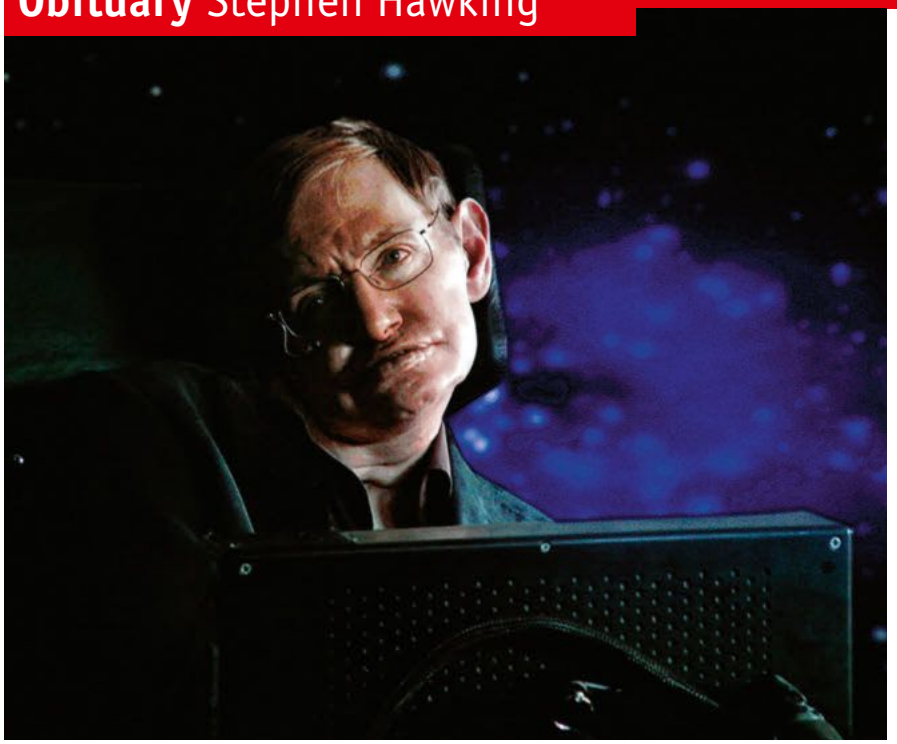

The cosmos from a wheelchair

Stephen Hawking, physicist, died on March 14th, aged 76

PREDESTINATION was not part of Stephen Hawking's system of belief. It was mere coincidence that he was born 300 years to the day after Galileo Galilei died. But he did share something with him, other than being a great physicist; he became famous as much for his suffering as for his physics. His was caused not by ecclesiastical politicians who preferred obedience to free enquiry, but by muscle-wasting amyotrophic lateral sclerosis. It meant that he, too, had to fight to be heard.

In youth he never lacked confidence. He once interrupted the great astrophysicist Fred Hoyle in mid-lecture, at the Royal Society, to correct him on the masses of particles. But once he could no longer write down equations, theories had to be translated into geometry in his head; and after a tracheotomy in 1985, the ocean of his thinking had to be forced through a cumbersome and narrow technological aperture. His words necessarily became so few that he had to stare hard at the universe in order to define, and refine as far as possible, the new things he had to say about it. His theories of everything emerged in a voice that was both robotic, and curiously laden with emotion.

His books, too, made his case even to the man in the street. "A Brief History of Time", published in 1988, sold in millions, though its difficulty meant that many copies languished on coffee tables. His "Briefer History" of 2005 was the same thing made plainer, at least to him. He hoped people would understand it, because it was important for scientists to explain what they were doing. His branch of science, cosmology, was now purporting to answer questions that were once asked of religion. In both books and several more he declared that the laws of science explained everything, without any need to bring God into it. If string theory and its 11 dimensions were understood, for example, it might show how the universe began.

In his day job, as Lucasian professor of mathematics at Cambridge University until he retired in 2009, it was black holes in particular that he worked on. He even proclaimed once that he was their master, added to his mystique. Black holes, which were predicted by maths before they were discovered in nature, are singularities—points where the familiar laws of physics cease to apply. They are surrounded, however, by surfaces known as event horizons. Anything crossing the event horizon is swallowed for ever.

This was a problem. The second law of thermodynamics, the strictest of nature's constraints, says that entropy, a form of disorder, must always increase. But if high-entropy systems could be sucked into nothingness by black holes, that would not be the case. Dr Hawking solved this problem by showing that black holes themselves had entropy, and that the more they swallowed, the greater it got. This in turn implied that black holes had a temperature, and thus must give off radiation.

He gave his name to it, but "Hawking radiation" surprised him as much as anyone; he claimed to have just tripped over it, to his annoyance. (His voice-synthesising machine included a button for jokes.) The radiation was not observed in his lifetime, which was why he never won a Nobel prize. But the link it provided between the theory of relativity, quantum mechanics and thermodynamics was rich food for physicists' imaginations.

Finite time, infinite space

His interest in singularities was not restricted to black holes. The universe itself can be viewed as a singularity, albeit one which human beings are seeing from the inside rather than the out. And he was intensely interested in its origin, coeval with that of time itself. To explain this concept, that before the Big Bang there was truly neither time nor space, he compared it to asking what lay south of the South Pole. He revelled in these unanswered, perhaps unanswerable, questions. When his disability left him behind in conversations, he happily drifted off to them again.

His work also encompassed large N cosmology, Yang-Mills instantons and the S matrix, anti de Sitter space, quantum entanglement, the Brans-Dicke and Hoyle-Narlikar theories of gravitation and Euclidean quantum gravity. His contribution to scientific journals continued throughout, but he wanted most keenly to outline for non-experts, baffled by the weirdness of scientific terms and the apparent contradictions of modern theories, humanity's place in the universe.

The departure of scientific reality from what common sense suggests is going on (the sun going round the Earth, for example) no longer threatens political institutions, but it threatens the human psyche just as much as it did in Galileo's day. Dr Hawking's South Pole of time was 13.7 billion years in the past—three times as old as the Earth. His mathematics showed that the universe, though finite in time, might be infinite in space.

No philosophy that puts humanity anywhere near the centre of things can cope with facts like these. All that remains is to huddle together in the face of the overwhelmingness of reality. Yet the sight of one huddled man in a wheelchair constantly probing, boldly and even cheekily demonstrating the infinite reach of the human mind, gave people some hope to grasp, as he always wished it would. ■