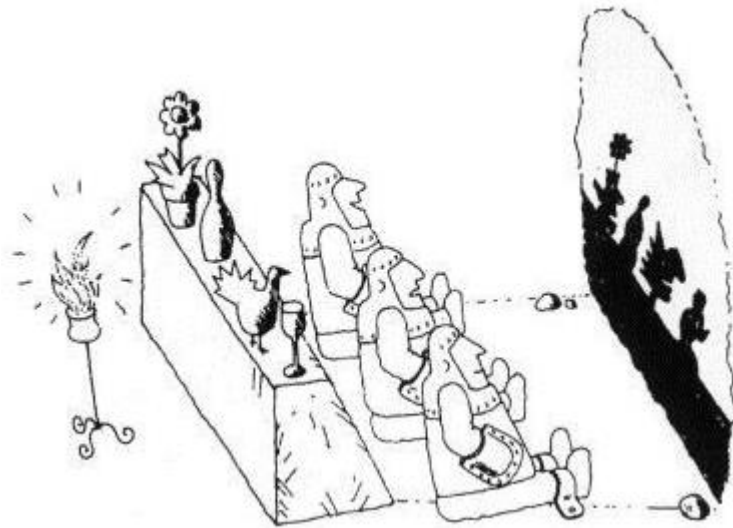


Gentlemen! The views of space and time which I want to present to you arose from the domain of experimental physics, and therein lies their strength. Their tendency is radical. From now onwards space by itself and time by itself, along with the entire physical world, will recede completely to become physicalized 4D shadows of their Platonic source.



## About Space and Time

Video lecture, 21 September 2018, 10:00 GMT

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Commemorating 110 years of Hermann Minkowski's lecture [RAUM UND ZEIT](#), given at the 80th Meeting of the Natural Scientists in Cologne on 21 September 1908 and based on the crucial contributions to the theory of Special Relativity by [Hendrik Lorentz](#), [Albert Einstein](#) and [Henri Poincaré](#)<sup>2</sup>, I offer my video lecture, entitled: 'About Space and Time'. It will be posted at my YouTube channel on Friday, 21 September 2018, at 10 AM GMT. Here is a brief introduction to the video lecture (draft version), which will be amended with the final text version by the end of September 2018. The lecture is organized in three sections: (i) what is the Platonic theory of spacetime, (ii) where it comes from, and (iii) what follows from it (read [below](#)). I hope that the video lecture, backed by its final text version with references and notes, will be easier to understand and study.

Ensuing from [Plato's Cave](#) and the ideas by Heraclitus and Aristotle, I present the Platonic theory of spacetime: the atom of geometry (dubbed "point") is treated as complex object endowed with topology, kinematics, and dynamics. It is suggested that what we call 'spacetime' is not some inert geometric object, but a holistic bootstrapping phenomenon, which holds the entire physical world together, as the latter evolves along the so-called Arrow of Space. Hence 'space' and 'time' are interpreted as *emergent* phenomena pertaining solely to the '[wall](#)' in Plato's cave, whereas their **nonphysical** Platonic source,

<sup>1</sup> Email: [dchakalov@gmail.com](mailto:dchakalov@gmail.com). Download the final version of [about\\_spacetime.pdf](#) on 30.09.2018 from [this http URL](#).

<sup>2</sup> H. Poincaré, Sur la dynamique de l'électron, *Comptes Rendus Acad. Sci Paris*, 140, [1504-1508](#) (5 Juin 1905).

dubbed ‘potential reality’ or *Res potentia*, does **not** live anywhere on Plato’s ‘wall’ (called ‘[local mode of spacetime](#)’, pp. 8-9 in [FRAUD.pdf](#)) and remains *perfectly* hidden by the “speed” of light (A2 in Slide 19 in [Quantum Spacetime](#)). What physicists nowadays call ‘spacetime’ is treated as *local mode* of spacetime relevant only to the *physicalized* explications of the Universe cast on the [light cone](#) – nothing but 4D “[shadows](#)” of *Res potentia*, as Plato suggested many centuries ago. Thus, a new quantum-gravitational spacetime, equipped with local and global modes, is proposed for quantum gravity and cosmology: every *physicalized* system is endowed with both 4D local mode of spacetime determined by the local properties of matter and fields, and global mode of spacetime determined by the global properties the entire Universe as ONE. It’s a bundle.

First, some history. On June 2, 2008, commemorating the one-hundredth anniversary of Hermann Minkowski’s lecture ‘Space and Time’ on 21 September 1908, I invited many theoretical physicists and mathematicians to attend my talk in Munich on 21 September 2008: read my invitation at [this http URL](#). Now I offer a video lecture, which will be available on 21 September 2018 (read above). Feel free to subscribe by email with subject “About Space and Time, 21 September 2018”. You will receive password to watch the lecture (app. 20 min) and will be able to download it until 10 AM GMT on 30 September 2018. The main idea was explained at my [first talk](#) on 21 September 2008<sup>3</sup>: every *finite* (bounded) spacetime region has both *local* properties (local mode of spacetime) and *global* properties (global mode of spacetime); the latter are determined by the properties the entire [Universe as ONE](#), most notably by the [self-acting](#) faculty of Aristotle’s [Unmoved Mover](#). Thus, we arrive at the proposal by [Heraclitus](#) ‘you cannot look twice at the same river’, and suggest that the irreversible *flow* of 4D events ‘here and now’, constituting the local mode of spacetime, cannot be observed in principle due to the “speed” of light. We only have *physicalized* remnants from the [self-action](#) of the Universe as ONE, which many (otherwise [smart](#)) people consider “[dark](#)”. Surely *Res potentia* does not emit nor reflect light, simply because it does **not** live anywhere on the [light cone](#). It is “before” light.

To give you a glimpse to the forthcoming video lecture, check out (i) [Slide 7](#) and [A2](#) in [Slide 19](#) in [Quantum Spacetime](#), (ii) my comments on the alleged temporal and spatial orientability of spacetime at [this http URL](#), and (iii) pp. 21-26 in [Hyperimaginary Numbers](#). Instead of mimicking Nature by postulating the orientability of spacetime ‘by hand’, we should get professional and uncover the proper mathematical formalism and tools.

Now, to understand ‘space’ and ‘time’, let me stress that their *origin* poses an outstanding challenge. Consider, for example, Sergio Ulhoa *et al.*<sup>4</sup> (I will talk on the Hubble Law [later](#)):

The modern observational cosmology inaugurated at the Mount Wilson Observatory gave a great impetus to understanding the Universe [1]. The Standard Cosmological Model, alongside the Cosmological Principle and field equations of GR, describes all knowledge about large structures with good approximation. The Hubble Law shows how fast galaxies move away from each other at a relatively small distances. Thus it could be used to test new cosmological theories. The Cosmological Principle states that the Universe is isotropic (above 100 Mpc) and homogeneous (there is no center) in addition its dynamics is given by the Einstein field equations,  $R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R = 8\pi T_{\mu\nu}$ . In such a way it is possible to trace a complete time evolution of the Universe. If the time is set backwards (Sic! - D.C.) we see that everything started in a warm and dense state with domination of the radiation energy. The metric that admits the Cosmological Principle and the dynamics given by the GR is that of Friedman-Lemaître-Robertson-Walker (FLRW) [2-6]:

<sup>3</sup> You may wonder, why am I doing these efforts to promote again the Platonic theory of spacetime? Because spacetime engineering is the future. If [people](#) again ignore my work, as they did [ten years ago](#) — so be it. [Matthew 7:6](#).

