LETTERS TO PROGRESS IN PHYSICS

The *c*-global Revival in Physics

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A return is proposed to the 6-years-long period before Einstein gave up on the global constancy of the speed of light *c* in the vacuum. *c-global* remains implicit in Maxwell's equations and in quantum electrodynamics. Reluctantly, Einstein abandoned *c-global* in 1911 after a $3\frac{1}{2}$ years long silence kept on gravitation during which he had tried in vain to avoid the conclusion that *c* is only an everywhere locally but not a globally valid constant of nature. It is shown that Einstein just overlooked a *corollary* to his own finding of an optically reduced speed of an horizontal light ray downstairs in his constantly accelerating long rocketship in outer space. The new corollary reads: *slantedness relative to the tip* of the locally horizontal light ray. Hence Einstein's famous gravitational redshift — the increase in wavelength compared to above of a *vertically* emitted light ray — is accompanied by a proportional enlargement of space. The new horizontal size increase is masked from above by the upwards slant valid relative to the tip. Einstein's *gravitational time dilation* thus goes hand in hand with an equal *gravitational space dilation*. Surprisingly, Quantum Mechanics enforces the same conclusion independently: the reduced energy of the locally normal-appearing photons downstairs generates (via Quantum Mechanics' creation and annihilation operators) atoms of a proportionally reduced mass and hence proportionally enlarged size. Two disappointing implications follow: *c-global rules out* both cosmological space expansion and black hole evaporation. The uplifting third implication is: *c-global* makes the equivalence principle compatible with Quantum Mechanics for the first time. This new compatibility predictably extends to the implied "*c-global*-rescaled General Relativity". Hence the "holy grail of physics" is bound to exist. The *cgr-GR* only waits to be written down.

1 Foreword

The following text seems to represent a footnote on the early prehistory of General Relativity, dealing only with long overhauled ways of thinking and of groping in the dark, because since 1915 we have the indubitable final reality of the theory of space and time in the large. The purpose of the present note is to show that this is not so. In the very foundations of the grandiose recipe, there is hidden a tiny minor oversight. It has little influence on most implications, but it nonetheless allows one to improve the theory eventually by at last putting straight an element that belongs into it since 1915: the nonglobality of *c*.

Many specialists will strongly disagree with the view that it could pay to return to the most early stage of this beautiful superhuman theory to find a little oversight in it and repair it. But this is exactly the purpose and aim of the following text. As the reader will see, the consequences — if this friendly detour into a long-gone stage of science is followed for the fun of it for a short stretch since everything is maximally simple on that level — are maximally far-reaching and rewarding.

Admittedly, such "nostalgic physics" à la Yul Brynner in the movie "Westworld" is an unusual approach. It looks like History of Science and has a dusty smell to it. But IF it unearths something that was really and actually overlooked, it has an important role to play. So with this Foreword, which owes its existence to a spirited written dialogue with the Editor-in-Chief, the present note belongs into a twilight category of theoretical physics. But it is the fruits that make results recognizable eventually. So if the result derived below, a so far overlooked gravitational-redshift-proportional size increase in gravitation, is correct — as is shown on the limited level of knowledge available in 1907 below, aided only by an independent development in physics that did not exist at the time, quantum electrodynamics —, then a major progress in today's thinking occurs. So the paper which follows after this acutely added preface is perhaps indeed worth the scrutiny of the specialists.

It is rare that such a naive but rigorous spatial thinking is used in theoretical physics. It reminds its author of the early phase in chaos theory when "absurdly simple" geometric ideas, like overlaying two transparencies with an expanding spiral drawn on each and defining straight threshold lines of transitions between them, sufficed to catapult chaos theory into the applied sciences. In that latter case, the specialists arrived at the same trick called "singular perturbation" eventually. In the present case, a similar "canonization" is hoped for.

2   Introduction

Einstein's biggest early discovery was an intuitive understanding of Maxwell's *c-global*: he saw in his mind that a light flash can expand as a sphere with the *same* speed *c* around each of two observers who are passing by each other at a high speed while the flash goes off at their feet at that moment.

This logical impossibility (one expects *two* light spheres around the two mutually fast receding observers) becomes a logical truth if the *simultaneities* valid for the two runners which coincide at the encounter, are *mutually slanted* as two equal-rights cuts through the same light cone. This fact Einstein was able to picture in his mind after a long nightly discussion with his by a few years older friend Michele Besso. On the next morning, he excitedly returned to Besso's front door to tell him: "*Thanks to you*, I have solved the problem!" This event Einstein reported to a Japanese audience 17 years later when he had just received the news of his Nobel Prize. His rare German phrase "Dank Dir" (thanks to you) got confounded with the conventional German phrase "danke Dir" (thank you) in the ensuing translation — so the co-authorship of Einstein's lifelong friend Besso never became public.

