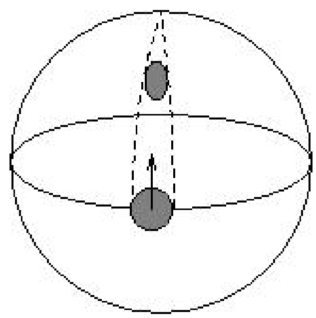
Can geometry produce work?

GR textbooks begin with a "massive body" (Wikipedia) that *somehow*, and for some unknown reason, would create particular influence in *non-flat* 4D spacetime (watch the clip below), and then "the Christoffel symbols play the role of the gravitational force field and the metric tensor plays the role of the gravitational potential", etc.

Can non-tensorial Christoffel symbols produce **work**? What kind of "influence" is that? It doesn't look like electromagnetism. All we know for sure is that gravity can alter the *rate* of time, as demonstrated in GPS navigation and time dilation. But again, the *rate* of time (W.G. Unruh) cannot produce **work** either.

Let's read the experts in GR. Quote from John Baez and Emory Bunn, *The Meaning of Einstein's Equation*, January 4, 2006, Sec. Spatial Curvature:

"On a positively curved surface such as a sphere, initially parallel lines converge towards one another. The same thing happens in the three-dimensional space of the Einstein static universe (cf. Einstein 1918 and Hubble – D.C.). In fact, the geometry of space in this model is that of a 3-sphere. This picture illustrates what happens:



"One dimension is suppressed in this picture, so the two-dimensional spherical surface shown represents the three-dimensional universe. The small shaded circle on the surface represents our tiny sphere of test particles (say, an apple – D.C.), which starts at the equator and moves north. The sides of the sphere approach each other along the dashed geodesics, so the sphere ***shrinks*** (emphasis mine – D.C.) in the transverse direction, although its diameter in the direction of motion does not change."

This last sentence may sound comprehensible only to my dog. I can certainly see that "the sphere shrinks" in the drawing above, but the 'shrinking' *itself* cannot produce **work**. Apples are *physical* objects, not some fictitious "vacuum" devoid of matter. Let me offer an explanation of the question posed in the title.

Consider two kitchen scales, A and B, on a table at rest, and two apples on them, with different weight, say, an apple with 200g on scale A, and another apple with 400g on scale B. How would you relate their "trajectories" in 4D spacetime to the non-tensorial Christoffel symbols, so that the latter will produce different **weight**?

Obviously, an apple with weight 400g will resist acceleration *harder* than 200g apple. Obviously, *something* is doing **work** by pressing the scales A and B on the table.

What is it?

If you can answer this question in the framework of GR, you may discover the coupling of geometry to matter sought by Felix Klein, David Hilbert, and Hermann Weyl, among many others. Also, you might (eventually) *vindicate* the claim by Kip Thorne and his LIGO collaborators about their "discovery" of so-called GW150914 (p. **13** in Zenon). You might also qualify for Nobel Prize for your astounding discovery of renormalizable perturbative quantum gravity based on "gravitons" with mass $m_g \leq 7.7 \times 10^{-23}$ eV/c^2: see the ground-breaking experiment proposed by Kip Thorne at p. **24** in BCCP. Good luck.

If you cannot answer the question, read Über Die Gravitationsfeldrelativitätstheorie. In an nutshell, gravity can produce enormous work (for example, Earth tides), but we need first to explain why we observe only one "charge" with positive energy density. This is totally unexplained puzzle, and theoretical physicists talk only about 'positive mass conjecture' (references are available upon request). The idea suggested in GTR is very simple: recall QM operators (*ibid*., p. **7**). They are *not* geometric points. They take some stuff, denoted **P**, at the input and convert it into *another* stuff **Q** at the output. The latter becomes *physical* stuff (**Q**), which is 'geometric point' that can be located at the apex of the light cone. But **P** (from **Plato**) is *not* on the light cone. We observe only **Q**-stuff, with positive energy density only. So, QM operators act **P** → **Q**.