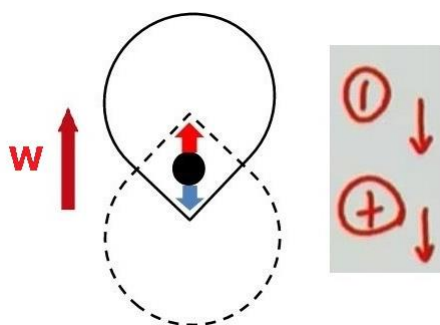
<sup>4</sup> Sergio Ulhoa *et al.*, [arXiv:1802.08087v1 \[gr-qc\]](#), 21 February 2018.

$$ds^2 = -dt^2 + a^2(t) \left[ \frac{dr^2}{1 - \kappa r^2} + r^2 d\Omega^2 \right], \quad d\Omega^2 \equiv d\theta + \sin^2 \theta d\phi^2 \quad (1)$$

where  $\kappa$  assumes values of  $-1$  (negative or closed spatial curvature),  $0$  (null or flat spatial curvature) or  $+1$  (positive or open spatial curvature).

Here's the problem: once we introduce *metric* of spacetime, as Hermann Minkowski did at his famous talk on 21 September 1908, we face the **origin** of spacetime, which must have existed "before" the instant of creating spacetime endowed with metric. This **metric paradox** prompted Yakov Zel'dovich to suggest that "long time ago, there was a brief period of time during which there was still no time at all." (Private communication; translation mine - D.C.) Needless to say, he was joking. Point is, the metric paradox remained unsolved until the author of these lines found its unique, and highly non-trivial, solution dubbed Finite Infinity (FI)<sup>5</sup>. Do you remember the ancient Dragon **chasing its tail**? You need two *dual* states of the Dragon: one in which it has already caught its tail, and another one in which it is only approaching its tail, but can never actually catch it. The first state of the Dragon is called actual or completed infinity, while the second one is known as potential infinity. Blend the two states and you will obtain FI, plus the so-called *dual age* of the Universe (p. 4 in [Hyperimaginary Numbers](#)). But let's go back to the basics.

Let me again suggest, following my previous talk on 21 September 2008, two *modes* of the Universe viz. its spacetime: **local mode** (determined by actual or completed infinity) and **global mode** (determined by potential infinity). It's a bundle: see Fig. 3 in [Gravity-Matter Duality](#). We can explain the local mode only by referring to properties of the global mode, and *vice versa*. I will elaborate later on the hypothetical *polarization* of primordial mathematical points (read my comments at [this http URL](#)); for now let me stress that the two *modes* of spacetime exist due to the Heraclitean *flow* of 4D events 'you cannot look twice at the same river'. Prior to the *polarization* of primordial points, the proto-Universe could have existed only as 'non-reality' or [John 1:1] which, *after* the Beginning, is located "inside" each and every **fleeting 4D shadow** 'here and now' (Luke 17:21).



The **self-action** of the Universe. Check out Fig. 5 in [Gravity-Matter Duality](#), Refs 9 and 10 in [Hyperimaginary Numbers](#), and Sec. 3 in [Panta Rei: The Evolution Equation](#).

The two modes of spacetime can be visualized with spacetime "lattice" in which every two consecutive points, A and B, are **timelike separated** ( $s^2 > 0$ ), only now you have to *totally* remove all gaps and make the spacetime manifold *perfect* continuum: see Fig. 1 in [Panta Rei: The Evolution Equation](#), p. 4. In the *local* mode, the gaps are **non-existent** due to the "speed" of light (A2 in Slide 19 in [Quantum Spacetime](#)), while in the *global* mode the same gaps are "elevated" along the **atemporal hyperimaginary axis W** (the radius of expanding balloon, Fig. 4 in [Gravity-Matter Duality](#)) harboring the Platonic *Res potentia*.

<sup>5</sup> D. Chakalov, [viXra:1410.0194vD](#), 2015-11-08, p. 7; [viXra:1705.0219v8](#), 2017-06-21, p. 6.

Notice that the local 4D “shadows” on Plato’s wall (local mode of spacetime) are patches from the inflating balloon in Fig. 4 in [Gravity-Matter Duality](#), p. 5.

In a nutshell, every **next** event ‘here and now’ along the Heraclitean *flow* of events is **jointly** (Sic!) determined by its irreversible history and potential future. This new form of *retarded* causality (there are no **tachyons** – the cause and its effect are always **timelike separated**) was called ‘biocausality’ in [January 1990](#), but it took over **23** years to model gravity and suggest the theory of quantum gravity on [20 October 2013](#).

Here I won’t have time to explain the Heraclitean *flow* of events hidden by the “speed” of light (**A2** in [Slide 19](#) in [Quantum Spacetime](#)), which produces two modes of spacetime. Let me briefly mention that the infinitesimal step “forward” along the *flow* of events (dubbed ‘Arrow of Space’) is *complemented* by infinitesimal step of “rotation”<sup>6</sup>. It’s a bundle. Check out the drawing [above](#) and study the references. As I mentioned [previously](#), we have in the local mode of spacetime only **physicalized** remnants from the **self-action** (depicted [above](#)) of the Universe as **ONE** in the global mode, which some people consider “dark”.

But what is *local* mode of spacetime? It pertains to the *physicalized* 4D world of “shadows” (see [above](#)). It is always “squared” ([Wikipedia](#)) and is placed exclusively in the *irreversible* past of every instant ‘here and now’ (Sec. 4 in [Gravity-Matter Duality](#)) from the **light cone**. The *global* mode of spacetime, on the other hand, does not live anywhere on the light cone (pp. **8-9** in [FRAUD.pdf](#)). It inhabits the *potential* future (*Res potentia*) of the same instant ‘here and now’. The latter is supposedly endowed with kinematics, dynamics and topology: the transition from potential future to irreversible past (recall the Dragon [chasing its tail](#), p. **3** in [Penrose-Norris Diagram](#)) is neither along an open (straight) causal line nor along a closed causal circle, but “along” topological *superposition* of the two (Fig. 1 in [CEN.pdf](#)).

Regarding Quantum Theory, the reason for introducing *global* mode of spacetime was explained in [Quantum Spacetime](#) (e.g., [Slide 7](#)). In one sentence: the genuine quantum state<sup>7</sup> of every quantum system is an **intact** *Res potentia*, which is neither “particle” nor “wave”, does not “collapse” nor “decohere”, and is not “uncertain” but *flexible*: God casts the die, not the dice ([Albert Einstein](#)). As to General Relativity (GR), we need the *global* mode of spacetime to understand the origin of inertia<sup>8</sup> and the *physicalization* of gravity in (the *local* mode of) spacetime. In current GR textbooks, it just doesn’t work ([MTW p. 467](#)) – check out the analogy with gravitational pizza in [Gravity-Matter Duality](#).