The miracle of the individualized global constancy of *c* fell in doubt with Einstein himself $2\frac{1}{2}$ years later, in December of 1907 [1], to be abandoned for good in mid-1911 [2]. By serendipity, *c-global* was retrieved a century later in 2007 as an allowed formal implication of the Schwarzschild metric of General Relativity [3, 4]. Subsequently, *c-global* was also discovered in the equivalence principle of Special Relativity [5], the very theory in which it had become questionable in late 1907 and been abandoned in 1911.

3   Motivation

The return of *c-global* into the foundations is important because a "facelift of physics" is implicit. For instance, the long-accepted paradigm of the *Big Bang* ceases to be tenable since it implies that two sufficiently distant objects on the expanding "balloon" recede from each other at a *superluminal* speed. As a second implication, black holes can now no longer "evaporate" since the well-known infinite *temporal distance* of their surface (called horizon) from the outside world is, by virtue of the global *c*, accompanied by an equally large *spatial distance*. Hence there can be no "tunneling" to the horizon anymore and thence no *Hawking radiation*. Thirdly, metrology acquires a whole new face [5].

What is the best way to convince the reader that *c-global* holds true again after a century? The answer lies in a return to the early Einstein. In 1905, he had described two radically new implications of *c-global*: the *twins paradox* (one twin ageing faster as if in a *Grimm Brothers*' fairy tale) and the *transversal Doppler effect*, which had both been overlooked by his great predecessors in the developing discovery of Special Relativity, Lorentz and Poincaré.

4   Genealogy

The drama with *c-global* began in 1907 with the last step in the discovery of the equivalence principle. The latter principle [1, 6] had just yielded the absolutely incredible but in retrospect true prediction of the *gravitational redshift*: inside a constantly accelerating long rocketship in outer space described by Special Relativity, a light pulse ascending with a finite *c* from the bottom reaches the tip only when the latter has picked up a fixed relative speed away from the original emission point. The GPS satellites confirm this absurdly daring insight of "gravitational time dilation" downstairs every minute.

Einstein's look at a *vertically* emitted light ray was then followed by his also having a look at a locally *horizontal* light ray that hugs the flat bottom of the ignited rocketship. This led him to his final discovery in the equivalence principle: a horizontal light pulse automatically *looks slowed* by the gravitational redshift factor when watched from above [1] (see the last unnumbered equation on the last-but-second page).

5   Main result

The second revolutionary finding of Einstein regarding gravitation is again absolutely correct notwithstanding its absurdity from a common-sense point of view. However, it happens to admit of a final touch. The latter takes the first Einstein result (the fact that the bottom is in constant recession relative to the tip) into account in the second (the apparent transversal slowdown of *c*). The synthesis is that the locally *horizontal* light ray hugging the floor is necessarily at the same time *slanted-upwards* relative to the tip at every point due to the continual falling-back of the bottom. Note that when the light from the neighboring spatial cell downstairs reaches the next, the latter is a bit faster already, etc. Owing to this new *relative slant*, the horizontal reduction of *c* discovered by Einstein becomes a mere *projection effect*: the new upwards slant restores *c-global*.

It is worth pointing out here that *c-global* formally underlies the equivalence principle from the outset since the latter is exclusively based on Special Relativity with its built-in global *c*. This fact was not sufficient, however, to directly rule out the conclusion that *c* is locally reduced. The lack of confidence shown has to do with the fact that the rocketship paradigm is so impossibly hard to think-through in every respect [6].

The newly retrieved global speed of light *c* downstairs in the equivalence principle now has its consequences: all *transversal lengths* downstairs which at first sight look unchanged from above are actually increased by the gravitational redshift factor relative to the tip. They only look optically compressed towards the original length by virtue of the slant. The only readily visible consequence upstairs is the seemingly reduced transversal speed of light *c′* downstairs, discovered by Einstein [1].

6 Consistency

The new found *transversal size increase downstairs matches* the increase in wavelength of all light emitted downstairs. Moreover, these lower-energy photons emitted downstairs remain, with their locally unchanged-appearing frequencies, *locally interconvertible* with particles of matter (as in positronium creation and annihilation) as a consequence of the much later discovered quantum electrodynamics. Hence *all* local atoms have a mass that is lower by the redshift factor valid relative to above. This *mass reduction*, in turn, entails a proportional size increase of these atoms via the Bohr radius formula of Quantum Mechanics. Therefore, space is enlarged downstairs, *both* by the *c-global* of Special Relativity and by virtue of Quantum Mechanics, in an identical fashion. The two theories confirm each other independently. The optically unchanged-appearing horizontal distances downstairs with their creeping c' seen by Einstein do therefore indeed mask a *size increase* proportional to the gravitational redshift.

Note that the thus doubly confirmed *new Einstein effect* of "gravitational space dilation" exactly matches the *old Einstein effect* of "gravitational time dilation" (implying *c-global*). The equivalence principle thus becomes even more powerful by the fact that the size change derived geometrically in it via the laws of Special Relativity gets independently confirmed by the creation and annihilation operators of quantum electrodynamics.

