Shift-symmetry in Einstein's universe: Part B: Gravity

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Part of a series. Gravitational shift-symmetry in Einstein's universe requires curvature horizons to be absolute horizons rather than relative. The resulting event horizons are incompatible with wider relativistic principles, local physics, and classical and quantum theory.

Table of Contents

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1. Introduction

This is the third of a series of papers [1] [2] [3] [4] [5] [6] exploring Einstein's concept of shift-symmetry.

As mentioned in the introductory paper of this series, [1] if the Doppler equations used in *inertial* physics have the property of shift-symmetry (are symmetrical with respect to the ± polarity of the velocity), [i] this also gives **gravitational shift symmetry** in *gravitational* physics, since the energy-change in signals moving between two levels can be calculated from the motion-shift on a body freefalling between those two levels. [ii] [iii] [iv]

If special relativity has the correct symmetrical equations for *inertial* physics, the same equations must describe the characteristics of *gravitational* shifts, and the *gravitationally shifted* energy-ratio and frequency-ratio must similarly invert when we reverse the direction that light takes in crossing a gravitational gradient. This is confirmed by the Schwarzschild solution's shift predictions as given by Wald (6.3.5), [9] [10] showing that the energy-change E'/E associated with a gravitational differential inverts when the differential is reversed. [1]

$$\frac{\omega_1}{\omega_2} = \frac{(1-2M/r_2)^{1/2}}{(1-2M/r_1)^{1/2}} \qquad \ldots\ 6.3.5$$

Gravitational shift-symmetry also gives gravitational *time*-symmetry, [4] and ...

> **Richard Feynman (1964):** [7] " … it's easy to prove that the law of gravitation is time-reversible. "

In Einstein's SR-centric 1915/1916 general theory, a signal sent through a gravitational feature therefore returns to its original height with exactly the same energy it started with. The gravitational shift E'/E of a signal sent between two locations, **A⟶B**, is the exact inverse of the shift on a signal sent the other way, **B⟶A** . Since the inverse of E'/E = 0 is E'/E = ∞ (*see:* section 2.2), shift symmetry also forces horizons to be absolute **event horizons**.

In this paper we will argue that this "neat and tidy" and apparently highly-desirable feature of Einstein's system is unworkable as the basis of a proper gravitational theory.

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i The SR shift Doppler shift equations for simple non-transverse motion, as given in section 7 of the 1905 "Electrodynamics" paper, [8] are E'/E = $\sqrt{(c\text{-}v)/(c+v)}$. Swapping the polarity (±) of v obviously inverts the relationship.

ii In the "dropped flashlight" thought experiment, we drop a flashlight from a great height directly onto an upward-pointed detector. The flashlight is briefly switched on to produce a single wavelength of light.

- **If the flashlight is triggered at the start of the fall**, the lightpulse will arrive with a gravitational blueshift.
- **If the flashlight is triggered close to the moment of impact**, the gravitational shift on the pulse of light will be zero, but the light will instead have an *approach* blueshift, calculable from the downward velocity v of the flashlight.

If the total energy of the impact of the depleted flashlight and the accompanying lightpulse is the same regardless of the moment during the fall at which when the pulse was emitted, then the gravitational shift on light falling across a gravitational differential that can be expressed by the associated velocity-change v, is simply the Doppler shift of a body moving at v.

iii The dropped flashlight example assumes for simplicity an initial relative velocity of the flashlight and Earth, of zero. If it is *non*-zero, we find that the "delta-vee" of the flashlight due to gravity, and therefore also the effective strength of the gravitational field as judged by its ability to produce velocity-change, depends on the initial relative velocity. The dependency of the effectiveness of a gravitational field with its relative velocity gives us a derivational path to gravitomagnetism. [11]

Since velocity-dependent gravitomagnetic effects are irreconcilable with special relativity's flat geometry, if we follow this line of reasoning, Einstein's system is automatically wrong, making the rest of this paper redundant (!)

iv In the usual argument, we can imagine a closed loop where photons are aimed from a satellite in deep space "downhill" to the surface of the Earth, where they are used to energise matter, which is then mechanically transferred back up to the satellite. Ignoring the inevitable inefficiencies of the method, if the gravitational blueshift generated proportionally *more* energy than was lost due to the increased weight of the energised matter (*via* $E=mc^2$), we could create a "closed loop" that gave more energy out than we put in. Alternatively, if the energy-change in the transmitted light was proportionally any *less* than the difference in energy of transporting the energised matter, then we could run the machine in reverse, and again get out more energy than we put in.