In short, I suggest quantum-gravitational spacetime endowed with local and global modes, which could allow us to model the entire Universe as **human brain**. Now let me more specific on the two modes of spacetime and their origin [[John 1:1](#)].

We assume that ‘spacetime’ is represented by geometry, but what is ‘geometry’ made of? What is the *atom* of geometry? We know ‘matter’ from classical physics, say, tables and chairs or physical fields (e.g., **electromagnetic field**). Given the indisputable practical success of Quantum Mechanics (**QM**), we are sufficiently confident that what we call ‘matter’ is ultimately rooted on **energy**, at least to the extent to which mass and energy are “**equivalent**” (there is a big can of worms in this issue, which I am not going to open right now). However, we cannot reproduce ‘matter’ solely from ‘energy’, because an *absolutely essential* ingredient of the physical world is missing in today’s QM textbooks:

<sup>6</sup> D. Chakalov, [viXra:1705.0147v3](#), Sec. 3.

<sup>7</sup> P. Ghose, [arXiv:0906.0898v1 \[quant-ph\]](#), 4 June 2009; M.S. Leifer, [arXiv:1409.1570v2 \[quant-ph\]](#), 6 November 2014.

<sup>8</sup> Ignazio Ciufolini and John A. Wheeler, *Gravitation and Inertia*, Princeton University Press, 1995, pp. **4-5** and p. **270**.



the **matrix**. Let me quote from the seminal speech by Max Planck *Das Wesen der Materie* (The Nature of Matter) at Florence in 1944:

There is no matter as such! All matter originates and exists only by virtue of a force which brings the particles of an atom to vibration and holds this most minute solar system of the atom together. We must assume behind this force the existence of a conscious and intelligent Geist (bewußten intelligenten Geist). This Geist is the matrix of all matter.

But the **matrix** is not ‘mind’ (bewußten intelligenten Geist): the **matrix** is not *Res cogitans*, but Platonic *Res potentia* or ‘potential reality’. Surely one cannot somehow “attach” mind and consciousness to quantum particles and the **vacuum**; check out a simple explanation on p. 3 in [Hyperimaginary Numbers](#).

You may ask, if the **matrix** is not physical stuff (*Res extensa*), how is the physical world related to it? By its spacetime **topology**: the **matrix** operates exclusively in the global mode of spacetime, whereas the creative effects of the **matrix** (Slides 9-12 in [Quantum Spacetime](#)) are being *physicalized* (Sic!) in the **local mode** of spacetime (Table 1 in [The Spacetime](#), p. 14).

To help you understand the **matrix**, replace it with ‘money’ and imagine a 4D physical universe made only by physical money: you can never see ‘money *per se*’ (global mode of spacetime), but only particular *physical* manifestation of ‘money’ (local mode). You cannot ask profound questions like ‘what are money made of?’, just as you cannot ask ‘what is matter made of?’. Everything in the physical universe, including gold, silver, and crypto currencies, are *physical* manifestations of ‘money’. If you prefer, you may replace the English label ‘money’ with different labels from other languages, say, *argent* (French), *Geld* (German), *pengar* (Swedish), 钱 (Mandarin), etc., yet you can never alter the *meaning* of ‘money’, nor observe its Platonic **matrix** ‘money *per se*’ kept in the global mode of spacetime. Why not? Because you can see only various *physicalized* 4D “shadows” from the **matrix** (see [above](#)) – you cannot “turn around” and look straight at their common **matrix**, as Plato explained many centuries ago. I wish to ameliorate Plato’s proposal by suggesting that the Platonic **matrix** is both ‘one’ and ‘many’ (non-denumerable *Res potentia*), which cannot have any **metric** (Yakov Zel’dovich), just as there is no *physical* distance between the *idea* of a tree and the *idea* of a mountain. Also, if the **qualia** from electromagnetic radiation with wavelength 620-750 nm is what we call (in English) ‘red’, keep in mind that there is no **qualia** from the Platonic **matrix**, because the latter is inherently **UN**speakable: check out a simple experiment with your brain on p. 2 in [Hyperimaginary Numbers](#). Thus, in cognitive psychology the **matrix** corresponds to ‘cognitive vacuum’, whereas in physics *the same* (Sic!) **matrix** corresponds to quantum vacuum<sup>9</sup>. If we learn how to access the **dual matrix** (cf. the doctrine of *trialism*, Slide 14 in [Quantum Spacetime](#)), perhaps we will be able to practice spacetime engineering. Again, the **matrix itself** is **not directly observable**, yet it is not “dark”, as some (otherwise **smart**) people chose to call it. It is neither physical stuff (*Res extensa*) nor mental stuff (*Res cogitans*). It is ‘potential reality’ (*Res potentia*), “just in the middle between possibility and reality” (Werner Heisenberg<sup>10</sup>).

Can we uncover *Res potentia* in Mathematics? Yes we can. It has been residing, right after the Beginning [[John 1:1](#)], in the **atom** of geometry, dubbed “point” – “that which has no part” ([Euclid](#)). Let me explain, along with the topological property of spacetime manifold, called Finite Infinity (FI).

<sup>9</sup> Peter W. Milonni, *The Quantum Vacuum*, Academic Press, 1993, [Ch. 2.6](#).

<sup>10</sup> Werner Heisenberg (winter 1955-1956), *Physics and Philosophy*, Prometheus Books, 1999, p. 43 and pp. 155-156.

Look at  $R_\infty = \emptyset$  in Fig. 7, p. 9 in [Hyperimaginary Numbers](#), and notice that ‘the Ghosts of departed Quantities’ (George Berkeley) has **absolutely** (Sic!) disappeared *exactly* at the **limit** we know from Augustin-Louis Cauchy: *Res potentia* does not belong to the “points” from the **real number line**; it has only *physicalized footprints* there (p. 8 in [FRAUD.pdf](#)). We can include **absolutely** all points (**footprints**) from the spacetime manifold with FI (read [above](#)), by *both* actual infinity (Fig. 11 in [The Spacetime](#), p. 12) *and* potential infinity (“as closely as desired”, [Adolf Fraenkel](#)): check out p. 6 in [Penrose-Norris Diagram](#).

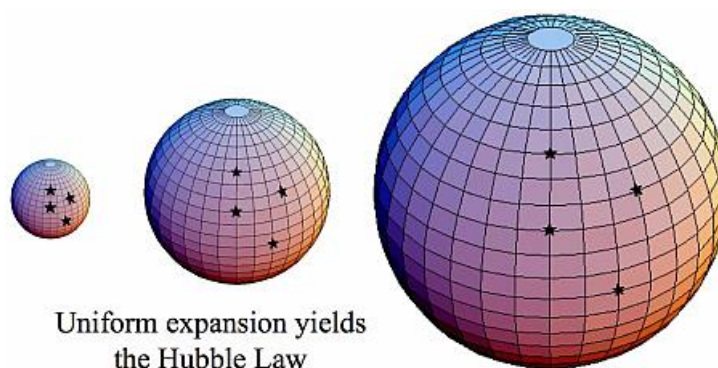
Everything said so far is intended only to explain the Platonic theory of spacetime, based on the two *modes* of spacetime [above](#). Now I will demonstrate that we ultimately need it.

