

Tribute to Stephen William Hawking
By Martin Rees
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Soon after I enrolled as a graduate student at Cambridge, I encountered a fellow student, who seemed unsteady on his feet and spoke with difficulty. I learnt that he'd arrived two years before me -- from Oxford, where he'd been, by all accounts, a 'laid back' but brilliant undergraduate. He'd recently been diagnosed with a degenerative disease, and told he might not survive to finish his PhD.

After this diagnosis, his expectations dropped to zero. He later said that everything that happened afterwards was a bonus. And what a triumph his life has been.

Astronomers are used to big numbers. But few could be as big as the odds I'd have given, back then in 1964, against witnessing his amazing crescendo of achievement spanning more than 50 years.

By the late 1960s he was wheelchair-bound. But in other respects fortune had favoured him. He married Jane, who provided a supportive home life for him and their children, Robert, Lucy and Tim.

And in those years astronomy was on a roll - we realized that black holes actually existed, and that our universe expanded from a mysterious big bang. Stephen gave us insights into black holes. And, with Roger Penrose, he discovered a new mystery: that deep inside them, and in the big bang, there lurked 'singularities' - where conditions transcended all known physics.

For acclaimed findings like these, he was elected to the Royal Society, when only 32.

He was by then so frail that many suspected that he could scale no further heights. But, for Stephen, this was still just the beginning. Within a year he came up with his best ever idea -- encapsulated in the equation on his memorial stone.

His 'eureka moment' revealed the first firm link between the two overarching 20th century theories: the quantum theory, describing the very small, and Einstein's relativity, describing gravity and the cosmos. He showed that, because of quantum effects, black holes weren't completely black but emitted what's now called 'Hawking radiation'. This discovery surprised all the experts - 40 years later, its ramifications still, in a colleague's words, cause 'more sleepless nights than any physics paper in history'.

Stephen was always based in Cambridge, and became a familiar figure

navigating his wheelchair around the city's streets. In 1979, the University elevated him to the Lucasian Professorship, once held by Newton and Dirac – both commemorated in the Abbey.

In 1985, he contracted pneumonia. He underwent a tracheotomy, which removed even the limited powers of speech he then possessed. But he was saved by technology. A computer, controlled by a single lever, allowed him to spell out sentences. These were then declaimed by a speech synthesiser, with the androidal American accent that became his trademark. And this machine enabled him to finish a long-planned book.

The feature film *The Theory of Everything* portrayed the human story behind his career -- and did this so well that the main characters were themselves happy with their portrayal.

But it chronicled only half of his adult life, concluding when the massive global sales of *A Brief History of Time* catapulted Stephen to stardom.

From then on he was lionized worldwide – in the White House, the Vatican and the Great Hall of the People – and made countless media appearances. The concept of the imprisoned mind roaming the cosmos had global resonance.

As the two Tributes have reminded us, Stephen was far from being the archetype nerdish scientist – his personality remained amazingly unwarped by his frustrations and handicaps. He reveled in his travels – and enjoyed theatre and opera. He had robust common sense, and forceful political opinions. He promoted many causes. Above all, we should acclaim his lifelong support for disabled people; and his recent campaign for the NHS – to which he acknowledged he owed so much.

In academia, it's a common custom to honour colleagues when they reach 60. In 2002, scientists came from all over the world for Stephen's 60th. But his celebrations weren't just scientific -- that wouldn't have been his style. He was surrounded by children and grandchildren; there was singing and dancing; there were 'celebrities' in attendance. When the week's events were over, he took his first trip in a hot air balloon.

And he later had a spin in the NASA aircraft that allows passengers to experience weightlessness – pictures show him manifestly overjoyed to escape, albeit briefly, the clutches of the gravitational force he understood so well.

As, year by year, he weakened, his supportive network expanded. And his communication – to his immense frustration – became even slower. He learnt to economise with words. His comments were aphoristic or oracular, but often witty too.

But his pre-prepared lectures – accompanied by clever visuals -- were still inspirational. He reached his largest-ever global audience when he starred at the opening of the 2012 London Paralympics. His mantra was: “Look up at the stars and not down at your feet. Try to make sense of what you see, and wonder about what makes the universe exist. Be curious”

Right until the end, despite the campaigns, the razzmatazz, and his fragility, he continued to probe grand questions. What equations describe the bedrock of physical reality? What ‘breathes fire’ into those equations? Most challenging of all, he strove, with many colleagues, to understand how our vast and complex universe might have evolved from something microscopically small -- a mindblowing cosmic analogue of Charles Darwin’s realization that all life evolved from a ‘simple beginning’.

When Darwin died, in 1882, the President of the Royal Society wrote to the Dean saying ‘...it would be acceptable to a very large number of our fellow-countrymen of all classes and opinions that our illustrious countryman Mr Darwin should be buried in Westminster Abbey’.

And so he was – despite not being a believer. Indeed Darwin wrote. ‘I feel most deeply that [religion] is too profound for the human intellect. A dog might as well speculate on the mind of Newton. Let each man hope and believe as he can’.

Stephen described his own scientific quest as learning ‘the mind of God’. But this was a metaphor. He resonated with Darwin’s agnosticism. It’s fitting that he, too, should be interred in this national shrine.

His name will live in the annals of science: nobody else since Einstein has done more to deepen our understanding of space, time, and gravity.

Millions have had their cosmic horizons widened by his books and lectures; and even more, worldwide, have been inspired by a unique example of achievement against all the odds.