2. Horizon types reviewed

2.1 Relative horizons:

The type of horizon most familiar to us in everyday life – the Earth's *visual* horizon – is **relative and observer-dependent**. Relative horizons are **projected** surfaces and boundaries that depend not only on the distance of the selected onlooker, but also on their other properties. If we crouch down on the ground, the Earth's horizon gets closer; if we ascend in a hot-air balloon, we can see further, and the horizon recedes. If we try to chase after the horizon it retreats before us, and if we run away from it, it follows us.

A relative horizon is not an absolute limit to information-transfer: we can see the results of an aerial firework display even if its grounds are just beyond our horizon (or behind a hill), and we can still see the mast of a ship that has just crossed the Earth's curvature horizon. If we want to know more, we can ask a colleague who is nearer to the hidden region (or is standing on top of a hill) to find out, and to relay the information on to us.

Under Newtonian gravity, a gravitational horizon is similarly observer-dependent and leaky: Although its horizon shares the same horizon coordinate at r=2M G/c^2 , matter and light can leave the r=2M surface for a limited time, [i] and travel a limited distance before being pulled back in by gravity. Whilst outside, the "visiting" particle can be knocked free of the star's gravity by a chance encounter with a passing object or another visiting particle. [12]

Under quantum mechanics, these "visiting" particles outside the horizon are replaced by "virtual" particles, and their behaviour can be modelled statistically as Hawking radiation. [13]

Cosmological horizons [5] are also relative and information-permeable, and allow the escape of massenergy along non-inertial trajectories, statistically equivalent to Hawking radiation.

2.2 Absolute horizons:

The behaviour of horizons under Einstein's system is very different.

Under Newtonian gravity, an astronaut momentarily stationary at r=2M sees infalling light at their location to be only *doubled* in frequency, and they can escape from the surface without obviously breaking any laws. [14]

With Einstein's SR-based gravity, a stationary astronaut "dropped off" in their spaceship at r=2M with instructions to immediately fire their engines and escape, would find that the energy of infalling light at their location would already be *infinite*. Not only would they have to counter an infinite inward radiation-pressure pushing them into the collapsed star, and somehow avoid being vaporised by the infinite radiation temperature, but if they *did* somehow manage to fire their rocket engines and escape, an infinite amount of outsider time would already have been seen to have elapsed before they left the surface.

With Einstein's shift-symmetrical system, it is illegal for an observer mass to even *exist* at r=2M unless they have an inward velocity. Matter cannot escape the horizon, and outward-aimed light generated at r=2M is described as being "frozen in place". *Information itself* is incapable of moving outward through r=2M, meaning that any events occurring within the r=2M surface are permanently sealed off from and unable to communicate with, or in any way influence, the universe outside: the surface is an inescapable **event horizon**.

According to Einstein's system, the horizon surface is not merely *dark*, but totally *black*, with a surface temperature of absolute zero.

i **Shutz (2009):** [15] " *… for Michell and Laplace the star was dark because light could not escape to infinity. The star was still there, shining light. The light would still leave the surface, but gravity would eventually pull it back, like a ball thrown upwards. In relativity, as we shall see, the light never leaves the 'surface' of a black hole …* "

3. Violation of classical theory

3.1 Unavoidability of total collapse under Einstein's system

Since a shift-symmetrical system forbids the outward transmission of any form of force, pressure or information from anywhere below *r*=2M, there is *in principle* no possible classical mechanism under Einstein's system to prevent any gravitational mass dense enough to have a horizon from undergoing total collapse, completely unopposed, all the way down to a point-singularity.

> **MTW (1973):** [16] §44.1 "*Gravitational Collapse as the Greatest Crisis in Physics of All Time*:"
> " ... A model universe that is closed, that obeys Einstein's geometrodynamic law, and that contains a nowhere negative density of mass-energy, inevitably develops a singularity. No one sees any escape from the density of mass-energy rising without limits… today gravitational collapse confronts physics with its greatest crisis ever. "

Since a classical theory of gravity requires that spacetime be continuous and singularity-free, a theory that must predict singularities is not a valid classical theory.

3.2 Relative horizons resist collapse

Relative horizons, like absolute horizons, cannot send signals to arbitrarily-distant observers directly, along unaccelerated trajectories: however, unlike event horizons, relative horizons support *indirect* radiation along accelerated paths, and these indirect radiation effects generate counterparts of all the currently-known QM phenomenology associated with Hawking radiation. According to our current knowledge, it would seem that QM's statical description of Hawking radiation is also a statistic description of dark star radiation, or radiation through an acoustic, relative horizon (or through a cosmological horizon [5]).