For comparison, consider another operator from particular pattern (Gesetzmäßigkeit): if I gently stroke Linda's head (**L**), she will wave her tail (**Q**): **L** → **Q**. In this case, I can track the entire sequence of events in **L** → **Q** with light. Not so in QM: **P** is *physically* unobservable (pp. **6**-**7** in BCCP), as we know since 1935, thanks to Erwin Schrödinger.

The *origin* of gravity is also **P** → **Q**, because again we observe only **Q**-stuff, once at a time, as recorded with a physical clock: read **A4** on p. **4** in GTR. Namely, the **Platonic** origin of quantum gravity (**P**) does *not* live on the light cone. We can see with light only its waving ***tail*** (**Q**). People claim that the trajectory of the *physicalized* tail implies some non-flat 4D spacetime (watch the clip below). But we cannot see our Linda (**P**). She has *already* disappeared at the very instant of observation, just like Macavity. See Escher's 'drawing hands' and my note on the spacetime interval here.

To sum up, the *origin* of gravity (**P**), called also 'John', does *not* act on any physical stuff. What actually acts on the physical world is the *physicalized* 'John's jacket' (**Q**). And since in **P** → **Q** the former is *physically* absent, the latter (**Q**) becomes *self-acting*, like your brain. Hence the *origin* of classical gravity (**P**) is *not* physical field, but **Q** is. Yet **Q** only ***facilitates*** the Platonic origin of gravity (**P**), like a **hand** in 4D glove (**Q**).

Moreover, GTR offers the path to quantum gravity from the outset: read my endnote here and pp. **2**-**4** in Gravitational Energy, and notice the Heraclitean ***flow* of events** (recall the puzzle above) depicted with the vector **W** in the drawing at p. **8** therein.

Needless to say, Einstein was fully aware of the problems in his General Relativity (see p. **13** in Gravitational Energy):

> The right side is a formal condensation of all things whose comprehension in the sense of a field-theory is still problematic. Not for a moment, of course, did I doubt that this formulation was merely a makeshift in order to give the general principle of relativity a preliminary closed expression. For it was essentially not anything more than a theory of the gravitational field, which was somewhat artificially isolated from a total field (Gesamtfeld) of as yet unknown structure.

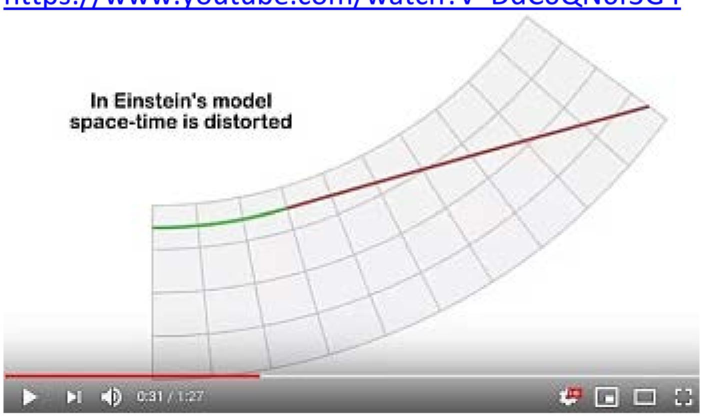
My theory is also incomplete, firstly because "the total field (Gesamtfeld) of as yet unknown structure", suggested by Plato many centuries ago (p. **9** in BCCP), lacks mathematical presentation: we need new Mathematics.

Feel free to download the latest version of this paper from this http URL.

D. Chakalov
20 March 2020
Last update: 24 March 2020, 12:55 GMT

Addendum 1

General Relativity: Einstein vs. Newton
https://www.youtube.com/watch?v=DdC0QN6f3G4



"In Einstein's model space-time is distorted." Fine. But there is no ***explicit*** time parameter τ in GR: read Carlo Rovelli, Bill Unruh, and Charles Torre. Why? Because the Heraclitean *flow* of Time, shown with the **radius** of the 'inflating balloon' (Hubble), is missing in Einstein's equations. The misleading drawing by John Baez and Emory Bunn above shows "Einstein static universe" from 1918 **without** the crucial *unphysical* inflating **radius**.

