need the *atemporal* [Platonic reality](#). Only the [Mathematics](#) is still uncovered.

D. Chakalov

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The three cats in quantum gravity



“Space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve.” J.A. Wheeler in [Gravitation, p. 5](#) (p. 3 in [Zenon Manifold](#)).

There are three cats in quantum gravity: the Cheshire cat above (as observed by [Alice](#), p. 15 in [Platonic Theory of Spacetime](#)), the [Schrödinger’s cat](#), and T.S. Eliot’s cat [Macavity](#).

Why is this important? Read p. 28 (last) in [Brain-Controlled Cold Plasma](#) (BCCP). I have explained there the crucial importance of spacetime engineering for combating climate change. It is *the* only chance we have to save our planet. [Nothing else](#) could fit the bill.

To understand the coupling of **matter to matter** via gravity, read pp. 23-27 in [BCCP](#) and focus on the *alterations* (depicted as “curvature” in the drawing [above](#)) of the metric “field” in GR, placed in the left-hand side of [Einstein’s equations](#) (the grin of the Cheshire cat *without* the cat). The GR effects that are widely known to the public are those implemented in GPS navigation ([Richard W. Pogge](#)). However, in this case the *alteration* of the “rate” of time is (i) minuscule and (ii) does *not* explicitly involve energy transfer (Sic!) in the coupling of **matter to matter** via gravity – we cannot in principle witness this ‘GR cat’ effect in real time “online”, as it unfolds (recall [time dilation](#)). This effect from *alteration* of the “rate” of time is not only minuscule, but its magnitude is fixed in time as well: at every instant we look at our GPS navigation, the matter (the [Cheshire cat](#) in the right-hand side) has *already* reacted “back on space”. The negotiation between the two sides of Einstein’s equations [above](#) is *already* completed and dead fixed. Subsequently, people refuse to even discuss spacetime engineering, as if it were “impossible”.

As a remote analogy, consider the reading of an air thermometer at your terrace in a summer day: suppose it shows 25° Celsius, and also that it does *not* change, being *already* fixed. Any time you look at the thermometer, you will see only 25° Celsius. The air temperature is obviously caused by the [Sun](#) (the Cheshire cat in the right-hand side of the equation [above](#)), so if you decide to *alter* the reading of your thermometer (the left-hand side of the equation [above](#)) locally, e.g., by heating it with a hair dryer to 35° Celsius, the air temperature at your terrace viz. the Sun’s temperature will not increase. Hence people believe spacetime engineering were “impossible”.

Of course it is possible. We only need the mental correlate ([qualia](#)) of the so-called [vacuum](#), which does not emit or reflect light (p. 3 in [BCCP](#)), so its [energy](#) must be *perfectly* “dark”, as explained [above](#). Watch ‘Spacetime Engineering 101’ on 15 January 2020 at [this http URL](#). To obtain the password for watching the video (720p, MP4), follow the instructions at pp. 2-3 in [Spacetime Engineering](#). For other inquiries, notice the excerpt from my website at [this http URL](#).

D. Chakalov

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Über die Substanz von Raum und Zeit

The question of the substance or “fabric” of spacetime (read [above](#)) has longtime precursor in [philosophy](#). Some philosophers call the Kantian [Ding an sich](#) ‘substance’, arguing that it “is a property-bearer that must be distinguished from the properties it bears” ([Wikipedia](#)). It may only exist “in itself,” without being property of *any* other things. Therefore, it could be non-reality, totally outside human comprehension. But what if Mother Nature is smarter? See the drawing at p. 8 in [Platonic Theory of Spacetime](#) and read closely pp. 29-30 therein.

Let me shed some light on the issues surrounding the *substance* of spacetime, arguing that these metaphysical issues may have decisive implications for the understanding of the “expansion” of spacetime metric ([Quora](#)) and subsequently the alleged “dark energy” (read [above](#)). Very briefly:

1. The notions of ‘energy’ and ‘spacetime’ should be understood like adjectives, say, **red**. If we say ‘*this is red*’, we must define what *physical* object has the property of being **red**. For example, the Cheshire cat in the right-hand side of the equation [above](#). Physically, it will be impossible to observe ‘space by itself’ or ‘time by itself’, just as it is impossible to observe an ideal sphere. We observe only a football or a planet with spherical shape, and the latter is property *of* these objects.

2. The grin of the Cheshire cat *without* the cat, as depicted [above](#), is the very *substance* of spacetime, yet it is *not* observable in Physics. If it were observable, we would immediately ask about its origin, which in turn leads to [infinite regress](#) known as ‘[turtles all the way down](#)’. Many centuries ago, Aristotle proposed a special cutoff on these ‘turtles’, dubbed Unmoved Mover: ‘that which moves without being moved’ ([Wikipedia](#)). Subsequently, the entire physical world could be endowed with the property of **self-action**, being rooted on the physically-undetachable Unmoved Mover. However, many (otherwise smart) people reject the Unmoved Mover and try to detect some *physical* origin of the “[accelerated expansion](#)” of the observable universe, only to fail [miserably](#). In life sciences (Case II, p. 27 in [BCCP](#)), we know that there can be no “[homunculus](#)” in the [human brain](#). You can’t explain brain’s **self-acting** faculty with some “[dark](#)” physical stuff.

