

Hawking's Scientific Legacy

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ABSTRACT

Stephen Hawking was a scientific and cultural star. As a man with extreme disabilities who maintained a sense of humor he inspired us all. As a physicist, he was woefully wrong on many occasions. This clear analysis examines his physics within the historical and personal context.

The Hawking Phenomenon: 1942-2018

Stephen Hawking was before his very convenient passing on "Pi Day" 2018 the most popular astrophysicist.¹ Fans have tried to place his legacy with Galileo, Newton, and Einstein, but that's a real stretch. His scientific legacy will be that of a clever follower of General Relativity, always seeking to merge GR with quantum theory in search of an elusive theory of everything.

He never came close to his goal of discovering the few elegant equations describing everything, but he seriously tried. What he didn't know was that his quixotic quest was so fundamentally

¹ <http://www.hawking.org.uk/about-stephen.html>

flawed that no possible set of equations fully within any antique paradigm could describe the real universe.^{2,3}

Where it really counts – in his envisioning mind and in his physics – Stephen Hawking was fully able. The cruel physical challenges he endured were irrelevant to the math visionary he really was. These challenges were only relevant to his extreme celebrity among masses of people who can't tell the difference in the night sky between a planet and a star.

Hawking had a knack for enhancing other scientists' ideas, thus making their original thoughts somehow seem to be his own. Whenever he came up with another original or derivative idea he made it seem like an exciting universal discovery. He thereby helped popularize scientific adventure for us all. Helping ordinary people everywhere love science is a rare gift.

Logical Positivism and Science

Shortly after the chaos of World War I there developed the orderly analytical philosophy of logical positivism.⁴ Here was an attempt to properly separate their concept of ideal physics from nonsensical metaphysics. It started with Ludwig Wittgenstein, but was "purified" by the Vienna Circle of Schlick, Carnap, Neurath, Waismann, and others. Wittgenstein himself declined to join their meetings.

A. J. Ayer from Britain joined this elite circle in the 1930s, and he wrote a famous book in English that likely was known to Stephen Hawking. Even if Hawking did not directly read Ayer's original thesis, those ideas strongly influenced British thought. Purist logical positivists held that if something is *unverifiable*,

² <http://astronomy-links.net/Gravities,BlackHoles,BigBangs.pdf>

³ <http://astronomy-links.net/String.Types.pdf>

⁴ https://philosophynow.org/issues/103/WittgensteinTolstoy_and_the_Folly_of_Logical_Positivism

then it also is *meaningless*. Hawking used this simple formula to justify becoming an atheist.⁵

It is worth noting that neither Pascal, Kant, Tolstoy, nor Wittgenstein would agree with the full purist thesis. They held that philosophy itself is not just science, so the scientific method has limited power over other areas important to us.⁶

Pure logical positivism imploded when it was shown how the very idea of verifiability versus meaninglessness is *a priori* faulty, making the *a posteriori* operational hypothesis an error.⁷ Ayer himself later grew to reject almost all of what he had first written. Nevertheless, Hawking still clung to the purist model when he said our recycling universe has no meaningful preceding or subsequent universe. However, he clung to the idea that clever math models alone could somewhat bypass this problem.

Hawking Models and Errors⁸

Stephen Hawking and Roger Penrose developed in 1970 the idea of a black-hole singularity, after Penrose reversed Einstein's General Relativity formulas. The universal seed singularity was our universe's beginning, with subsequent black holes being its thermal end.

Hawking later backed off the idea of point-like singularities, saying our universe began with *almost* a singularity, for quantum reasons. That's a better and defensible model. Everybody today knows of Stephen Hawking, but Roger Penrose is a footnote.

⁵ <https://www.theguardian.com/science/2011/may/15/stephen-hawking-interview-there-is-no-heaven>

⁶ [https://philosophynow.org/issues/103/WittgensteinTolstoy and the Folly of Logical Positivism](https://philosophynow.org/issues/103/WittgensteinTolstoy%20and%20the%20Folly%20of%20Logical%20Positivism)

⁷ [https://philosophynow.org/issues/103/WittgensteinTolstoy and the Folly of Logical Positivism](https://philosophynow.org/issues/103/WittgensteinTolstoy%20and%20the%20Folly%20of%20Logical%20Positivism)

⁸ <http://astronomy-links.net/hawkingerrors.html>

In another famous Hawking “discovery” he developed in 1974 the famous idea of “Hawking radiation” leaking out of black-hole event horizons through quantum effects. That idea seems to transcend the early model where our universe simply disappears down entropic black holes, never to restart. However, two sharp Russian nuclear physicists had already thought of this idea:

Yakov B. “Zel’dovich played a key role in developing the theory of black hole evaporation due to Hawking radiation, where in his visit to Moscow in 1973, Soviet scientists Zel'dovich and Alexei Starobinsky showed Stephen Hawking that, according to the quantum mechanical uncertainty principle, rotating black holes should create and emit particles.”⁹ This fruitful encounter was reported fifteen years later by Hawking in his 1988 book, *A Brief History of Time*.

There is a corollary thesis to the leaky event horizon paradigm. In a 2016 paper co-written with two others it was postulated that the event horizon is *fuzzy*, not smooth. This fuzzy interface is said to be how energy is coherently stored and escapes. Very clever idea this is with sub-Planck units, but it is unprovable even with cool math.¹⁰

The ideal Platonic model of perfectly spherical, stellar-mass Schwarzschild-radius event horizons has been around since 1916.¹¹ It could follow that for less-than-perfectly-spherical event horizons around supermassive black holes there are multiple ways for electromagnetic energy to leak out over hundreds of billions of Earth years. Given sufficient time the leaking elemental contents of any supermassive black hole could thereby return to the greater universe, ready for recycling.

