

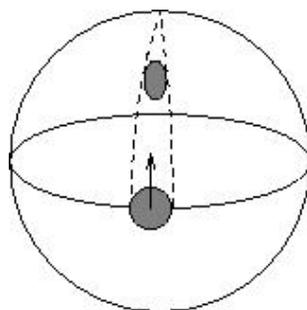
Can geometry produce work?

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. 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, you will discover the coupling of geometry to matter sought by [Felix Klein](#), [David Hilbert](#), and [Hermann Weyl](#), among many others. You will also be able to *vindicate*, although with considerable efforts, the claim by [Kip Thorne](#) and his [LIGO collaborators](#) about their “discovery” of GW150914 (p. 13 in [Zenon](#)), and will qualify for Nobel Prize in physics for your astounding discovery of [renormalizable](#) perturbative quantum gravity based on “gravitons” with mass $m_g \leq 7.7 \times 10^{-23} \text{ eV}/c^2$: 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 a 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. Happy [reading!](#)

Feel free to download the latest version of this paper at [this http URL](#).

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General Relativity : Einstein vs. Newton

<https://www.youtube.com/watch?v=DdCOQN6f3G4>