3. The **self-acting** substance of spacetime could be the origin of the *flow* of time, exhibited with four billiard balls in the drawing [above](#). The latter are only 4D “shadows” of the Platonic world, like a Platonic **hand** in 4D “glove”: read p. 9 in [BCCP](#) and the *calibration* of spacetime [above](#).

To sum up, in the physical world at [macroscopic scale](#) we have “colorless” objects; for example, an octopus: read ‘Reversible Elimination of Inertial Mass’ ([REIM](#)). Yet an octopus is like the “colorless” hand [above](#), whereas the colorless **matrix** (p. 7 and pp. 10-11 in [BCCP](#)) is atemporal Platonic reality (*Res potentia*) nested in the *substance* of spacetime. It (not “He”) is neither matter (*Res extensa*) nor mind (*Res cogitans*): read the doctrine of [trialism](#) at p. 25 in [BCCP](#). Also, the Platonic **matrix** is presented as ‘John’ in [Schrödinger’s cat](#), and with a new kind of ‘**zero**’ in [Macavity cat](#) [above](#). In symbolic terms, $1 + 0 = 1$, meaning that all “[probabilities](#)” for observing [John’s jackets](#) sum up *exactly* to 1, whereas the chance to observe the Platonic **matrix** is *exactly zero*. Read Erwin Schrödinger from 1935 at p. 6 in [BCCP](#) and pp. 13-14 therein.

Details at p. 6 in [The Physics of Life](#) and at p. 27 in [BCCP](#). Nature is unique non-relational entity (p. 31 in [Zenon Manifold](#)). It (not “He”) can be reached only with [Mathematics](#).

D. Chakalov

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The Doctrine of Trialism

Sometimes it is difficult to realize what the world is made of. Eskimos, for example, have hundreds of words for [different types of snow](#), but no general notion of ‘snow’. We are a bit better – we can formulate the ultimate notion of ‘[substance](#)’ (Plato suggested the term [Form](#)) from which [matter and spacetime](#) emerge, stressing that we refer to the *origin* of all types of matter. Obviously, what we call ‘substance’ is *not* observable in principle – read Aristotle [above](#). Metaphorically speaking, it (not “He”) is like a Platonic [hand](#) in 4D “[glove](#)”. As C.J. Isham and J. Butterfield noticed (source [here](#)), it will be ferociously difficult to understand the *emergence* of spacetime from ‘something else’. Besides, who cares about ‘something else’?

We do, very much indeed, for at least two reasons: if we wish to fix something, first we must know how it works. Here by ‘fixing’ I mean [spacetime engineering](#), which is rooted on the oldest proposition on the origin of mind and matter, as Gottfried Wilhelm von Leibniz has elucidated it in 18th century: read again the doctrine of trialism at p. 25 in [BCCP](#). The second reason to seek the common origin of mind and matter is the *emergence* of ‘mind’ (*Res cogitans*): the mind does *not* originate from its brain, much like the images on a TV screen do not spring from it. Nothing in the human brain could even remotely resemble *anything* we know from psychology, by means of brain-mind [isomorphism](#). The human brain and its mind, or if you prefer the human mind and its brain, have *nothing* in common. They are ontologically different ‘elements of reality’, in line with the doctrine of trialism.

Thus, we care about the *origin* of mind as well. As [Thomas H. Huxley](#) rightly noticed, the bold fact that “a state of consciousness comes about as a result of irritating nervous tissue, is just as unaccountable as the appearance of the djinn when Aladdin rubbed his lamp”. Some physicists can afford to ignore the puzzle of ‘substance’, as the common origin of mind (*Res cogitans*) and of [matter and spacetime](#) (*Res extensa*), but we are constantly aware of it: read p. 31 in [Platonic Theory of Spacetime](#).

These are the prerequisites to the so-called doctrine of trialism. But what can we make from it? Read p. 6 and p. 9 in [The Physics of Life](#). As noticed earlier, spacetime engineering works better than a Swiss watch (p. 2 in [Zenon Manifold](#)). Don’t ever say that you knew nothing about it.

Finally, let me go back to the main question [above](#), about what the world is made of, and offer a simple way to reject the doctrine of trialism. You only have to show that the underlying Platonic theory of spacetime is *not* unique, namely, to offer an *alternative* to Platonic reality: It (not “He”) is the [origin](#) of physical reality, yet it does not exist as physical reality. The latter is explained, in symbolic terms, with $1 + 0 = 1$ [above](#). To be specific, recall the quantum vacuum ([Peter Milonni](#)) and the “[vacuum](#)” invoked in the “definition” of the *invariant* “[speed of light](#)” (Justin Christensen at pp. 23-24 in [Zenon Manifold](#)). These two manifestations of “vacuum” explicitly show that we cannot consider them ‘physical reality *out there*’, like the water in toilet’s reservoir (*ibid.*, p. 11).

Physically, they *must not* exist. Otherwise the radius of the universe “could not even reach to the moon,” as calculated in the late 1920s by [Wolfgang Pauli](#), and the [Michelson–Morley experiment](#) would have proved some *physical* medium of [EM waves](#) viz. *physical* absolute reference frame, which could provide *absolute* coordinates to the ‘billiard balls’ in the ‘movie reel’ [above](#), fixed on their ‘movie screen’ (known as [Aether](#)) at *absolute* rest: *reductio ad absurdum*.

Ergo, this “[vacuum](#)” can only exist as [Platonic reality](#). Q.E.D.

D. Chakalov

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