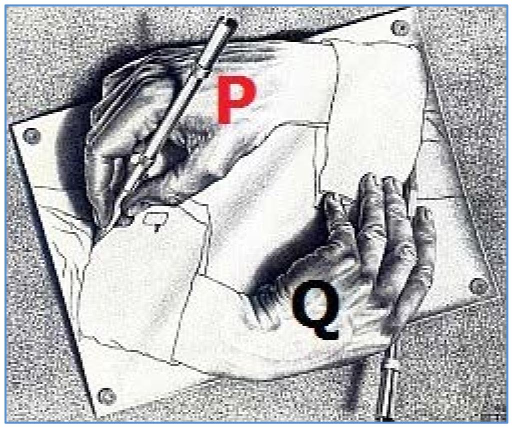
We read that "space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve." (J.A. Wheeler, p. **1** in Gravitational Energy.)

Fine. But which goes **first**? Space acting on matter (telling it how to move) or matter acting on space (telling it how to "curve")? See again Escher's 'drawing hands' and my note on the spacetime interval Δ $\mathbf{s^2}$ (R.M. Wald, Ch. 11, p. 286) here. Simple, isn't it?

In GTR, the statement by J.A. Wheeler above is amended as follows:

> Space**time** acts on matter, telling it how to move-and-rotate. At the same instant, matter acts back on space**time**, telling it how to ***alter*** the *rate* of Time in the invariant spacetime interval $\Delta \mathbf{s}^2$.

Namely, the local *deflation* of $\Delta \mathbf{s}^2$ creates attractive gravity, like going from Bob (**B**) to Alice (**A**), and the local *inflation* of $\Delta \mathbf{s}^2$ creates repulsive gravity, like going from Bob (**B**) to Carol (**C**): p. **12** in GTR and p. **2** above. See the 'general rule' (**1 + 0 = 1**) in p. **2** in Gravitational Energy and the 'atom of geometry' at p. **7** therein, shown below.



The Platonic hand (**P**) in 4D glove (**Q**).
Examples from QM in The Physics of Life.

The arrow of Time *cannot* be modeled with *temporal orientability* of spacetime: see the enormous smashing **errors** by Robert Geroch and Gary T. Horowitz in 1979 here. The *orientability* of **3D** space by "a choice of spatial parity" ("left-handed and right-handed triads", *ibid*.) is also **false**. The fact that in 3D space we can invert 2D *left* rubble glove into its mirror image of 2D *right* rubber glove (parity inversion) does ***not*** represent the fundamental *asymmetry* in spacetime topology: time reversal symmetry (**t** ⇔ **-t**) and left glove ⇔ right glove symmetry (parity inversion) do *not* model the fundamental *asymmetry* along the **3D** "axis" of Small and Large. That is, if you have a large 3D ball in front of you, you cannot "invert" it ***inside-out***, so that you will wind up *inside* the ball. Do you know how mathematicians would catch a lion in Sahara? Check out p. **19** in Hyperimaginary Numbers and Mark Armstrong at p. **26** in BCCP. The non-trivial topology of spacetime is a big can of worms, which has been quietly swept under the carpet by the established mathematicians and theoretical physicists.

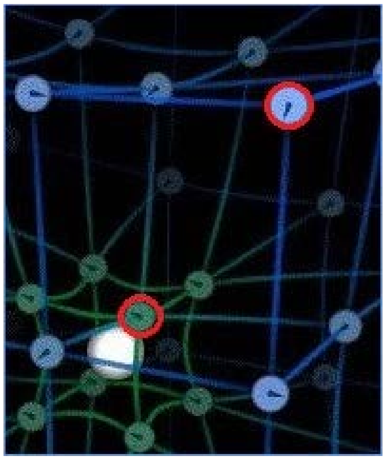
Further information on the flow of Time is available to qualified individuals: read the last paragraph of p. **15** in Über Die Gravitationsfeldrelativitätstheorie.

