

Tribute to Stephen William Hawking

by Kip Thorne

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Stephen William Hawking was a marvelous explorer. He explored black holes. He explored the Universe and how it began. He explored the laws that govern the universe and govern all it contains.

Isaac Newton famously said: “If I have seen further, it is by standing on the shoulders of giants”. And Newton did see further, discovering laws of mechanics, optics and gravity.

Hawking, like Newton, guided the course of science through great discoveries: laws of black holes and of cosmology. But Hawking’s greatest impacts, I think, were the questions with which he challenged us: questions about black holes, their information, and their entropy. For more than 40 years, we physicists have struggled with his questions. They seem to be keys to help unlock the most difficult mystery we have ever tackled: our quest to discover and comprehend the laws that governed our universe’s birth, the laws of quantum gravity.

We remember Newton for answers. We remember Hawking for questions. And Hawking’s questions themselves keep on giving, generating breakthroughs decades later. When ultimately we master the quantum gravity laws, and fully comprehend the birth of our universe, it will be by standing on the shoulders of Hawking.

Stephen and I were very close friends for 53 years. He was, by far, the most stubborn friend, I have ever had. He absolutely refused to let physical disability get in the way of doing great science, or get in the way of having great fun.

In the early 1970s, as his motor neuron disease progressed, he gradually lost the use of his hands - and so also lost the ability to manipulate long formulas with

pencil on paper. This should have been devastating, since mathematics is the language in which are written all the laws of Nature. But Stephen transformed this loss into a powerful advantage: He taught himself to do mathematics without pencil, paper and formulas. In their place, he manipulated, in his mind, images of geometric shapes: of ribbons, curves, cubes and spheres, and topological images, like a coffee cup deforming into a donut.

His flowing mental images gave him insights that nobody else could find. They underly his discoveries that black holes always grow, and that our universe must have been born in a big-bang singularity.

Stephen had a fabulous sense of humor. It infused his public lectures, and his private conversations. As I watched him assemble a sentence, laboriously, word by word, at two words a minute, I often didn't know 'till nearly the end, whether he was producing a pearl of great wisdom, or an off-the-wall joke.

Though Stephen and I shared the quest to understand the universe, our private conversations turned away from science, to matters of life, love, and death.

Stephen's love for life was legendary. His joyous grin was contagious, as he helicoptered through the Grand Canyon; and his grin was contagious at a gala ball, as he twirled his wheelchair in an ecstatic dance, and in Antarctica, as he drove his chair out of the hold of a C130 aircraft into the snow in the depths of the Antarctic winter.

Stephen William Hawking inspires us by his joyous life; by his courage, his stubbornness, and his creativity. He inspires by his love for family and loyalty to friends. He inspires, above all, by his scientific discoveries, and his challenging questions for scientists of today and of the future. He has earned a special place in the hearts of admirers worldwide — and a special place here in Westminster Abbey, alongside Isaac Newton.