The **conceptual solutions** to (i) the **measurement problem in QM** and (ii) the “**dark energy**”, with the **self-action** (see the drawing [above](#)) of the entire Universe as **ONE**, are unique — there is no other solution to the **unification of QM and GR**. The latter theories turned out to be essentially incomplete, as their textbook versions lack the crucial notion of quantum-gravitational reality, presented with two *modes* of spacetime: read [Gravity-Matter Duality](#).

Now I will argue about the need for Platonic theory of spacetime to understand the mundane notions of ‘space’ and ‘time’. For example, suppose you look at the night sky and see an unbounded black space sprinkled with bright stars, while your clock reads every consecutive moment from your observation of this endless, seemingly infinite, 3D space. Simple, isn’t it?

Not at all. Thanks to [Edwin Hubble](#), we know that this enormous spatial container, dubbed ‘space’, is “expanding” *within itself* (Fig. 4 in [Gravity-Matter Duality](#)), and the *dynamics* of this totally incomprehensible “expansion” determines the **dimensionless scaled factor**, presented with what we call ‘time’, as read with a physical clock. Nothing is simple here, as the alleged “expansion” of space must be *non-referential*, that is, ‘absolute’<sup>11</sup>, and the engine of this “expansion” is related to the **energy density of the vacuum**, which leads to “the worst theoretical prediction in the history of physics!”<sup>12</sup>

The great [Edwin Hubble](#) never accepted the interpretation of his groundbreaking discovery as “expansion” of space. [Georges Lemaître](#) did, and now physicists and cosmologists have to use, *faute de mieux*, the **FLRW model** mentioned [above](#), and quietly ignore the metric paradox exemplified by [Yakov Zel’dovich](#), about the **center** of the “expanding balloon”:



See Fig. 4 in [Gravity-Matter Duality](#)

<sup>11</sup> Michal Chodorowski, [arXiv:astro-ph/0610590v3](#), 27 March 2007, p. 1.

<sup>12</sup> M. P. Hobson, G. P. Efstathiou, A. N. Lasenby, *General Relativity: An Introduction for Physicists*, Cambridge University Press, 2006, p. 187.

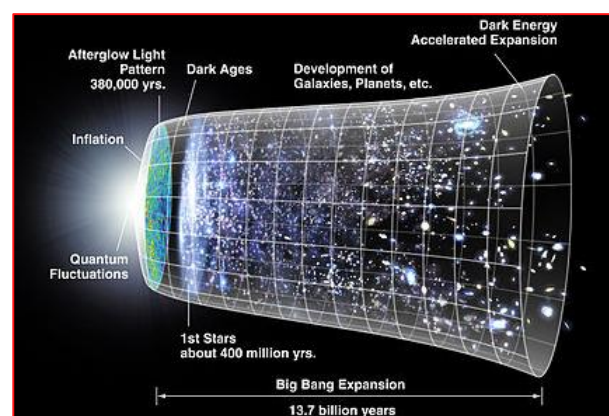
All physical systems live on the 3D surface of the cosmic “balloon” above, as 4D “shadows” depicted [above](#). Thanks to the “speed” of light (A2 in Slide 19 in [Quantum Spacetime](#)), we have no **direct physical** access to its (hyperimaginary) radius denoted with **W** in Fig. 5, p. 6 in [Gravity-Matter Duality](#), which matches the “direction” of the Heraclitean *flow* of events dubbed here ‘Arrow of Space’. The latter is omnidirectional and *atemporal*, and its “vector” is *totally* eliminated in the **squared** (Sic!) spacetime interval ([Wikipedia](#)). Hence the Heraclitean ‘arrow of time’ (read my comments on the current temporal and spatial orientability of spacetime at [this http URL](#)) is **non-relational** and **absolute**, or else it will be *physical* phenomenon and the theory of relativity will be **demolished**. This very simple argument poses great problems to many people, perhaps because they are haunted by Marxist-Leninist philosophy and deeply believe that we are made exclusively by atoms (ref. [18] in [Hyperimaginary Numbers](#), p. 15).

The Platonic theory of spacetime solves all these problems *en bloc*. For if we use Finite Infinity (read the explanation [above](#)), we have *dual age* of the Universe: finite in the local mode of spacetime, and “infinite” or rather **undecidable** in the global mode. Once created by God [[John 1:1](#)], the **Dragon** can never reach any ‘**limit**’ and (inevitably) **stop** there.

Let me go back to the **self-acting** faculty (see [above](#)) of the entire Universe as ONE. In the physical world modeled with local mode of spacetime, there is only physical stuff. The Platonic *Res potentia* (global mode of spacetime) does not interact with matter. Instead, matter interacts with **itself** by **self-action**: **only matter can act on matter**. In the world of *living* matter, such as the **human brain** and every living organism, their self-organization and self-action is known as ‘activity’, after Nicolas Bernstein<sup>13</sup>.

As an example, consider the **human brain**: there is **no “dark” computer in your brain**, which could conduct and correlate **billions of neurons and trillions of synapses**, not to mention your **embryonic state**. What could possibly achieve such astonishing result? The biological **matrix**<sup>14</sup>. Now switch to the entire Universe modeled as ‘brain’ and check out the quantum **matrix** [above](#). If you don’t like parapsychology and “**anthropic principles**”, you need the Platonic theory of spacetime and the doctrine of *trialism* (Slide 14 in [Quantum Spacetime](#)).

Since I have to squeeze my lecture into 20 min, I cannot address here the *rate* of time. Check out [6] above, regarding the so-called ‘relative scale spacetime’ or **RS** spacetime. It’s all relative. Keep also in mind that the popular drawing from [Wikipedia](#) below, showing the alleged topology of “expanding” spacetime, is *terribly* misleading, to say the least.



<sup>13</sup> N.A. Bernstein, *Essays on the Physiology of Movements and Physiology of Activity*, Moscow, 1966 (in Russian).

<sup>14</sup> At the time you were 12- to 14-week-old embryo, your nerve cells were created at the rate of about **15 million per hour**, and later your brain established **1,000 trillion synaptic connections**, so that now you can **read and think**.

There are no *absolute* inertial observers in GR, who could “see” the Universe *en bloc*: recall the metric paradox [above](#) and the bold fact that the “expansion” of spacetime is, and has *always* been, faster-than-light<sup>15</sup>. The entire Universe as **ONE** can exist only in its [global mode](#), as Platonic *Res potentia* grounded on God ([John 1:1](#); [1 John 4:8](#)). It (not “He”) **re-creates** the local (physical) mode of spacetime at every 4D instant ‘here and now’ along the **radius** of the “expanding balloon” [above](#) (dubbed ‘Arrow of Space’), as **both** change **of** spacetime (global mode of spacetime) **and** change **in** spacetime (co-ordinate time in the local mode of spacetime). It’s a bundle, again. But you will need Finite Infinity (FI) [above](#) to understand the new “limits” of spacetime *manifold* (Sic!) toward the two opposite “ends”, the Small and the Large. In short, when you look at the night sky and see an unbounded black space sprinkled with bright stars (read [above](#)), your eyes trace the four topological dimensions of the local mode of spacetime, which are literally **re-created** and **re-assembled** along **null intervals** ( $s^2 = 0$ ), to match the “speed” of light from the [light cone](#).