Although the Hawking radiation temperature and pressure at the horizon of a stellar-mass collapsed body is calculated as being incredibly weak (colder than the cosmological background), as we allow ourselves to fall into the star, the *effective* horizon separating us from the putative central singularity shrinks, and as it shrinks, it increases in temperature, to the point where, as the horizon area shrinks towards *zero*, its temperature (and outward radiation pressure) increases towards infinity.

3.3 Is total collapse solved?

This is not enough to let us say that the internal Hawking radiation-pressure prevents total collapse – at the centre there will be various other infinities and zeroes that have to be played off against one another, and since the infalling observer encounters more and more mass-energy as they fall, it is debatable how much more matter they should be able to find as they arrive at the centre (if anything). We also have the complication that switching to a theory supporting classical Hawking radiation means changing the form of the equations away from the conventional SR-based forms (*e.g.* the Schwarzschild solution), which might affect some of the usual calculations.

Although we cannot yet say that relative horizons solve Wheeler's "catastrophe", they do appear to offer at least a *glimmer* of hope – they represent the only *potential* classical solution to the problem. By comparison, in a shift-symmetrical theory, it is well established that the chance of a successful classical resolution to the problem is zero.

4. Violation of quantum theory

4.1 GR1916 black holes are different to dark stars

According to Einstein's shift-symmetric general theory, to hover at the horizon is as impossible as travelling at the speed of light under special relativity, and just as the SR lightspeed barrier represents an absolute limit to the speed at which information can propagate, a black hole event horizon, where the outward velocity of light is zero, represents a "spatialisation" of the SR lightspeed barrier. Since anything moving outward through r=2M would then be moving outward at more than the region's (zero) outward velocity of light, the outward motion of *anything*, light, matter, information – is deemed impossible. Any event occurring within r=2M finds it impossible to influence the region outside r=2M, in any way, either directly or indirectly.

4.2 Einstein rejects black holes

Einstein argued that breakdowns of mutual causality (here, allowing events outside the horizon to affect those inside with no possibility of a back-reaction), were unacceptable, and that that since certain definitions broke down at the horizon we should take this to mean that GR1916's predictions at the horizon were unreliable. Something had to happen to prevent these objectionable creatures coming into existence.

> **Einstein (1940):** [17] " Of course, these paradoxical results are not represented by anything in physical nature. … the "Schwarzschild singularity" does not appear for the reason that matter cannot be concentrated arbitrarily. "

Although Einstein didn't approve of black holes on aesthetic-philosophical grounds, his shift-symmetrical theory insisted on predicting them, and it was left to John Archibald Wheeler to promote and popularise them.

4.3 Classical-quantum correspondence

Since the early days of quantum mechanics, Niels Bohr's **correspondence principle** had insisted that quantum and classical calculations must agree at larger scales: quantum statistics, aggregated, must build to an arbitrarily close approximation of classical field theory, and classical field theory must in turn quantise to give QM statistics.

Our classical and quantum theories seemed to be able to obey this rule until Hawking's 1974 letter on "black hole explosions" [18] demonstrated that the behaviour of curvature horizons needed to be *qualitatively different* to their behaviour under Einstein's system.

4.4 QM also rejects black holes

According to quantum mechanics, gravitational horizons need to fluctuate and radiate, leaking matter, energy and information, and must present a positive temperature. Their Hawking temperature means that they are not "black" and the presence of Hawking radiation pressure means that they are also not presence-less "holes". A gravitational horizon under QM reverts (at least broadly) to the observable behaviours of a Newtonian "dark star", [i] [12] [19] and a shift-symmetrical model's inability to replicate this behaviour classically breaks the correspondence principle. [14] Our two major systems of physics refuse to agree.

i At the present time, it is not clear whether there are *any* identifiable qualitative differences between the QM predictions for QM-modified black holes and those of Eighteenth Century dark stars based on ballistic emission theory. All the basic phenomenology described in the QM literature seems to have classical (non-SR) counterparts.

