THE ONTOLOGICAL EINSTEIN – FOUR CASES IN POINT

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Abstract

The four points which are the message of this paper are as follows: (i) ontological clock slow-down, downstairs in gravity; (ii) ontological rest-mass decrease, downstairs in gravity; (iii) ontological size increase, downstairs in gravity; and (iv) ontological charge decrease, downstairs in gravity. The simplest proofs of these partially unfamiliar results are sketched and their far-reaching consequences pointed at.

Keywords: Completed equivalence principle, Max Abraham, Global constancy of c, Neutron stars, Quasars, Black-hole unchargedness, String theory confirmed, Hawking radiation refuted

Introduction

Use of the word "ontological" in the context of the "relativity" theory of Einstein appears paradoxical. Nevertheless Einstein himself frequently expressed the need for a better name. Here the word is used, not as the ultimate umbrella for the theory as a whole but only for four basic elements of the theory, three of them new, which are shown to deserve this intimidating epithet.

First Case in Point: Gravitational Clock-Slow down

Assume an upstairs floor and a downstairs floor to be equally strongly accelerated in gravity – a plausible idealization. Then this situation can be transposed onto a constant-acceleration rocketship of matching height travelling in empty outer space – a situation governed by the rules of special relativity. Einstein worked out this idea in some detail in his first paper on gravity in 1907 [A. Einstein, 1989], as is well known, cf. [A. Pais, 1982].

Following this logic, one finds that whenever a light ray from the rear end arrives upstairs at the tip of the rocketship, the point of arrival has – during the flight time of the photon in question – picked up additional speed. Hence the emitted light predictably arrives

upstairs, redshifted. Therefore the locally normal ticking rate of clocks and atoms, downstairs, appears slowed-down from the point of view of an upstairs observer. The reason is a constant backwards-receding motion of the point of origin of the clock ticks relative to upstairs, a motion which paradoxically leaves the pertinent distance unchanged. The latter fact distinguishes the present situation from an equally strongly receding case in "special relativity without acceleration."

This earliest deductive result in gravitation theory can be called "ontological" – that is, belonging to a maximally real, hands-on reality ("ón" with a long "o" means "really being" in ancient Greek). The reason for the legitimate applicability of this term lies in the fact that an upper-level clock, if brought down and then back up again, predictably presents an objective deficit in the number of ticks performed in the meantime, when placed side by side with a stationary twin clock. This "vertical" – or synonymously "gravitational" – twins paradox, although straightforward and not infrequently mentioned on physics blogs (cf. [yuiop (an anonymous author), 2008]), is rarely to be found in the literature [M. Schön, 2009] – an observation which may have to do with the fact that Einstein never mentioned the gravitational twin paradox explicitly. The vertical twin paradox nevertheless represents the most astounding implication of his seminal paper of 1907 [A. Einstein, 1989] which, as he used to say, reflects the "happiest thought of my life" – the insight that in free fall you are weightless so that the laws of the special theory of relativity automatically apply. Newton had come across the same weightlessness [T. Damour, 1987], but Einstein was privileged to see that a novel formalism – the theory of special relativity – can be applied here which fact can be used to unravel the mystery of gravity.

Einstein's flash of insight proves miraculously powerful. The ultimate reason: It derives an asymmetry from a symmetry, the symmetry of special relativity: The upper clocks tick faster relative to the lower clocks while the lower clocks tick slower relative to the upper clocks. This is almost miraculous since in special relativity proper, when the other clock ticks more slowly relative to the first (if one is on that side), the first likewise ticks more slowly relative to the other (if one is on the other side). Owing to this perfect symmetry, rest mass is an invariant in special relativity as is well known: only "total mass" (including the kinetic energy of motion) is a function of the relative velocity.

The "equivalence principle" – as Einstein called the equivalence between an extended long rocketship and a standing tower in gravity – represents a unique mental puzzle. So many back and forth "perspective changes" had never been made in science before (cf. [G.H.

Mead, 1934]). Therefore, it does not come as a surprise perhaps if further corollaries – three of them – can be found in Einstein's happiest thought.

Second Case in Point: Gravitational Rest-mass Change

Since the red-shifted photons arriving from below are not redshifted on emission downstairs, everything is normal there. In particular, the local photons remain inter-transformable into material particles down there. Take a local event of positronium creation and/or annihilation as an example. This well-known phenomenon from Quantum Electro Dynamics (QED) implies that, along with the reduced energy of the locally emitted photons, relative to upstairs, all other masses that are locally at rest besides a rare positronium atom must likewise be reduced by the redshift factor valid for the locally emitted photons compared to upstairs.