Keep also in mind that the Platonic *Res potentia* is not organized in **polar** structures, as we have in the local (physical) mode of spacetime, e.g., spin-up vs. spin-down, good vs. evil, etc. For example, we cannot talk about [banks](#) of [Heraclitean River](#) at rest, with respect to which the ‘flow of water’ runs in particular rate of ‘water (events) per second’. With respect to the local mode of spacetime, *Res potentia* is **non-relational absolute** reality, which can be defined only with respect to its *complemental* ‘non-reality’: an absolute vacuum *presented* in theology as God [[John 1:1](#)]. Once we introduce spacetime *metric*, we face the metric paradox [above](#), which can be illustrated with so-called vacuum cleaner paradox (VCP) along the deflation time toward the Beginning, from [Pink Panther](#): he used super powerful vacuum cleaner to suck in the entire world, including himself, after which the vacuum cleaner sucked itself and disappeared into the blob of gray stuff below (known as “[inflation](#)”, see Slide 12 in [Quantum Spacetime](#)), with duration from  $10^{-36}$  until  $10^{-32}$  seconds after the Beginning [[John 1:1](#)]. What happened between  $10^{-36}$ s and ‘time zero’? Well, “there was still no time at all” ([Yakov Zel’dovich](#)).



Again, the only possible solution to VCP is with Finite Infinity (FI) and *dual age* cosmology [above](#). Here we enter the doctrine of *trialism* (Slide 14 in [Quantum Spacetime](#)) and physical theology, which I won’t have time to explain in this lecture. Suffices to say that we have two *dual* presentations of Nature, God [[John 1:1](#)] and (*sit venia verbo*) absolute vacuum; the latter is *purely* mathematical object. Depending on the context, we may use any of the two *dual* presentations of Nature, much like we use both ‘quantum wave’ and ‘[quantum particle](#)’. Only in the case of physical theology we face Kantian ‘[Ding an sich](#)’

<sup>15</sup> Tamara M. Davis, Charles H. Lineweaver, [arXiv:astro-ph/0310808v2](#), 13 November 2003, [Fig. 1](#).



and have to use Ludwig Wittgenstein's [Proposition 7](#): "Whereof one cannot speak, thereof one must be silent."

To sum up, the Beginning at [[John 1:1](#)], depicted in the drawing [above](#), is not an event. It is noumenal 'non-reality' *eternally* residing "inside" us (pp. 6-7 in [CEN.pdf](#)). It is the ultimate origin of the three forms of reality: *Res extensa*, *Res cogitans*, and *Res potentia*. We cannot prove nor disprove its ([undecidable](#)) existence. If we could, it (not "He") won't be the [First Cause](#). It is a kind of 'limit' that is beyond human comprehension. We could only hope one day to describe it mathematically, with the new hyperimaginary numbers.

One practical issue remains open: can we produce unlimited clean energy with spacetime engineering (p. 9 in [Gravity-Matter Duality](#))? Yes we can – Robert Geroch<sup>16</sup> is 'not even wrong'. I will be happy to explain my opinion to all people who have subscribed by 10 AM GMT on 21 September 2018. Yes, we can tweak our common global mode of spacetime (Fig. 10 in [CEN.pdf](#), p. 11). No, it is not "magic": Any sufficiently advanced technology is indistinguishable from magic ([Arthur C. Clarke](#)).

For comparison, the alternative to my project **BAVER**, from brain-aided vacuum energy release, is [Wendelstein 7-X](#) in Germany. People there deeply believe it might achieve "up to approximately 30 minutes of continuous plasma discharge in 2021." If confirmed, [Wendelstein 7-X](#) will be just 'the proof of concept'. So far over €1 billion – all taxpayers' money – were invested in it, as some "potential of stellarators as power plants". But how about the potential of **BAVER** as power plant? My proposal was sent by snail mail to Max Planck Society in **March 1994** (no typo), and again by email on 27 April 2017 (p. 94 in [gravity.pdf](#)). Dead silence (p. 20 in [Hyperimaginary Numbers](#)). Mind you, the idea of **BAVER** is *very* simple: see [9] above and Fig. 10 in [Panta Rei: The Evolution Equation](#). Contrary to Bob Geroch's belief, the *potential* future is never fixed "once and for all" [16], because it is *flexible* (not "uncertain", as in current [QM textbooks](#)), up to 'the unknown unknown'.

Thus, the only way to change the future is to *create* it, within the limits of its *flexibility*. As Henry Ford famously noted, whether you believe you can do a thing or believe you can't, you are right. Our genuine free will is gift from God as **Love** ([1 John 4:8](#)). Don't seek fake comfort in some "great supervisor" who makes all decisions for us and tacitly controls us like his "beloved" puppets. Get real.

Perhaps we only need the Platonic theory of spacetime and new [point-set topology](#), [set theory](#), and [number theory](#) to model *Res potentia* with *hyperimaginary* numbers. All the rest is provided by the [human brain](#) embedded in the [Brain of the Universe](#), and the Law of Reversed Effort: "To the mind that is still, the whole universe surrenders" ([Lao Tzu](#)).

Do you want to watch **BAVER** in action? It's not "magic" but gravitational radiation<sup>17</sup>. Only at this moment the **BAVER** effect is not yet scalable, as Nature does it. But we never know what the future holds in all the things we know that we don't know, and in those still in 'the unknown unknown'.

D. Chakalov  
21 March 2018, 10:00 GMT

<sup>16</sup> Robert Geroch, *General Relativity from A to B*, University of Chicago Press, 1978, pp. 20-21: "There is no dynamics within space-time itself: nothing ever moves therein; nothing happens; nothing changes. (O)ne does not think of particles as moving through space-time, or as following along their world-lines. Rather, particles are just in space-time, **once and for all**, and the world-line represents, **all at once**, the complete life **history** of the particle (emphasis mine – D.C.)."

<sup>17</sup> Forget about "GW astronomy": read p. 25 in [FRAUD.pdf](#).

## About Space and Time

21 September 2018, 10:00 GMT

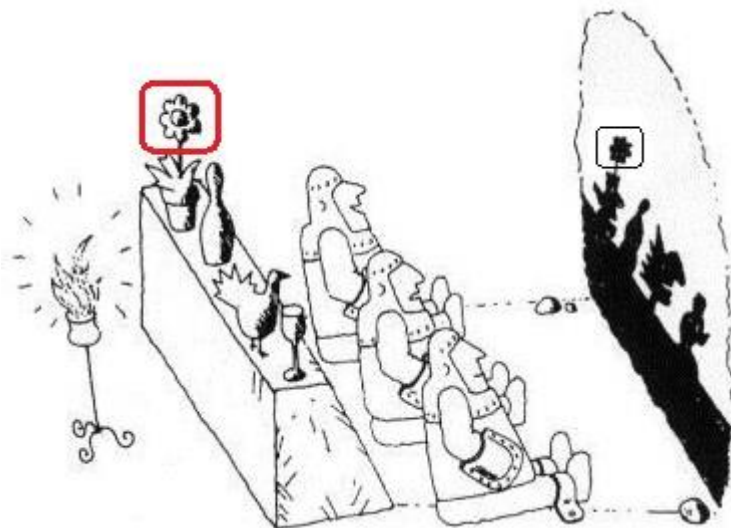
Ladies and Gentlemen,

Welcome to my video lecture ‘About Space and Time’, presenting the [Platonic theory of spacetime](#). My name is Dimi Chakalov; please notice the pronunciation of my family name: *tcha-KA-lov* (the accent is on the *second* syllable). It may be a bit difficult to pronounce it, but that’s the way it is.

