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The reverberating glow of Stephen Hawking's daring theories, and elastic mind: by Glenn Starkman (Opinion)

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CLEVELAND -- Black holes are not quite the light-tight containers we thought. The strange and beautiful workings of quantum mechanics make them leaky, make them shine.

Stephen Hawking taught us that, so we call the glow Hawking radiation.

This quantum glow is contrary to the usual description of black holes. We say that a black hole is an object so dense that even light can't escape from its surface.

For a ball thrown upwards to leave the surface of the Earth and continue on into interplanetary space, it must be moving at more than seven miles per second. Imagine compressing the Earth so it is one-quarter the size, then that "escape velocity" would double. Compress the Earth far enough - down to a ball just three-and-a-half inches across - and the escape velocity would be larger than the speed of light.

Since nothing travels faster than the speed of light, nothing, even light, could escape! Hence the name, "black hole."

If even light can't escape a black hole, how could Hawking argue that it glows?

Stephen Hawking, famed physicist, dies at age 76, reports say

Hawking was renowned for his theories on the origins of the universe.

There is a simple way to picture the paradoxical process. Quantum mechanics tells us that pairs of fundamental particles are constantly appearing out of nothing. Normally, those particles quickly find each other and cancel out (physicists use the more violent verb "annihilate") before they can be caught.

Hawking realized that, near the surface of the black hole (known as the horizon), nature sometimes interferes to prevent the annihilation. Instead, one of the pair falls into the black hole, while the other particle, starting out just a little above the horizon, and with enough energy, manages to escape.

As it flies away from the black hole, it loses much of its original energy. The black hole appears to glow!

This idea opens a landscape of potential phenomena that connect the physics of black holes, quantum mechanics, cosmology and beautiful mathematics.

This story of particle pairs is a useful one, but stories aren't enough.

To convince his scientific colleagues that this radiation was real, Hawking had to do some very involved mathematical calculations. This is where his story diverges from those of other great physicists.

At the age of 21, Hawking was diagnosed with amyotrophic lateral sclerosis, "ALS", also known as Lou Gehrig's disease; the doctors told him he had two years to live. That was in 1963.

In Hawking's case, the progress of the disease was extraordinarily slow, allowing him 55 more years in which to make seminal contributions to the physics of black holes and cosmology. Nevertheless, it rapidly robbed him of the ability to write.

The difficult calculations buttressing his ideas would have to be executed entirely in his mind. His speech became progressively less and less understandable, and he had to use a voice synthesizer - slowly, eventually, one might even say in impatient moments, painfully, assembling his sentences in the distinct voice that became his own.

I cannot imagine doing the calculations Stephen had to do in my head, nor do I know of any of my colleagues, no matter how brilliant, who attempt it. We don't have to. Stephen did.

The public perception of Hawking rested on this almost-archetypal story of a genius, trapped in an uncooperating body, who by the sheer force of his mind

wrestles the universe for its secrets. It is an inspiring story, that touched the hearts of millions of people around the world. It allowed him to teach the public about the wonders of science and the value of a scientific world view through hugely successful books and movies.

He played a holographic simulation of himself in a legendary (at least to his fans) 1993 episode of "Star Trek: The Next Generation," and had a cameo appearance on "The Simpsons." He entered the public imagination as the face of science in a way that was perhaps unprecedented since Einstein and used that recognition to publicly support political causes or challenge us all to think about the future of humankind.

The scientific problems Hawking wrestled with did not lend themselves to experimental tests - how the universe began, whether information can be recovered from a black hole. We have not yet measured Hawking radiation from a black hole, and it may be a very long time indeed before we do. As a scientist, I am impatient with my colleagues who profess not to care whether their theories can be tested in their lifetime, or ever.

Stephen Hawking finally succumbed to his disease on March 14, most of his major predictions still untested, **but he chose his questions so well that they needed to be asked, even if the experiments to check the answers must wait for time when a real starship Enterprise can voyage to a distant part of the galaxy.** I expect that, when it does, the captain and crew will choose to have Stephen Hawking along on their holodeck.

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