This corollary to the gravitational redshift law was inaccessible at the time the equivalence principle was found. It has in the meantime quite often been spotted by aficionados who for their being non-specialists would, on encountering resistance, often get caught up in a misleading polemic with the scientific establishment [R. Hatch, 1992]. For a learned paper in general relativity which arrives at the same "redshift-proportional gravitational rest-mass change," see [R.J. Cook, 2009] (cf. [O.E. Rossler, 2012]).

Third Case in Point: Gravitational Size-change

Since the wavelength of all locally emitted photons is increased downstairs by the relative redshift factor valid there compared to upstairs (first point), and since simultaneously all masses that are locally at rest down there are reduced by the relative redshift factor (second point), it follows that all locally normal-appearing lengths downstairs increase by the relative redshift factor. For the described mass decrease (second point) has due to quantum mechanics the effect of a proportional local size increase. This fact follows directly from the "Bohr radius formula" of modern quantum mechanics under careful analysis, cf. [O.E. Rossler, 2012].

This size change result could not possibly be spotted in 1907 because quantum mechanics did not exist yet. Einstein therefore was forced to sacrifice the global constancy of the speed of light c – his most astounding original finding – to retain only a "local constancy" of c [A. Einstein, 1989]. For he had to assume that length remains basically unchanged downstairs in accordance with what holds true in special relativity proper, which only knows of a Lorentz contraction but of no size expansion. The consequence was the non-numbered equation following Eq. (32b) in the 1907 paper [A. Einstein, 1989], which says that the speed of light c is reduced down there by the local redshift factor.

On the other hand, the "rescuing" size change proposed here contains an Achilles' heel at first sight: It is at variance with the fact that in special relativity proper, lateral distances remain unchanged. Therefore the lateral size change, implicit in the isotropic size change just described, must somehow be prevented from being manifest when looking down on it from above. In other words, c is bound to appear "creeping" in the transversal directions downstairs when looked at from above, as Einstein had noticed. Does c indeed decrease transversely downstairs?

The resolution of the paradox follows from a look at the "Lorentz contraction" of special relativity. The contraction there applies only in the longitudinal direction as is well known – transversal directions appear unaffected. However, this visible anisotropy does not cause a Lorentz-contracted object to become non-isotropic in its own frame: the local isotropy is "masked" in the transversal direction. The same thing occurs with the gravitational size change: the isotropically expanded object, present downstairs, appears laterally non-expanded when looked at from above – so the light only appears to be creeping when watched from above. This in 1907 unresolved fact – that c only appears to be manifestly reduced in the transversal directions downstairs – caused Einstein to stop publishing on gravitation for 4 years. He only returned in 1911, after his good friend Ehrenfest had engaged him in a discussion about the, on the face of it related, problem of the rotating disk.

Fourth Case in Point: Gravitational Charge-change

All masses locally at the rest downstairs are reduced as we saw (second point). However, the charge/mass ratio is necessarily locally conserved. This follows from Einstein's principle that the laws of nature are the same in every inertial system, so that special relativity holds true in gravity for every locally at rest (or freshly released-into-free fall) body. As a consequence, the charge of every local electron (and quark, etc.) is ontologically reduced by the redshift factor in parallel to its ontologically reduced mass.

This last result is the most astounding one of the Einsteinian "gang of four" since the law of charge conservation stood unchallenged for almost two centuries. The Colorado-Springs school [R.J. Cook, 2009] explicitly supports the Tübingen school in this regard in an addendum, cf. [O.E. Rossler, 2012]. There rarely existed a more exciting situation in the history of Einstein's theory. The present fourth point, if correct, can be called the "happiest corollary" to Einstein's happiest thought.

Discussion

Einstein's seminal 1907 insight in the theory of gravity – the gravitational clock slowdown – got quadrupled into a four-leafed clover. Even the first leaf thereby acquired a new strength. The newly implied fact that c is globally constant means that Einstein's breakthrough has become even greater after more than a century.

Quantitatively speaking, the "Einstein redshift factor" proves applicable in all 4 cases, either in the numerator or the denominator. This factor reads $(1+\varphi/c^2)$ in Einstein's paper for the gravitational clock slowdown (the mentioned expression following his Eq.32b, with the Greek letter phi stands for the gravitational potential [A. Einstein, 1989]). Why is this simple 4-tiered fact not well-known? It may have to do with Einstein's "battle-of-giants" with Max Abraham. Abraham had challenged Einstein in 1912 to return to his main discovery, the universal constancy of the speed of light c [M. Abraham, 1912]. But Einstein realized that if he tried doing so, as he had done on and off in vain for 4 years, this would sidetrack him from finishing the general theory of relativity which he had begun to conceive. The choice made proves wise in retrospect because the omission involved (the fact that c is globally constant) does not detract from the overwhelming power of the finished theory of general relativity. The most fundamental equation derived from the latter – the Schwarzschild metric – is fully consistent with the new global constancy of c (where it was first spotted [O.E. Rossler, 2012]).