4.5 Importance of the disagreement

This *qualitative* disagreement over emissions means that at least one of the two systems must be wrong: the importance of duality between classical and quantum theories can be seen in MTW's second test for credible potential classical competitors to GR1916:

> **MTW (1973):** [16] §39.1 "… *three criteria for viability … Completeness:* To be complete, a theory of gravity must be capable of analyzing 'from first principles' the outcome of every experiment of interest and must therefore mesh with and incorporate a consistent set of laws for electromagnetism, quantum mechanics, and all other physics. "

According to MTW, a theory that failed to "mesh" with QM was automatically wrong, and did not even meet the threshold criteria of credibility to be considered to be worth testing. [i]

If we held Einstein's general theory to the same standards that we applied to its potential competitors in the 1970s, then its incompatibilities with QM and QM-style statistics ... due to its absolute horizons, caused by shift-symmetry … would classify the theory as a failure.

4.6 Quantum gravity

The relativity community's reaction to realising that their own theory failed the QM-compatibility test was to relax this rule, and say that, with mature hindsight, we now realised that, obviously, classical and quantum theory were *supposed* to predict inherently different behaviours in this situation, because they were different types of theory, and that the reconciliation was expected to appear in the form of a forthcoming theory of **quantum gravity** that would incorporate the existing general and quantum theories in their current forms, as part of a larger system.

Unfortunately, fifty years after Hawking's paper, we seem to be no further along in finding such a theory, and, in fact, there are reasons to believe that such a theory may be definitionally impossible. [20]

We do have some excellent work on **acoustic metrics**, which are classical systems that replicate QM behaviours such as Hawking radiation [21] … but since Hawking radiation is classically impossible in a shift-symmetric theory, acoustic metrics, although they may well turn out to be the correct classical description of Nature, are necessarily irreconcilable with the SR equation-set. [ii] [23]

4.7 Relative horizons

Since GR1916 has an obvious problem running through its definitions in its arbitrary adoption of the SR relationships (which don't work with gravitomagnetism), [24] and QM does not seem to have a correspondingly-arbitrary design decision in *its* definitions, it is easier to assume that QM is basically correct, and to try to resolve the conflict by starting with QM and reverse-engineering a new general theory to fit, from QM's stochastic behaviour (*e.g.* Namsrai, 1984 [25]).

To bring GR into line with QM, we need to turn GR1916's absolute horizons into *relative* horizons (Hawking, 2014 [26]), which means abandoning special relativity. [14]

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i As well as failing MTW's second criterion, of completeness, Einstein's system also fails the first criterion, of consistency. [16]

ii It has been suggested that acoustic metrics must reduce to SR physics as a geometrical reduction. [22] This doesn't work. [23] In the context of an acoustic metric, all matter has associated curvature, and any reduction to SR geometry is only possible in the absence of matter. SR is then an unphysical solution that can *at best* only apply when there are no physical masses or observer-masses present for it to apply to. The laws of *actual* matter-physics, that hold in the *presence* of matter would then be different to Einstein's.

5. Uneven distributions of matter

5.1 Modifying the horizon radius

There are three obvious ways to increase the gravitational differential between a remote observer and the region outside a collapsed star: **(a)** we can add additional massenergy *to* the collapsed star (which increases the star's gravitational field for everyone), **(b)** we can distribute additional massenergy to the region *around* the star, or **(c)**, we can instead *reduce* the field intensity in the distant region occupied by the remote observer.

5.2 The shell problem: Using nearby matter to dilate the horizon

Applying method **(b)**, we can increase a star's gravitational differential by adding matter to the region around the star in the form of a hollow spherically-symmetrical shell. This matter can be orbiting the star at a safe distance, can be artificially constructed, or can simply be a transient configuration of passing material.

5.2.1 The nearby observer's view

For an observer inside the shell but outside r=2M , the influence of the new surrounding shell cancels to create a uniform gravitational field in the shell's interior – a flat "gravitational plateau" with increased flux-density, but no discernable density-gradients or resulting forces. The shell's interior field is "flat", and if the shell was empty, its interior would represent a region of effectively-flat spacetime. An inertial observer inside the shell should only be able to detect gravitational gradients caused by the central star.

According to locally-calculated physics, the gravitational differential between their location within the shell and and the collapsed star has not obviously increased with the creation of the shell: Both they and the star are immersed in the same (now denser) environment. If there is no increase in differential, then the local physics should be unchanged, and they should still be able to see down to r=2M.

5.2.2 The remote observer's view

According to an observer at **null infinity**, the gravitational differential between *their* location and the star's position has now increased, and the horizon surface at which light's gravitational redshift gives E'/E=0 must now be some way further out.

