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Seven New Features of Black Holes Impart a Great Risk on the LHC

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Abstract

The most recent chapter in the fascinating story of black holes is reviewed. Johnny Wheeler's witty profundity in the footsteps of his mentor Einstein still shines through with his "no-hair theorem" which gets modified for the first time – with three hairs remaining (mass and angular momentum stay, charge goes, magnetism comes in the form of monopole formation). A 7-decades old oversight of the scientific community is exposed: an infinite slow-down of an infalling astronaut's clock, representing the most extremal case of the gravitational twin paradox. More specifically, black-holes are, (1) unreachable, (2) uncharged, (3) non-evaporable (in the sense of Hawking) and, if very small, (4) threshold reduced, (5) posing an exclusive risk to earth, (6) innocuous to neutron stars through quantum protection of the latter, (7) prone to exponential growth inside earth. Falsification of this 7-element chain in at least a single link is a logical precondition for the potentially black-hole producing "Large Hadron Collider" experiment to get its okay.

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Black holes carry a funny name – John Wheeler had thought about the latter for half a year dropping every other activity in the process. Later, he added the witty "no hair theorem" to further boost their popularity, borrowing that name from a pop song from Einstein's Berlin time ("Say, is it real' true that the frog at the ass has no hair??") – we apologize. There exist many sci-fi stories and crime novels about "black holes." The seven unfamiliar features to be offered in the following might give one the impression of conspiring against humankind; however, disproving a single one of them will suffice to break the chain and with it the frightening spell – so that a grandiose experiment can get off the ground.

First proposed new feature: *Unapproachability in finite time*

The fact that light takes an infinite time to travel down to the horizon (the surface) of a black hole and back up again, is well known: "infinite radar distance" [1]. Astronauts take twice as long to plunge down and bounce back up again (if a trampoline is assumed suspended on the horizon to magically invert the momentum of every impacting atom). This "infinite delay" is verbally acknowledged in the best popular textbooks (see two verbatim quotations [2,3]), but remains totally unknown to the scientific community at large – including the two just-quoted authors.

The reason for this unbelievable oversight maintained for generations in a row clearly is Oppenheimer and Snyder's spectacular 1939 finding that the *proper* infalling time (as well as rebouncing time were this possible) is finite and quite short: From the surface of a collapsing star to the horizon it is only about one day [4]. This proper infalling-plus-rebouncing time of two days bridges an infinite time in the outside world, as is straightforward to see (an astronaut cannot overtake light). An infinite slowdown of the astronaut's clock is the more technical explanation [5]. Thus what we are faced with here is an extremal case of Einstein's famous twin-clocks paradox. While for finite plunging depths, the "gravitational twin paradox" is a well known (if rarely mentioned) fact, the present extremal case went unappreciated. Note that an infinitely slowed-down clock enables one to cover any infinite distance in finite proper time. Thus the conventionally assumed "finite link" between horizon and outside world [3] turns out to be a mirage; the horizon is infinitely far away as far as any outside measurement can teach. Apart from employing the Schwarzschild metric itself [6], an explanation in terms of the simpler Rindler metric is also available [6].

Second proposed new feature: *Unchargedness*

Charge was one of the three "hairs" still found left on the horizon's bald pate by name-giver John Archibald Wheeler [3]. The new unchargedness is a corollary to the new-found effective infinite distance: Any charge dropping down towards a black hole takes an infinite outer time while falling-in at near-luminal speed [6]. This extremal velocity of recession (demonstrable to the eye in the Rindler metric [6]) reduces the charge's attractive force exerted in the rear direction toward virtually zero, as a consequence of Rindler's "radiation field" principle ([7], p. 519). Since the attractive electric force exertted by an infalling charge on the outside world thus approaches zero, black holes are effectively uncharged.

This new prediction [6] got challenged by the Albert-Einstein Institute (personal communication, March 13, 2009): In proof, they offered the famous combined Gauss law and Stokes theorem, which states that the force lines coming out from a stationary charge that is located respectively far from, or close to, or inside, a black hole are identical and thus unmitigated. This *static* theorem [8] is absolutely correct in its own right (it indeed corresponds to the first of Maxwell's four equations taken in isolation [9]). However, it cannot be applied in the present *dynamic* context. Thus, the above demonstration of unchargedness remains unfalsified by the Einstein Institute up until now.

Nevertheless the above demonstration of unchargedness is not the end of the story. The fast-receding infalling charge not just pulls less forcefully on the outside world as shown: it in addition represents an electric current itself. This current is the source of a magnetic field in accord with Maxwell's *fourth* equation. The fact that the latter applies as well in the present case went unnoticed by the scientific community up until now. Hence a black hole subjected to an infalling electric charge becomes magnetized as far as the outside world is concerned. More specifically, it acts as a "magnetic monopole" since the other pole pointing to the horizon is inaccessible to the outside world. The first magnetic monopole to be found in nature thus appears to be a charge-eating black hole.

What are the consequences of this magnetism if the black hole is very small? Does it convey an equal "stickiness" to the black hole as if it were charged (to let it get stuck in ordinary matter much like an alpha particle)? Surprisingly, the answer to this question is no. This is so because unlike charge, magnetism represents a vectorial force. Whereas charges falling-in from opposite directions in space simply add up in their electric effects, their magnetic effects do cancel each other out (apart from a remaining torque). The new "unchargedness" therefore still effectively endows black holes with "unstickiness" [6].

