CHU'S CONFIRMATION OF EINSTEIN'S EQUIVALENCE PRINCIPLE, C-GLOBAL, AND THE WIDELY IGNORED FACTOR 30 000

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Abstract

A brief historical account of the paradox of the gravitational clock slowdown is offered. It took Einstein's finding more than a century to have its main consequence fully appreciated in the wake of the quantum-relativistic results of the Chu school. A return to the global constancy of the speed of light c is implicit. The latter finding enables an improved understanding of the theory of black holes and in particular of a recent mega experiment which proves unsafe in the new light. Neglect of a factor of 30 000 by the scientific community is drawn attention to.

Keywords: Gravitational clock slowdown, Chu et al.'s measurements, The new mass change, c-Global, Black holes revised, Hawking radiation disproved, LHC experiment, The overlooked factor of 30 000

1. Introduction

Einstein's slowdown of clocks downstairs in gravitation of 1907 [A. Einstein,1907] is a commonplace in the age of the G.P.S.: the clocks in the high-altitude satellites do indeed tick faster. Julian Schwinger gave the best explanation: Ascending photons do not lose in energy, but the upper region with its higher potential harbors the higher-energetic photons. Specifically the latters' energy is raised by (E/c^2)g'h, with g' the gravitational acceleration and h the height difference [J. Schwinger,1986]. This "Einstein effect" turns out to have further consequences.

2. Step One: Precision

The gravitational clock slowdown was demonstrated more accurately than ever before by the Chu school [M.A. Hohensee et al.,2010; H. Müller et al.,2010]. They hey showed that very minor height differences do already reveal the effect. Quantum mechanics helped prove this with its incredibly accurate clocks.

3. Step Two: Lower Particle Masses downstairs

If atoms tick slower downstairs compared to upstairs, also all normal-appearing photons generated there have a proportionally lower energy compared to upstairs (see [J. Schwinger,1984] again). Therefore also all particles created locally out of these normal-appearing but less energetic photons – and all locally at rest particles – have a proportionally smaller rest mass down there [O.E. Rossler,2012].

4. Step Three: Larger Particle Sizes downstairs

The locally normal-appearing slower clocks and mass-reduced particles (and meter sticks) present downstairs are proportionally enlarged. This follows from the Bohr-radius formula of quantum mechanics which contains particle mass in the denominator [O.E. Rossler,2012; H. Kuypers,2005]. The same size increase follows also from angular momentum conservation [H. Kuypers,2005; O.E. Rossler,2013].

5. The Global-c Consequence

If everything is larger more downstairs in gravity, a surprise consequence follows: The ratio "delta-s over delta-t" is preserved globally. In particular, the speed of light, c, is now not just locally constant, as always acknowledged, but globally so [O.E. Rossler,2012]. The global constancy of c had, to Einstein's grave chagrin, been abandoned in 1907 since the increased transversal distances downstairs are masked. The close analogy to the also seemingly unchanged transverse distances in Lorentz contraction despite the locally conserved isotropy, could not possibly be seen before the advent of full-fledged quantum mechanics [O.E. Rossler, D. Frohlich,2013].

The new global validity of c implies that all "time delays" suffered by light traveling in gravity – like the famous Shapiro effect [I.I. Shapiro,1964] – simultaneously reflect the presence of a proportionally increased path length. In particular, the horizon of a black hole is now infinitely far away as seen from the outside. Note that light has always been known to take an infinitely long outside time for coming up from or going down to the horizon [J.R. Oppenheimer, H. Snyder,1939]. Therefore, all textbook calculations which maintain that radiation can reach the horizon of a black hole – or come up from it – in finite outer time ("Hawking radiation" [S.W. Hawking,1974]) prove outdated. Even the "quantum tunneling" assumed by Hawking cannot bridge the infinite distance at stake.

Another baffling consequence of the new global constancy of c is the fact that the universe is now bound to be stationary (since expanding-universe solutions automatically imply that the local speed of light is modulated by the expansion rate). This fact is only mentioned here to remind the reader that the present return to Einstein's early hope is intimidatingly rich in formal implications.

6. A vital Application

During the more than a century long absence of the global-constancy-of-c result, minor or major errors predictably accrued in physics – up to the possibility of survival errors. Specifically, the scientific community may have been ill-advised to agree to the attempt to create artificial miniature black holes on earth which was one of the official purposes of the LHC experiment [S.B. Giddings, M. Mangano,2008].

The reason for the lack of apprehension was that the proton-proton collisions, actually performed at CERN at record energies during the years 2011–2012, appeared to be equivalent to the natural two-proton collisions occurring for eons between high-energy cosmic-rays and stationary protons on the surface of white dwarfs, which are the densest form of matter in the universe (besides neutron stars which are protected by quantum mechanics [O.E. Rossler,2008a]) which fact makes their survival the most convincing as a security argument. Therefore, CERN's Large Hadron Collider (LHC) experiment appeared innocuous because it "only reproduces" what nature is doing every moment." This conclusion was accepted as a guarantee offered to humanity by nature that the LHC is safe [S.B. Giddings, M. Mangano,2008].