To help you with understanding the whole bundle of issues, I would strongly recommend downloading and printing the lecture notes (9 pages) supplementing this video lecture: please visit my website, shortcut [chakalov.net](http://chakalov.net), and download [about\\_spacetime.pdf](#). I will limit the duration of the lecture to app. 20 min and will try to present ‘About Space and Time’ at level accessible to people without professional knowledge in [theoretical physics](#) and [mathematics](#), yet at many instances I will have to refer to the lecture notes mentioned above (e.g., [16] on [p. 9](#)). Please feel free to ask questions by email – anything you were unable to understand will be exclusively my fault. Also, keep in mind that I am not a good presenter and that my English is quite limited, as you may have already noticed.

The lecture is organized in three sections: (i) new axiomatic theory of spacetime (compare it with the one at [this http URL](#)), (ii) where it comes from, and (iii) what follows from it.

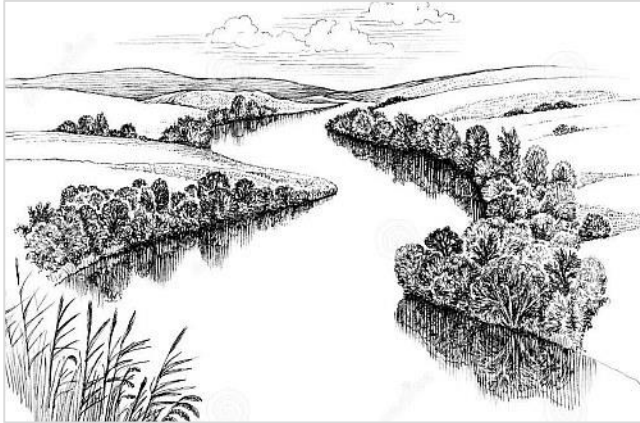
Let’s start from first principles. Recall [Plato’s Cave](#) (see [above](#)) and consider, for example, a Platonic flower (marked with **red**), which we, as ‘chained observers’, can see only as *physicalized* “shadow” cast from the **unphysical** Platonic flower on our 4D **physical** world (marked below with **black**), endowed with three spatial and one temporal dimensions:



Plato pictured us as ‘chained observers’, to stress that we cannot ‘turn around’ and look straight at the Platonic source of our **physical** world. And yes, our **bodies** are *physicalized* 4D “shadows” as well, which we call collectively *Res extensa*. As to our soul, mind, self-consciousness, memory, volition, etc., which we label with *Res cogitans*, they are also kind of “shadows” from their Platonic source which can *penetrate* the 4D physical world only to the extent to which our brains would allow this to happen, like neural “filters” for Platonic

ideas (to be explained later). Thus, the **unphysical** Platonic *Res potentia* is considered the common source of both the physical world (*Res extensa*) and the subjective world (*Res cogitans*), yet it (not “He”) can never be *directly* observed (p. 5 [above](#)).

Next, recall the irreversible *flow* of 4D events, pertaining to all *physicalized* “shadows” [above](#), which can never be *directly* observed either: Heraclitus’ *Panta Rhei*.



Everything changes and nothing remains still –  
you cannot step twice into the same stream.

But why is the most important element of our **Weltbild**, which we call ‘time’, totally hidden to *physical* observations? Because if **Plato’s wall** and Heraclitus’ river [above](#) were produced by any *physical* phenomena, they have to be *relational* (not absolute, see p. 7 [above](#)), and then we could ask questions about the **banks** of Heraclitus’ river ‘at rest’, the *direction* of the flow of events, the physical “engine” of the river, the common *source* of Platonic ideas and their ultimate origin, etc., *ad infinitum*. This is the inevitable problem of any *reductionist* approach to Nature. Aristotle was fully aware, many centuries ago, of this ‘dead end’ and suggested the only possible solution: the **Unmoved Mover** (p. 2 [above](#)). It is *perfectly* hidden, along with the Platonic *Res potentia*, **by** the so-called “speed” of light: check out **A2** in Slide **19** in **Quantum Spacetime**.

Before going into the verification of the Platonic theory of spacetime with indisputable facts from **theoretical physics**, **mathematics**, and life science ([14] on p. 7), let me answer a simple question: do we really need this heavy metaphysical theory? Yes we do. The theory here is like a navigation map, showing the most likely location of an enormous, perhaps unlimited, hidden treasure: quantum gravity and spacetime engineering. If our ‘map’ has been correctly designed, we *might* have a chance to discover our ‘treasure’, for example, BAVER (p. 9 [above](#)). There is no other way to proceed. Follow me, if you’re interested and ready to work. Alternatively, if you prefer the current GR textbooks (e.g., [16] on p. 9), this video lecture is definitely not for you – don’t waste your time any more.

Have you ever wondered *why* **Planck’s constant** and the “speed” of light have fixed **finite** values? What phenomenon could possibly make them *constants*? Any viable theory of quantum gravity should be able to offer some plausible explanation, and the Platonic theory of spacetime offers a very simple explanation based on the bootstrapping holistic effect of the so-called global mode of spacetime. We also offer conceptual explanation of so-called **quantum waves**, which are not caused by any “vibrating” mechanism, like sound waves: the current QM textbooks are conspicuously silent about the *source* of quantum waves. As to gravitational waves (GWs), see [17] on p. 9 [above](#). As a bonus, we can explain brain correlations ([14] on p. 7) facilitating the **binding phenomenon** and **brainwaves**.

To trace [Planck's constant](#) and the “speed” of light to the topology of spacetime, let me elaborate on the global mode of spacetime (p. 3). Have you seen [holomovement of fish](#)?



Suppose every fish follows the rule ‘think globally, act locally’, such that every ‘point’ from the trajectories of each and every fish is **pre-correlated** (Leibnitz’ [pre-established harmony](#)) with ‘the rest of fish’ from the shoal. The correlation “takes place” in the so-called global mode of spacetime: the bi-directional negotiations (“thinking”) of every **next** state along the trajectories of **all** fish are **already-completed** (Sic!) at the very instant  $t_n$  at which every fish executes its **pre-correlated** *infinitesimal* displacement  $t_n \rightarrow t_n + dt = t_{n+1}$  (compare it with [16] and the GR mantra at [this http URL](#)).

In the [quantum-mechanical](#) version of the story above, replace fish with dice. Think of four dice, which you toss in the air, after which they drop on a table. All dice have to be correlated “in the air” (global mode of spacetime) in such way that the sum of their readings must be **already** (Sic!) confined in the interval [10, 20] at the instant they are fixed/dropped on the table. You can see only four dice *on* the table, where they exist as ‘facts’ (local mode of spacetime). Suppose you observe four consecutive sets of readings, (3, 5, 1, 6), (6, 4, 3, 5), (5, 6, 2, 6), (1, 3, 5, 1), all of which are **pre-correlated** by the ‘global’ requirement [10, 20]. The trajectories of all dice are comprised only by their *physical* states ‘on the table’, which are **pre-correlated** ([Henry Stapp](#)) like the shoal of fish above. They will be bootstrapped into holistic ‘shoal of dice’ and will display wave-like holomovement, without any *physical* source ([Erwin Schrödinger](#)) of such “wave” endowed with *complex* (not real-valued) phase ([Chen Ning Yang](#)).