The result of adding the surrounding shell of matter must be to extend the star's effective horizon for this remote observer. [i]

5.2.3 The resulting horizons are relative

If the two observers assign their own "versions" of a horizon's surface to physically different (but overlapping) parts of space, then the horizon is, pretty much by definition, relative rather than absolute. [ii]

i **Wheeler (1961):** [27] " *... to bring up nearby masses perturbs the metric by an amount which cannot be made negligible in comparison with the effect of the concentration of under consideration. This perturbation mass-energy even deforms the limiting sphere into a new shape.* "

ii We could also, in principle, use a star at the edge of collapse, in which case the distant observer could reckon that the exterior shell's additional gravitational contribution could tip the total differential past the critical threshold, to $v>c$. The star would then be a black hole for the distant onlooker, but not for the nearby observer inside the shell. This is obviously not workable.

5.2.4 Is the shell argument wrong?

The shell argument's invalidation of absolute horizons seems to rest on three things:

1. The calculation of the horizon for a nearby observer, inside the mass-shell, but outside r=2m ,
2. The calculation of the horizon for a remote observer, and,
3. The idea that the two sets of different numbers do not refer to the same physical location.

For **(1)**, we might try to argue that perhaps increasing the gravitational field strength of a region alters the local physics in such a way that the uniform increase in field strength somehow nonlinearly increases the differential between the nearby observer and the star, dilating the horizon to the same position calculated by the remote observer. But if increasing field levels across the shell interior *does* affect the physics, it is more likely to have the opposite effect: if we uniformly increase the field strengths, the field density *ratio* between the two locations is reduced. So if, hypothetically, the gravitational shift was not calculated from the absolute difference in field strengths, but from the relative *proportional difference* in field flux-density, the shell argument would get even stronger.

For **(2)**, the calculation for the remote observer seems solid, as increasing the gravitational differential between two locations *really does* seem to have to increase the redshift. We could *try* to engineer a special gravitational shift law in which, no matter how much we increase a gravitational differential, a region outside the horizon always stays outside the horizon … but if we do this, the same amended law would tend to tell us that black hole horizons never form in the first place. So this would not be a viable way to defend the existence of absolute horizons.

Finally, for **(3)** we could try to argue that perhaps it doesn't matter if both observers calculate different *nominal* distances for the horizon, because the reference-rulers for the two observers are sized differently. The snag here is that the distant observer, in a more rarefied gravitational environment, has longer unit rulers, and the nearby observer, in the more intense environment, has their rulers shortened. So even if they both assigned *the same* nominal radius to the standard r=2M horizon, the distant observer's calculation, using their own reference-rulers and a projection of the region onto a flat reference-grid, would still put the horizon physically further away from the star's centre than the same nominal distance referenced to more local, shorter rulers. Again, this just makes the situation worse rather than better.

We can now consider method **(c)**, reducing the local environmental field density of a far-distant observer. This is essentially the inverse case of the "shell" argument:

5.3 The "Void observer" problem

5.3.1 Observers at null infinity

Shift symmetry forces all gravitational horizons to be absolute horizons and one-way surfaces, and turns all collapsed stars into Wheeler black holes. The position of the horizon is calculated as being the surface intersecting a straight-line or geodesic infall path, at which an object falling in from arbitrarily far would expect to achieve the speed of light. Below the horizon, the object is expected to be falling faster than the external background *averaged speed* of light, [28] but not any faster than their inward-pointing *local velocity* of light. [i] The critical *absolute* horizon surface is supposed to be the surface at which the field's velocity-differential exactly equals the speed of light, referenced to a hypothetical observer at "null infinity", an arbitrarily-distant location at which the star's contribution to the total local field can be taken to have dropped away so much that it can effectively be treated as zero.

"Null infinity" is intended to be a concept that everyone can agree on – in a perfectly homogenous universe, the observer at null infinity has a background field flux-density that is assumed to be the universe's background field level – the "gravitational floor" upon which the star's field is overlaid.

5.3.2 "Void" observers

Unfortunately, the real universe's mass-distribution is not perfectly smooth, and large-scale surveys suggest the existence of vast empty voids that may well have a faster rate of timeflow and be expanding faster than the rest of the universe, [29] with galaxies collecting as "wall" and "thread" structures at the boundaries between the expanding voids.

An observer placed in the centre of one of these voids may experience a lower gravitational flux-density than would exist in the star's local environment if the star was removed: the gravitational velocity-differential between the void observer and the standard r=2M horizon will then be *greater* than c, and for them, the horizon needs to be placed further out.