Thus, the original interpretation of Einstein's creeping effect (as a reduction in c [1, 2]) can be given up for good to date. However, it is important to realize that in the days *before* the advent of quantum electrodynamics with its creation and annihilation operators, the double-tiered consistency obtained above was *inaccessible*. Hence the above-described fractal-like *relative local slant*, which saves *c-global* on the part of Special Relativity downstairs, was in the absence of Quantum Mechanics' own rest-mass-dependent size increase impossible to spot. Einstein's giving *c-global* up for good in 1911 after more than 3 years of trying to preserve it was therefore preprogrammed.

The *new Einstein effect* of "gravitational space dilation," when added to the *old Einstein effect* of "gravitational time dilation" (so that c remains a global constant of nature), has mind-boggling consequences like the two already mentioned (no Big Bang and no Hawking evaporation). The second implication is especially important in view of the fact that it renders the most hoped-for success of a currently running experiment — generation of miniature black holes down on earth — undetectable by virtue of the absence of their generally expected Hawking signature. Any unrecognized success at CERN will then grow exponentially inside earth [3]. So the return to *c-global* implies "tangible consequences" for an experiment rated innocuous in its last — still pre-*c-global* — safety report LSAG of 2008. Einstein's results are notorious for entailing existential consequences.

7 Discussion

It is a good idea to "return to the mothers" from time to time, poet Goethe advised. In the present case, a trip back to the *pioneer phase* of relativistic gravitation theory was offered. The retrieved crumb from Einstein's table — *c-global* — is still big enough to revolutionize cosmology and metrology.

All of this is only possible because in 1907, a young outsider dared think clearly in three dimensions with an almost superhuman exactitude including motion effects and their entailed delays — much as a computer-games freak of today would do with the aid of modern simulation tools, cf. [7]. Composing the computer game "*Einstein Rocket*" and putting it on the web will greatly aid physics. In this way, a modern young Einstein may be enabled to let the only "to some extent accessible" [6] thought experiment of the younger Einstein reveal its most important if presently still unfathomable secret.

To conclude, a *revolution in physics* based on Einstein's early work was described. A *corollary* to his optically manifest reduced speed of light c' downstairs in gravitation was pointed out — a gravitational-redshift proportional *size increase* downstairs in gravity that is masked from above. The *new space dilation* is proportional to the *old time dilation* and thus restores *c-global* in accordance with the special-relativistic nature of the equivalence principle of Einstein. Consistency of the equivalence principle with Quantum Mechanics arises for the first time (the previous absence of this feature had gone unnoticed). As a bonus, the new size dilation predictably enables the long-missed unification of General Relativity with Quantum Mechanics — "the holy grail of physics" [8].

References

1. Einstein A. On the relativity principle and the conclusions drawn from it (in German). *Jahrbuch der Radioaktivität*, 1907, Bd. 4, 411–462 (ref. to p. 458).

2. Einstein A. On the influence of gravitation on the propagation of light (in German). *Annalen der Physik*, 1911, Bd. 35, 898–908 (ref. to p. 906).

3. Rossler O. E. Abraham solution to Schwarzschild metric implies that CERN miniblack holes pose a planetary risk. *Vernetzte Wissenschaften — Crosslinks in Natural and Social Sciences* (P. J. Plath and E. C. Hass, eds.), Logos Verlag, Berlin, 2008, pp. 263–270. [Correction: the phrase "infinite proper in-falling time" must read "finite proper in-falling time"].

4. Rossler O. E. Abraham-like return to constant c in general relativity: Gothic-R theorem demonstrated in Schwarzschild metric. *Fractal Spacetime and Noncommutative Geometry in Quantum and High Energy Physics*, 2012, v. 2, 1–14.

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5. Rossler O. E. 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*, 2012, v. 5, 44–47.

6. The essential phrase in Einstein's paper on the equivalence principle [1], p. 454 (p. 302 of the English translation) reads as follows: "[...] in the discussion that follows, we shall therefore assume the complete physical *equivalence* of a gravitational [field] and a corresponding acceleration of the reference system. This assumption extends the principle of relativity to the uniformly accelerated translational motion of the reference system. The heuristic value of this assumption rests on the fact that it permits the replacement of a homogeneous gravitational field by a uniformly accelerated reference system, the latter case being *to some extent accessible* to theoretical treatment." (Emphases added.)

7. Rossler O. E. Bye-bye Big Bang due to the analogical thinking of the young Einstein. In: *Das Numen* (Julian Charriere, Andreas Greiner, Markus Hoffmann and Felix Kiessling, eds.), pp. 59–75. Distanz Verlag GmbH & Institut für Raumexperimente, Berlin, 2015.

8. The remaining task is to write down the "*c-global*-rescaled (cgr) general relativity". Hereby, the Einstein field equations must be condensed into a "global-*c* skeleton". Before this job has been finished, "experimentation in the dark" is discouraged. Once the "global-*c* space-time theory" is found, the deeper meaning of the retrieved "Maxwell-Einstein miracle of *c-global*" can start to be addressed.