The same phenomenon works in your brain [14], while you’ve been reading these lines. If the [human brain](#) seems too complicated, think of a [centipede](#): how does it correlate its legs? With some [invisible “dark” computer](#), which [does not emit nor reflect light](#)? I can’t help but quote [Sir Arthur Eddington](#): “Something *unknown* is doing we don’t know what.” Nowadays people may even be awarded Nobel Prize in physics, as in [October 2011](#), for proving Sir Arthur right, namely, “for the discovery of the accelerating expansion of the Universe”. Three years earlier, I suggested *the* alternative explanation of the alleged “expansion” of spacetime (read p. 2 [above](#)), but nobody even mentioned it.

Again, the **self-action** of the Universe (“something *unknown*”, Sir Arthur) is related to the topology of spacetime and the **two** types of infinity, actual/completed infinity (relevant to the local mode of spacetime) and potential infinity (global mode of spacetime). Let me explain the puzzle of **self-action** of the Universe (p. 3), along with the [quantum of action](#) and the **cutoff** on the *local* mode of spacetime, known as “speed” of light.



Just think [outside the box](#) and recall the discussions of the proposals by [Plato \(p. 10\)](#) and Heraclitus ([p. 11](#)): the global effects of the global mode of spacetime, pertaining to the entire Universe as ONE, are *physicalized* into local effects in the local mode of spacetime, yet their global origin cannot *in principle* be traced back to any physical object. This is why the *physicalized* local effects, originating from ‘the Universe as ONE’, are called by some people “dark”, including the alleged non-baryonic “dark matter”. Following the same twisted “logic”, these people should call the [gravitational rotation](#) and [vacuum energy density](#) “dark” as well, and then collect their Nobel Prize in physics, as in [October 2011](#).



There is no “dark” stuff whatsoever. It is not like spreading “dark” butter on a hot toast, as I said on different occasions – we always have ‘bread’ and nothing but ‘bread’, only now the toast has become **self-acting** and “quasi-local”, like the fish [above](#). The same applies to all living (Nicolas Bernstein, [p. 7](#)), quantum, and gravitating system ([p. 4](#)).

Next question: why are [Planck’s constant](#) and the “speed” of light constants? To use again the analogy with a shoal of fish [above](#), the bootstrapping holistic effects of their global ‘shoal’ are constants, because they have *the same* magnitudes for every quasi-local fish. The latter are governed by the [principle of locality as well](#), just as all neurons in the human brain [14] are connected by neural networks *as well*. It’s a local-and-global **bundle** ([p. 3](#)), **rendered** with actual/completed infinity and limited to the “speed” of light.

To complete the first section of this lecture (see (i) on [p. 10](#)), let me stress that the topological property of spacetime, which is called here Finite Infinity ([p. 3](#) and [p. 5](#)), **requires** numerically finite but physically unattainable “boundaries” of spacetime, such as [the “speed” of light](#), [Planck’s constant](#), [Planck length](#), and  $10^{-36}$ s “after” the Beginning at time zero ([p. 8](#)). These “boundaries” pertain to the *physicalized* world of “shadows” (cf. Plato’s metaphor [above](#)), **rendered** with actual/completed infinity, and called *local* mode of spacetime. The latter has numerically finite but physically unattainable **cutoffs**, and inhabits the irreversible **past** of every 4D event ‘here and now’, called ‘atom of geometry’ ([p. 1](#)). On the other hand, the Platonic *Res potentia* is placed in the **unbounded** (Sic!) potential future of the same ‘atom of geometry’, thanks to which the Dragon ([p. 3](#)) can never *actually* bite its tale viz. *actually* reach these **cutoffs**. Once created [[John 1:1](#)], the Universe is *already* eternal, because its “beginning” and “end” are *physically eliminated* (hence the need for so-called [hyperimaginary numbers](#),  $|\mathbf{w}|^2 = 0$ ).

This is the axiomatic theory of spacetime, called Platonic theory of spacetime. Now let’s move to the second part of the lecture and explain the *origin* of our theory (see (ii) on [p. 10](#)) by zooming on some perplexing axioms in [metageometry](#), starting from Euclid’s

definition of ‘point’ – “that which has no part”. I will show the existence of ‘points’ (see Fig. 5 below) and will elaborate to the ideas of ‘limit’ (after Augustin-Louis Cauchy) and ‘infinity’ (actual vs. potential infinity), briefly mentioned on p. 5 above. At the end of the day, I hope to convince you that our theory is both the only possible and the optimal one. I will argue that, to the best of my knowledge, no alternative metageometry can possibly exist, and also that the solutions to many outstanding problems in Mathematics, offered with our Platonic theory of spacetime, are unique. It is like assembling pieces from the jigsaw puzzle of Nature, which fit in their unique places effortlessly.

Let me demonstrate a process, which has a ‘limit’ at which it **must** end, because at this limit we obtain a ‘point’ – “that which has no part” – and the process must **stop** there. I call this **endpoint** ‘atom of geometry’ (p. 1). The process (not the atom of geometry itself) is depicted in the drawing below (borrowed from Wikipedia), along with the so-called **limit of (bounded and monotonic) sequence** of increasing numbers of polygon’s sides,  $n$ .

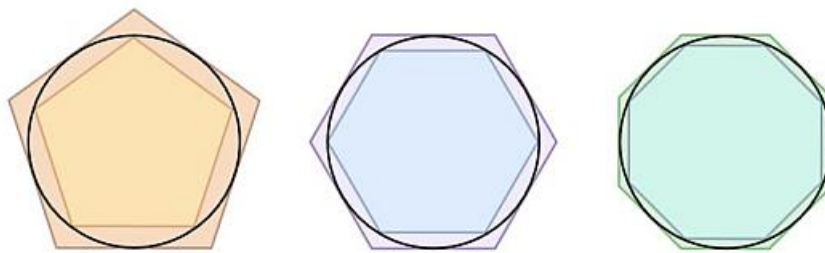
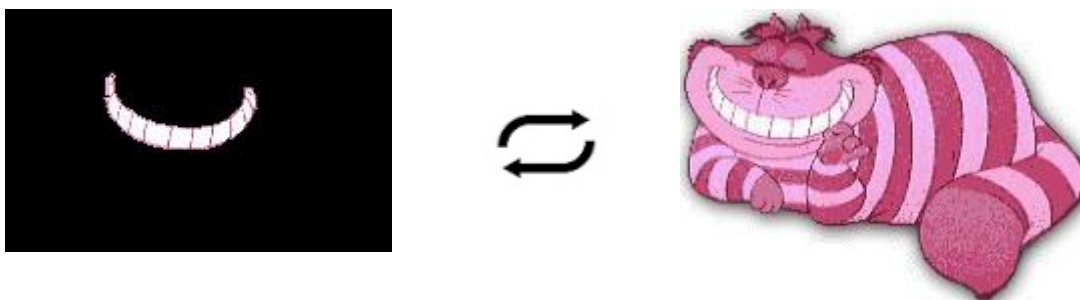


Fig. 5 in [Hyperimaginary Numbers](#), p. 8

The sequence above has unique *limit* at “infinity” ( $n \equiv \infty$ ), in the sense that we *imagine* (Sic!) that at this endpoint the side of the inscribed polygon becomes *identical* to the side of the circumscribed polygon. We denote the two *identical* sides with *infinitesimal*  $ds$  and stress that  $ds$  does not have *metric* any more – there is no underlying spacetime to define any metric – and therefore we cannot attribute any rational number to its “size”. It is just a geometric point from the circle, neither “small” nor “large”. It has no matter anymore. It has become *pure* geometry, like the grin of Cheshire cat *without* the cat.