⁹ https://en.wikipedia.org/wiki/Yakov_Borisovich_Zel%27dovich

¹⁰ <https://arxiv.org/pdf/1601.00921.pdf>

¹¹ https://en.wikipedia.org/wiki/Schwarzschild_metric

There are indeed ways to verifiably prove the existence and mass of stellar-mass black holes in human-frame time, such as with the LIGO experiment. We can also spectrally approximate the mass of our Milky Way's supermassive black hole with orbits of nearby stars. This hypothesis works beyond our galaxy with spectrally Doppler-shifted areas in nearby galaxies.¹²

Later in life Hawking promoted the psychedelic math idea of vast holograms just inside the event horizons of large black holes. There is no way to verifiably prove his holographic hypothesis, but at least it does provide an entertaining, if bogus, "solution" for the black hole information paradox. Nothing inside black hole event horizons verifiably yields the holographic paradigm.¹³ This idea is suspiciously similar to Plato's allegory of the cave.

In 2016 Hawking presented the mathematical possibility of black-hole-acquired information being preserved by directing some into an alternate universe.¹⁴ That's very fanciful, totally unprovable, but fun to visualize. This late math cannot verifiably explain the so-called black hole information paradox.

The Timeless Universe

The field of physics has long been torn between the search for perfectly elegant mathematical formulas – and the brute fact that the closer we approach fundamental problems (with math or with instruments) the less we can verifiably prove them.¹⁵

Nevertheless, there are those who like to envision this wall as just another barrier. Hawking was one of those purist romantics,

¹² <http://astronomy-links.net/SBH&MV.pdf>

¹³ <http://astronomy-links.net/Holograms.html>

¹⁴ <https://www.bostonglobe.com/metro/2016/04/18/black-holes-may-offer-way-out/ayFIhHEzAZyLjIzN7xWz4K/story.html>

¹⁵ <http://astronomy-links.net/AstrophysicsCloudCastles.pdf>

which is OK. However, the Nobel Prize was never his because his large concepts could not be experimentally verified.¹⁶

Toward the very end of his life Hawking was interviewed on TV by Neil deGrasse Tyson. He explained that our universe recycles without interference or guidance from anything beyond.¹⁷ This is not a paradigm that allows for a 4D multiverse. Nor does it allow for any divine, or supra-universal, intervention or direction.

The epitome of absurdity was published just ten days before Prof. Hawking left us on Pi Day. It was a co-authored thesis about how there could be a "lesser number" than M-theory of dimensional universes beyond our own.

Pop-science reports seldom discuss this actual paper, which is here.¹⁸ They gush over the idea of proof of a "multiverse," using special space probes. No mention is made of the tens of billions of light years it would take for magical hyperluminal vessels to return with such proof.

Here is a London paper's pathetic and panegyric text: "The research, submitted two weeks ago, sets out the maths needed for a space probe to find experimental evidence for the existence of a "multiverse". This is the idea that our cosmos is only one of many universes."¹⁹

However, the M-theory version he starts with works not with a single 4D multiverse, but with 10^{500} logarithmically possible universes. Consider that the estimated number of hydrogen

¹⁶ <http://www.newser.com/article/2aff2dd760a848acbc51cdcc426c83ec/the-latest-hawking-never-won-a-nobel-despite-big-ideas.html>

¹⁷ <https://www.livescience.com/61914-stephen-hawking-neil-degrasse-tyson-beginning-of-time.html>

¹⁸ <https://arxiv.org/pdf/1707.07702v2.pdf>

¹⁹ <https://www.thetimes.co.uk/article/stephen-hawkings-parting-shot-is-multi-cosmic-nbg0t6t9j>

atoms in our visible universe is 10^{80} , then even a sharp drop from the 10^{500} math is still absurd.

Hawking and his co-authors have found mathematical ways to maybe verify that the real number of parallel universes (i.e., his version of the multiverse) is less than 10^{500} , but he doesn't say how much less. In contrast, my logically elegant "bubble-bath" formulation has multiple universes within a single 4D multiverse.

Discussion: Totality that itself never begins and never ends is timeless. Relative time is measured by humans using photon accelerations, creating the illusion of cosmic spacetime from an observer's perspective.²⁰

What Hawking was conceptually trying to envision through a myriad of dimensional universes is much more elegantly and parsimoniously approached from the equally unverifiable model of the 4D multiverse.²¹ Individual universes within the elegant model appear and dissipate into other adjacent universes over billions of Earth years, thus being somewhat like bubbles in a bubble bath. It's the yin-yang cosmic circle of life.

Omnisciently from within the possibly infinite multiverse, with its seas of quantum-like, matter/energy component particles, any local universe has "no time." Any finite number of Earth years within one local universe is a numerator over the ultimate denominator of infinite time, which yields zero.

So it is that real timelessness is a multiversal reality, not individually universal. Here is how the essential and existential merge. This model is coherent from individual yin-yang particles up to the multiverse itself. Behind every relativity is unity. Behind every complexity is simplicity.

²⁰ <http://astronomy-links.net/LightSpeed.pdf>

²¹ <http://astronomy-links.net/Universe.universes.pdf>