Nevertheless the prospect that not all derived implications of the finished Einstein equation may show the same compatibility with the new global constancy of c, is a reason for unease in the scientific community. Almost all specialists in general relativity reserve judgment for 5 years. (Early immediately refuted criticism on the web – by G.W. Bruhn, Darmstadt, and H. Nicolai, Potsdam – go unrepeated in the scientific literature.) The caution shown is not surprising: if the above results hold water, they amount to a minor "scientific revolution" in the sense of Thomas Kuhn. For the same reason, they are likely not to survive, of course. Some implications show how much current wisdom is affected if they survive:

First, the famous "wormholes" across time and space implicit in general relativity cease to form an open passage – if it is true that passing through in short proper time (as remains possible) takes an infinite amount of outside time on either side. Second, longitudinal gravitational waves (which Einstein had put into doubt himself) vanish – if c is globally constant. Third, some later-obtained solutions to the Einstein equation (like the Reissner-Nordström and the Kerr-Newman metric) lose their physical validity – if the charge and rotation rate go to zero on the horizon compared to upstairs. Fourth, the famous

"Hawking radiation" ceases to exist – if it is true that at the proper time of the not inward-bound twin particle of a short-lived quantum fluctuation, the inward-bound partner cannot possibly reach the infinitely far-away horizon to disappear behind it for good, as Hawking had assumed. Hence nothing prevents the horizon-bound particle from returning to its waiting partner for their joint annihilation – so no Hawking radiation is produced. Fifth, the new unchargedness implies that electrons can no longer be point-shaped since in this case they could no longer be charged for being black holes themselves [O.E. Rossler, 2012]. Therefore space-time itself must be "bored open" in the very small – so that a very general form of "string theory" applies in reality.

A way to empirically check on the new charge reduction exists: re-calculate the electromagnetic properties of neutron stars. Their gravitational redshift of almost 30 percent implies that the voltage of the jet-producing "battery" on their surface is reduced by the same factor. A second quantitative check concerns the observed properties of quasars (and miniquasars): a new explanation of their giant electrical properties is implicit in the fourth leaf. The differential in-falling rate of the lighter-and-faster electrons, compared to the heavier-and-slower protons, in the hot plasma of the innermost layer of the accretion disk around the central black hole, has a novel consequence: The electrons not only get sucked-in faster but at the same time lose their charge earlier – so that a strong voltage gradient predictably forms. Hence an improved Blandford mechanism (cf. [M. P. Galanin et all,]) to explain the "quasar battery" becomes possible.

To conclude, a return to a pivotal point in the immediate prehistory of general relativity was proposed. Since generations of scientists have worked in the neighborhood of the same point (cf. [H. Dehnen et all, 1960][G. Castagnetti et all, 1997] [G. Weinstein, 2012][J. Norton et all, 2012]), it appears unlikely at first sight that the "archeological" method has a chance. On the other hand, the same method was proposed by Maxwell when he suggested a return to the origin of a past "gold vein" as a royal road to scientific progress, because a "sister vein" would invariably be waiting there (cf. [M. Goldman, 1983] – the exact reference page is momentarily elusive). Whether or not the above "clover" is a 4-tiered success story can only be judged from a sufficient historical distance since the empirical checks proposed will take their time. Was the use of the word "ontological" justified?

Acknowledgments

We thank Heinrich Kuypers, Jürgen Parisi and Wolfgang Rindler for discussions and Greg Andonian, William Graham, George Lasker and Ali Sanayei for encouragement. Paper dedicated to Alfred Klemm, founder and editor of the "Zeitschrift für Naturforschung a" for

many fruitful decades, on the occasion of his hundredth birthday on February 15, 2013. (For J.O.R., Nov. 16, 2012)

References:

A. Einstein, On the relativity principle and the conclusions drawn from it (in German), Jahrbuch der Radioaktivitaet und Elektronik 4, 411-462 (1907), English translation in: The Collected Papers of Albert Einstein, Vol. 2, Doc. 47, pp. 252-307 (Anna Beck, Translator). Princeton University Press 1989.
http://www.pitt.edu/~jdnorton/teaching/GR&Grav_2007/pdf/Einstein_1907.pdf
A. Pais, Subtle Is the Lord…, Oxford, Clarendon 1982, p. 177 pp.
http://www.questia.com/library/74596512/subtle-is-the-lord-the-science-and-the-life-of-albert
yuiop (an anonymous author), Gravitational twins paradox 2008 (http://www.physicsforums.com/showthread.php?t=238070) plus earlier postings (cf. http://www.physicsforums.com/showthread.php?t=366816)
M. Schön, Clock Synchronization in arbitrary gravitational fields (2009), http://biblioteca.universia.net/html_bura/ficha/params/title/clock-synchronization-in-arbitrary-gravitational-fields/id/46475463.html ; cf. also Martin Schön 2004, http://130.203.133.150/viewdoc/summary?doi=10.1.1.36.7449
T. Damour, The problem of motion in Newtonian and Einsteinian gravity. In: 300 Years of Gravitation (S. Hawking and W. Israel, eds.). Cambridge University Press 1987, pp. 128-198.
http://books.google.de/books?id=Vq787qC5PWQC&pg=PA128&lpg=PA128&dq=Damour+%22Einsteinian%22&source=bl&ots=Y_aWS3-4f1&sig=JtCiQ-d2VIRcVgxPrlcFeCFyhQo&hl=de&sa=X&ei=b8QgUabuEsvDswbIyYGYCw&ved=0CBwQ6AEwAA#v=onepage&q=Damour%20%22Einsteinian%22&f=false
G.H. Mead, Mind, Self and Society. Chicago University Press 1934, http://www.brocku.ca/MeadProject/Mead/pubs2/mindself/Mead_1934_27.html
R. Hatch, Escape from Einstein. Wilmington, The Kneat Kompany 1992.
http://step.yourfiledownloader.com/j5GARGHRuV4m0r9QZ5i0KmDPoSJ7rv88e625ci341XVtuYcgT7mNZh%2Ft3G4d%2FoUQE%2B3GUQPRyFwH1s8%3D
R.J. Cook, Gravitational space dilation (2009), http://arxiv.org/pdf/0902.2811v1.pdf
O.E. Rossler, Einstein's equivalence principle has three further implications besides affecting time: T-L-M-Ch theorem (“Telemach”). African Journal of Mathematics and Computer Science Research 5, 44-47 (2012), http://www.academicjournals.org/ajmcsr/PDF/pdf2012/Feb/9%20Feb/Rossler.pdf

M. Abraham, Relativity and gravitation: reply to a remark of Mr. A. Einstein (in German). Annalen der Physik 38, 1056-1058 (1912). Cf. also the editors‘ comments in: The Collected Papers of Albert Einstein. Princeton University Press 1995, Vol. 4, p. 126.

O.E. Rossler, Abraham-like return to constant c in general relativity: “R-theorem” demonstrated in Schwarzschild metric. Fractal Spacetime and Noncommutative Geometry in Quantum and High Energy Physics **2, 2012,**
http://www.nonlinearscience.com/paper.php?pid=0000000148 (preprint: http://www.imamu.edu.sa/Scientific_selections/abstracts/Physics/Abraham-like%20return%20to%20constant%20c%20in%20general%20relativity.pdf)

M. P. Galanin, V. V. Lukin and V. M. Chechetkin, Mathematical modeling of magnetic jets acceleration. AIP Conf. Proc. 1301, pp. 468-475;
http://proceedings.aip.org/resource/2/apcpcs/1301/1/468_1?bypassSSO=1

H. Dehnen, H. Hoenl, K. Westphahl, Ein heuristischer Zugang zur allgemeinen Relativitätstheorie. Ann. der Phys. 7, 370-406 (1960).

G. Castagnetti, H. Goenner, J. Renn, T. Sauer, and B. Scheideler, Foundation in disarray: essays on Einstein’s science and politics in the Berlin years (1997), http://www.mpiwg-berlin.mpg.de/Preprints/P63.PDF

G. Weinstein, Einstein's 1912-1913 struggles with gravitation theory: Importance of static gravitational fields theory (2012), http://arxiv.org/ftp/arxiv/papers/1202/1202.2791.pdf

J. Norton and D. Giulini, Appendix: is special relativistic gravitation a theoretically viable option?, a discussion. In: Einstein and the Changing Worldviews of Physics (Christoph Lehner, Jürgen Renn and Matthias Schemmel, eds.), pp. 17-18. New York: Springer Verlag 2012. http://carlossicoli.free.fr/L/Lehner_C.,_Renn_J.,_Schemmel_M.-Einstein_and_the_Changing_Worldviews_of_Physics_-Birkhaeuser_Boston%282011%29.pdf

M. Goldman, The Demon in the Aether – The Story of James Clerk Maxwell. Edinburgh: Paul Harris Publ. 1983 (ISBN 086228026-5); cf. also:
http://archive.org/details/lifeofjamesclerk00camprich