Third proposed new feature: *Nonevaporation*

Hawking's beautiful evaporation prediction for black holes [10] presupposes a finished horizon and finite escape times – each in contradiction to point #1 above. Hence Hawking evaporation becomes unphysical. Alternatively speaking, Hawking radiation persists but is infinitely delayed and infinitely weakened [6].

Fourth proposed new feature: *Threshold reduction*

14 trillion electron volt (14 TeV), the collision energy of two accelerated protons in the planned Large Hadron Collider experiment, do not suffice for black-hole formation according to classic calculations. String theory reduces the threshold dramatically [11]. Yet so far, no strings or loops have ever been observed in nature (with the possible exception of an anomaly in positronium decay [12] which may be interpretable as a finite electron diameter). This situation gets changed by point #2 above: The intrinsic unchargedness of black holes implies that electrons cease to be potential point particles (as could still be assumed up until now). For *if* electrons were maximally compact, they would have to be black holes themselves and hence be uncharged. Therefore, strings or loops do already exist empirically – in the form of charged leptons. The prospect of mini-black holes arising in the LHC experiment at CERN is thereby dramatically enhanced.

Fifth offered new feature: *Exclusive risk to earth*

Only earthlings can produce "almost zero-momentum" miniblack holes. This is because nature's own analogous products, necessarily generated whenever ultra-fast cosmic-ray protons collide with

stationary protons on the surface of celestial bodies, automatically possess a near-luminal speed by virtue of the conservation of their joint momentum. Their unchargedness and unstickiness (point #2) prevent these ultra-fast analogs from getting stuck inside planet earth [13]. Only their maximally slow human-made cousins can possibly get trapped inside earth (and the sun) [13]. All celestial bodies are immune to the natural fast variety [13]; for the special case of neutron stars, see the next point.

Sixth offered new feature: *Quantum protection for neutron stars*

If only human-made ultra-slow mini-black holes can possibly pose a threat to earth through getting stuck, their natural-borne ultra-fast cousins still ought to get stuck inside neutron stars, owing to the latters‘ ultra-high density. Neutron stars should therefore no longer exist, apart from the most recently born ones, if miniblack holes do exist and pose a risk. This is CERN's strongest safety argument. But, alas, neutron stars happen to be protected by quantum mechanics: The well-known superfluidity of neutron stars prevents any friction from being exerted on a fast miniparticle entering them – so that it will not get stuck but rather pass right through [13]. And if one were to get stuck in the (non-superfluid) crust, the accreting black hole formed in the crust will soon stop growing since the star's superfluid bulk remains immune. The implied long-term "depilation" of an originally broad-crusted neutron star may be astronomically observable.

The prediction of "frictionlessness toward passing fast miniparticles," made for superfluids [13], can by the way be empirically tested in the lab: on superfluid helium, serving as the target, and neutrinos being used as the bullets (for example), with normal-fluid helium acting as a control [14]. This novel experiment can only be done at CERN since the latter harbors the largest amounts of superfluid helium on the planet [14]. Thus if ever a dangerous aspect of a planned major experiment could be tested beforehand in a safe auxiliary experiment, the LHC presents the prime example.

Seventh offered new feature: *Exponential growth inside matter*

This is a result from chaos theory. The black holes in quasars and microquasars accrue matter exponentially as is well known (cf. [15]). They do this by forming a chaotic "Kleiner attractor" (see [16–18] for this notion in phase space). More specifically, a quasar represents a "rotation-symmetric Kleiner attractor in real space" [19]. The two pertinent classes of celestial examples known empirically – quasars and microquasars – differ in radius by a factor of a billion (one billion stellar masses in a quasar versus approximately a single one in a microquasar). Apart from this nine orders of magnitude difference in scale, they look identical. No other comparably broad scaling phenomenon between spatially implemented attractors does there exist in nature (imagine two beetles that differ, not by a factor of a hundred as a stag beetle and a mite do, but by ten million times more). Hence it is safe to predict that the mass-proportional downscaling by nine rders of magnitude continues further down the line – with the corresponding pico and nano, etc., versions only waiting to be discovered empirically [19].

Even a miniblack hole residing inside terrestrial matter would be bound to already form a "maximally miniaturized quasar" (a sub-nano version of that very electrico-gravitational engine that still eludes complete understanding even in its largest versions). At first sight, this prediction appears reckless given the feeble strength of gravity close to a resident miniblack hole. But – as it turns out – an extremal "boost of attraction" occurs on this very level. As soon as the first charged quark begins spiralling in, the attractive force of the miniblack hole momentarily exerted on a neighboring outside charge gets boosted up by more than 30 orders of magnitude (since electricity is 38 orders of magnitude stronger than gravity). Gravity thus gets "nonlinearly entangled" with electromagnetism even on this smallest scale [19]. The quantum mechanics of this predicted "subnano engine" presents a worthy challenge to theoretical chemistry (quantum chemistry, to be exact). If the attractor-forming principle is indeed as universal as predicted, the ensuing exponential growth inside earth of a resident miniblack hole could endanger the planet in a matter of a few years [19,20].

This finishes our 7-element list of falsifiable proposals about black holes.

To conclude, seven proposed new results on black holes were presented, some very surprising. A back-reaction from the involved subdisciplines is hoped to occur in due time. The situation happens to

be compounded in the present case by a deadline lurking in the background: Can a scientific consensus be achieved *before* the LHC experiment is re-started in a few months time as currently planned?

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