If we nevertheless suppose that  $ds$  were ‘the smallest pixel of spacetime’ with metric, say, the [Planck length](#) ( $10^{-35}$  m), we could reproduce any *finite* region of spacetime, e.g., 1m by  $10^{-35} \times 10^{35} = 1$ . However, at  $ds$  the Archimedean topology (read below), which pertains to the physical world (local mode of spacetime), is **not** valid any more: the atom of geometry is “that which has no part”. It is neither ‘finite’ object nor “zero” ([empty set](#)). It has become *Res potentia*, a new kind of reality “just in the middle between possibility and reality” ([Werner Heisenberg](#)). Physically, it will look like ‘pure geometry’.

Let me explain **ds** with [Thomson's lamp paradox](#). The paradox underlines the two ontologically different forms of 'infinity': actual/completed infinity and potential infinity. The former can be explained with the famous story about a bartender:

An infinite (*actual infinity*) crowd of mathematicians enters a pub. The first one orders a pint, the second one a half pint, the third one a quarter pint... "I understand", says the bartender – and pours two pints.

The bartender does not have to count the "number" of mathematicians, just as we don't have to count the "number"  $n$  of polygon's sides in Fig. 5 above. All engineers, for example, use calculus like the bartender above. We just calculate the 'limit', and it works perfectly well. But in [Thomson's lamp paradox](#), we *also* use potential infinity, as every definable state of the lamp, either 'on' or 'off', is the necessary and sufficient condition for the *next* definable state, *ad infinitum* (cf. pp. 21-26 in [Hyperimaginary Numbers](#)). First, let me explain what we mean by Archimedean topology based on the [Archimedean Axiom](#). Suppose you have two timbers with different length,  $A = 3\text{m}$  and  $B = 10\text{m}$ . You can always find a positive integer  $0 < k < \infty$ , such that if you multiply the smaller  $A$  by  $k$ , you can produce a timber larger than  $B$ , say, if  $k = 4$ , then  $4 \times 3 = 12 > 10$ . But you can never reach some "infinitely large" timber and **stop** there. Ditto to the opposite case of going toward "zero timber" depicted in Fig. 5 above. Hence the Archimedean topology is based on **potential** infinity, whereas the case of *the* largest two-pint beer above employs **actual** (completed) infinity ([Georg Cantor](#)). To cut the long story short, the alleged [Dedekind completeness](#) cannot solve Thomson's lamp paradox. Here's an excerpt from [Wikipedia](#):

Consider a lamp with a toggle switch. Flicking the switch once turns the lamp on. Another flick will turn the lamp off. Now suppose that there is a being able to perform the following task: starting a timer, he turns the lamp on. At the end of one minute, he turns it off. At the end of another half minute, he turns it on again. At the end of another quarter of a minute, he turns it off. At the next eighth of a minute, he turns it on again, and he continues thus, flicking the switch each time after waiting exactly one-half the time he waited before flicking it previously. The sum of this infinite series of time intervals is exactly two minutes.

What is the state of the lamp at *exactly* two minutes? Is it 'on' or 'off'? The bartender above doesn't have to address such question. He uses only **actual** (completed) infinity, and his two-pint beer is a dead frozen chunk of matter: "nothing ever moves therein; nothing happens; nothing changes" ([Bob Geroch](#)). All living organisms [14] and quantum objects ([Erwin Schrödinger](#) and [Werner Heisenberg](#)) **require** Platonic *Res potentia* as well, viz. the global mode of spacetime endowed with potential infinity: read p. 13 above. Notice also the implementation of potential infinity in Thomson's lamp paradox: flicking the switch is **not** instantaneous – it will always take some (local mode of) time, no matter how brief, to execute it. Thus, 'flicking the switch' is like the dark gap in a movie reel below, which separates consecutive shots, and therefore the (local mode of) spacetime of Thomson's lamp is **not** continuous.



The global mode of spacetime, on the other hand, eliminates *completely* such ‘dark gap’, as explained with the shoal of fish [above](#) and the Dragon biting its tail: see Finite Infinity (FI) on p. [3 above](#). FI is “finite” in the sense that it can reach **absolutely** all points *en bloc* (p. [6 in Penrose-Norris Diagram](#)), yet FI is also “infinite”, because it can never reach *any* ‘limit’ and inevitably **stop** there, like the endpoint from the circle in Fig. [5 above](#).

Unlike the movie reel [above](#), there is no ‘dark gap’ in what we dubbed ‘atom of geometry’, hence the resulting local mode of spacetime is *perfect* continuum: the irreversible **past**, the potential **future**, and their *interface* (Sic!) called ‘here and now’ make together one **indivisible** ‘atom of geometry’. Every consecutive **past** state is the necessary and sufficient condition for the existence of its **next** potential **future** state, *ad infinitum*. Stated differently, the Dragon both bites its past tail in the irreversible **past** (local mode of spacetime) and is trying to reach its future tail in the **next** potential **future** (global mode of spacetime), *ad infinitum* (p. [3 in Penrose-Norris Diagram](#)). This is the *atom* of geometry.

Again, we use the two ontologically different forms of ‘infinity’, actual/completed infinity and potential infinity, to explain the topology of the atom of geometry, as mentioned in p. [5 above](#): the physical world (local mode of spacetime) of ‘two-pint beer’ is assembled by actual infinity in the irreversible **past**. On the other side of the *interface* ‘here and now’, we have the potential **future** (global mode of spacetime) of the same atom of geometry, inhabited by the Platonic state of Thomson’s lamp, in superposition (*Schrödinger’s cat*) of its two states, either ‘on’ or ‘off’. Notice that the elementary “shift” along the *Heraclitus’ River*, called *infinitesimal ds* (see Fig. [5 above](#)), is made by the **self-action** (p. [3 above](#)) of the Universe as ONE, also known as God [[John 1:1](#)], in line with the doctrine of *trialism*, Slide 14 in [Quantum Spacetime](#).

Now comes the third part of the lecture (see (iii) on p. [10](#)), which deals mostly with physical theology (p. [8 above](#)), [quantum gravity](#), and [spacetime engineering](#). Interested? Make sure you’ve subscribed by 10AM GMT on [21 September 2018](#).

Good Friday 2018, 14:14 GMT

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### For the Record

As of today, 21 September 2018, (X) individuals have signed to watch the video lecture, until 30 September 2018 (p. [2 above](#)): check out ... (T.B.C.).

D. Chakalov