5.4 Breaking local physics (space)

The "shell" and "void" exercises cause a problem for anyone trying to do physics in the vicinity of the black hole: they are told that an absolute horizon must exist, and must have physical consequences, but they can no longer calculate where that surface is, without knowing the properties of some far-distant region of space.

5.5 Breaking local physics (time)

Worse, the more distant the "minimal g" observer is, the further in the future their defining observations will be made: we cannot then calculate the largest horizon radius that might apply here-and-now without knowing in advance the minimal field density of *all future points in the universe* that signals spreading radially from around the hole may be able to reach.

With gravitational shift-symmetry, wherever a minimal-g future observer reckons the horizon ought to be, that position marks a "one-way" surface in the "here-and-now" so that the result of future observations (in an unknown direction, at an unknown distance, at an unknown time) has absolute consequences in the present. [ii]

We then cannot define physics in the local present without knowing the distant future.

i **Hamilton and Lisle (2006):** [28] " *The place where the infall velocity hits the speed of light, ... marks the horizon, the Schwarzschild radius. Inside the horizon, the infall velocity exceeds the speed of light, carrying everything with it.* "

ii This is obviously even more troublesome if the universe is expanding, as the "future-universe" observers will tend to occupy a more rarefied environment than us.

6. Summary

The extension of special relativity's equations to general relativity, generating gravitational shift-symmetry, doesn't work as the basis of a credible physical model:

- **Total gravitational collapse.** Gravitational shift-symmetry creates absolute event horizons, which in turn give total collapse to point-singularities.

> ⚠ *Gravitational shift-symmetry generates absolute, **event** horizons with point-singularities, that are incompatible with classical theory.*

- **Quantum mechanics.** QM predicts that effective horizons need to fluctuate and radiate: they must behave like relative horizons. The horizons of any QM-compatible classical theory of gravity must be relative, not absolute.

> ⚠ *Gravitational shift-symmetry's absolute event horizons are incompatible with quantum mechanics.*
>
> *To have any chance of meshing with QM, a classical theory of gravity must generate **relative** horizons, which requires non-SR equations.*

- **Inhomogenous universe problems:**
  - **Increased mass around a star.** Black hole candidates tend to occur within galaxies. Surrounding a black hole with additional matter means that a local observer's calculation of the position of the horizon disagrees with the calculation made by a distant observer. If both calculations are valid, the horizon cannot be absolute.
  - **Decreased field intensity around the distant observer.** If the distant observer inhabits an inter-galactic void, their default environmental field-density will be lower, and they will calculate the horizon to be further out than we will.
    If both calculations are valid, the horizon cannot be absolute.

> ⚠ *Gravitational shift-symmetry's event horizons don't work consistently in inhomogenous universes.*
>
> *Event horizons defined by distant observers break local classical physics.*

7. Conclusions

Shift-symmetry and the Schwarzschild metric forces all gravitational horizons to be *absolute event horizons*, and event horizons generate inconsistent and impossible physics when we have different observers in different gravitational environments. Event horizons also destroy the principle of local physics (relativity of space), and prevent any theory that supports them from meshing with quantum mechanics. As a final flourish of incompatibility, event horizons lead to what Wheeler called "*the greatest physics catastrophe of all time*", total gravitational collapse.

It may well turn out to be that total gravitational collapse is *not* the greatest theoretical catastrophe of all time, and that Wheeler's own event horizons, which are responsible for the collapse, AND and for the breakdown of local physics, AND for the incompatibility of classical and quantum theory, are a worse culprit.

It then may be that an *even worse* disaster for theoretical physics is the *cause* of event horizons, which is also the cause of the other catastrophes mentioned in this series of papers … the idea of shift-symmetry.

Since it doesn't work in an inhomogenous universe, and also doesn't work *with either classical or quantum theory*, gravitational shift-symmetry should not be considered to be a workable concept.

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Wheeler describes the concept of the catastrophe (in theoretical terms) of gravitational collapse as also applying to current-era cosmology, since the current expanding universe translates to a collapsing universe in reversed time, the "end" result of this time-reversed collapse being the Big Bang singularity ([16] §44.1). *In the next paper we will dispute the concept of time-reversibility, the legitimacy of time-reversed observers, and the idea that physics can look the same in forward and reversed time, and take a further look at* ***time-variant*** *gravitational effects – gravitomagnetism and gravitational waves.*

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