No one in the physics community at large disagreed for 5 years. However, there is a snag: the natural miniature black holes generated on the surface of white dwarfs – in case the collisions performed on earth do this as well as hoped – do differ in one important respect from the artificial ones. The natural ones possess almost the speed of light (300 000 km/sec) while the artificial ones – if one is slow enough to stay inside earth as must be reckoned with – have only 30 times more than the speed of sound with their sub-Keplerian speeds ($v < 11$ km/sec). Therefore a speed ratio of 30 000 (namely, 300 000/10) separates nature's own collision products from CERN's artificial ones. This factor can prove vital.

7. Discussion

An instance of "delayed recognition" was described: the re-discovery, made after more than a century, that the speed of light c is indeed a global constant of nature. It took three intermediary steps – time change; mass change; size change – to recover Einstein's global-c law of 1905. This good news of "c rehabilitated" (see [O.E. Rossler,2008b]) goes unappreciated so far. The lack of resonance is not surprising. The beauty of general relativity lies partially in its flexibility. Many transformations are formally allowed – including singularity-removing ones like the Kruskal-Szekeres transformation (compare the "bible" of general relativity published by the Wheeler school in 1973 under the single-word title "Gravitation"). This accepted freedom is suddenly removed if the local mass change, implicit in the gravitational redshift by virtue of quantum mechanics as we saw, is taken into account. A development on the most basic level like this is bound to take its time before being appreciated.

Unfortunately, this understandable neglect goes hand in hand with a five-years-long planet-wide oversight: Disregard of a speed difference of more than four orders of magnitude (a factor of 30 000 was taken to be equivalent to unity). The reader at this point hopes that the oversight has no tangible implications.

This hope appears to be unfounded. As we have seen the safety guarantee derived from nature's own miniature black holes [S.B. Giddings, M. Mangano,2008] fails to extend to the human-made ultra-slow ones in case the LHC experiment succeeded. While the ultra-high-speed natural miniature black holes created on the surface of a white dwarf traverse this star without being captured given their necessarily maximally small size, their by a factor of 30 000 slower man-made cousins, possibly planted into the earth, make for a qualitatively different case.

An argument from Newtonian mechanics can show that the difference is not just a quantitative one, as one might tend to think at first sight. A nuclear quark inside a white dwarf will, when grazed by an ultra-**fast** miniature black hole remain unscathed, because the law of angular momentum conservation enforces an immediate disengagement again ("two-body almost collision"). By contrast, a nuclear quark inside earth will, when grazed by an ultra-**slow** miniature black hole, enjoy a 30 000 times longer interaction time. This makes for a qualitative difference. For the much slower passage effectively "unfreezes" the nucleon that contains the quark in question. So the interaction is turned into an effective "three-body collision" (or a 4-body one, to be more precise). As a consequence, the grazed quark can now get bound gravitationally to the slow black hole. This "quake model" as it may be called involves two steps. First, the grazed quark gets rid of its strong orbital angular momentum by dynamically interacting with the two other quarks to which it is asymptotically bound. Second, the three quarks in the nucleon equilibrate in turn with the other nucleons inside the same nucleus. The fact that this interaction is not classical but governed by the laws of chromodynamics makes no difference in this context. Since the strong angular momentum thus got dissipated in effect, the nucleon can now be dragged along by the slow miniature black hole in order to be eaten by it eventually. This type of effect (transposition of angular momentum) is well known in the classical theory of globular star clusters [J. Waldvogel,1975] but appears to be unfamiliar in the nuclear domain. It deserves further scrutiny. The effect gains in psychological weight by the familiar fact that in nuclear fission, it also is only the slower ("cold") neutrons that get bound to initiate a fateful chain reaction.

No matter how persuasive or not the just offered details, the fact remains that a speed difference by 4 ½ orders of magnitude (a factor of 30 000) got overlooked by the scientific community for 5 years. The reputation of the nations involved in the experiment is thereby possibly put at stake – even if the oversight itself will prove innocuous in hindsight as everyone hopes.

The story is not finished. From the moment on that a first charged nucleon has been captured (but not yet swallowed) by the slow black hole circling inside earth, the hole's cross section with the next charged particle of the opposite sign is increased by a very large factor (about 30 orders of magnitude) [O.E. Rossler,2008a]. Therefore, the miniature black hole in question from that moment on starts to grow exponentially inside earth. The runaway growth then never stops. This means that the planet would get reduced to a two-centimeter black hole in a matter of years [O.E. Rossler,2008a]. All that remains to be hoped-for is that no miniature black holes were actually formed at CERN. The coincidental fact that CERN's detectors are blind by construction toward their most anticipated product (black holes) owing to the latters' new properties [O.E. Rossler,2012] makes this hope even more poignant.

To conclude, two points were made. (1) Sluggish appreciation of the recovered global constancy of the speed of light c by the scientific community. (2) Global lack of appreciation for 5 years, of a qualitative asymmetry existing between nature's own and humankind's ingenuity, respectively. Specifically, collisions which occur asymmetrically on the surface of stars in nature differ qualitatively from the same collisions produced in a maximally symmetric fashion artificially down here on earth. The factor is 30 000. A preliminary strong-force interpretation was offered. To return to the beginning: Einstein's superhuman mental agility brought humankind a unique gift – the gravitational clock slowdown. The latter still fuels ingenious experiments and proves even richer in implications than thought in the wake of the quantum-relativistic results of the Chu school.

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