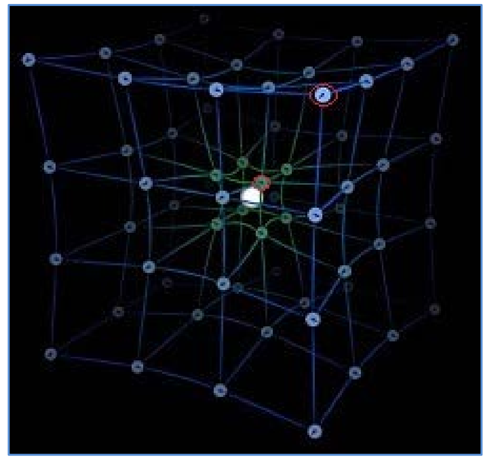
Feel free to download the latest version of this paper from this http URL.

D. Chakalov
24 March 2020
Last update: 30 March 2020, 13:33 GMT

Addendum 2

This is what we know about gravity: read William G. Unruh and compare the local *rates* of time read by the two (highlighted) clocks in the animation (time.gif) below.





Read the principle of GTR at p. **4** above. There is no ***explicit*** time parameter **τ** in GR: read Carlo Rovelli and Charles Torre, as well as Adam Helfer, Mihaela Iftime, and my comments at p. **4** in The Atemporal Platonic World. The latter is always **nullified** in the ***squared*** spacetime interval Δ $\mathbf{s^2}$ (R.M. Wald, Ch. 11, p. 286): click here. If it were possible to "discover" a *local* expression for gravitational field energy density (*ibid*.), the gravitational field will be local tensorial observable (L. Szabados and MTW p. 467) and gravity will become a *classical* force field. Therefore, GR cannot be a *bonafide* classical theory. But it cannot be quantum theory either. We need quantum gravity. We need Mathematics.

More in Über Die Gravitationsfeldrelativitätstheorie and Gravitational Energy. There are *two* classical limits in quantum gravity, depending on the "direction" taken from the macroscopic world (denoted **B**) along the **3D** "axis", toward the Small or the Large (p. **12** in GTR): (**i**) from Alice (**A**) to Bob (**B**), and (**ii**) from Carol (**C**) to Bob (**B**). At the first classical limit (**i**), the nonlocal effects from the quantum world are FAPP zero; for example, in the effect discovered by Charles Wilson. At the second classical limit (**ii**), the nonlocal effects from large-scale gravity are also FAPP zero. That is, the *physicalized* effects facilitated (Sic!) by the "glove" (**Q**), as explained with **P** → **Q** at p. **2** above, do <u>not</u> lead to any "anomalous" **Q**; for example, in Earth tides. There is no violation of energy conservation by "dark energy" or by "mystery matter" at (**ii**): the phenomenon of **self-action**, exhibited also in the human brain, is FAPP zero, too. With very few exceptions, people can use at (**ii**) only Newtonian gravity (e.g., NASA), and everything is sweet, because nobody dares to talk about gravitational rotation.

Those interested in quantum gravity would eventually acknowledge that it would be "ferociously difficult" to understand the *emerging* of spacetime from 'something else' (C.J. Isham and J. Butterfield), although Plato suggested it many centuries ago (p. **2**).

The latest feedback to my ***pre-geometric*** **Platonic** theory of spacetime, initiated in July 1997, came eight years ago from Prof. Dr. Maurice de Gosson at the University of Vienna: "Buzz off, idiot!" (Mon, 21 May 2012 18:47:46 +0200). That's it. Nothing else.

Regarding the topology of spacetime discussed at p. **4** above: the **4**+**0** D spacetime, made exclusively by ***physicalized*** 4D 'jackets' **Q** (p. **2** above), has simply connected topology of ***perfect*** continuum, as it consists of one asymptotically flat ($\mathbf{\Omega_0}$=**1**) 'piece' that does not have any "holes" denoted **P** above. The intrinsic *dynamics* of spacetime topology is highly non-trivial, and it also requires hyperimaginary numbers. This is why we live in **4**+**0** D spacetime ($|\mathbf{w}|^2$ = **0**): read carefully pp. **3**-**4** in Gravitational Energy.

More in p. **16** in GTR. Download the latest version of this paper from this http URL.

D. Chakalov
27 March 2020
Last update: 30 March 2020, 14:41 GMT