COSMOLOGY

A life in space–time

George Ellis appreciates a Stephen Hawking biography that highlights the epochs of an illustrious career — and the personality behind them.

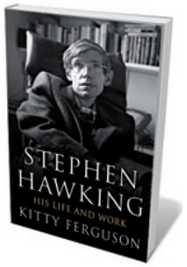
As both a global icon and an innovative theoretical physicist, Stephen Hawking is well served by science writer Kitty Ferguson's fascinating biography. Ferguson explains in accessible terms the major themes that Hawking has explored in his career, and creates a portrait of the private man by drawing on her close personal contact with him and his family.

Hawking — a huge inspiration to disabled people worldwide through his great achievements in the face of motor neurone disease — lives through sheer willpower, yet retains an impish sense of humour and a delight in saying provocative things. For example, when his fame made it difficult for him to be private, he programmed his voice synthesizer to say, "I am often mistaken for Stephen Hawking." He has an incredible determination and adventurousness, epitomized by his taking a zero-*G* flight in 2007 to experience weightlessness.

Born in Oxford in 1942, Hawking found out about his disease when he was just 21, soon after beginning work as a research student at the University of Cambridge, UK. He was able to face this shock through his inner strength, together with strong support from his first wife, Jane Wilde, who married him in the knowledge of his illness — and despite the terrible way he drove while they were out on dates.

Ferguson divides Hawking's career into four epochs. The first, from 1962 to 1973, included his careful technical work on general relativity and cosmology, including his famous critique of the 'action at a distance' alternative theory of gravity by astrophysicists Fred Hoyle and Jayant Narlikar. The highlight was his series of cosmological singularity theorems, developing the work of mathematical physicist Roger Penrose on black-hole singularities. Hawking showed that classical general relativity implies that there was a start to the Universe: a space-time singularity beyond which normal physics would not apply. Hawking also worked on theorems of black-hole geometry and, with his colleagues, established four laws of black-hole thermodynamics.

With this solid work, Hawking built his scientific reputation during this period. But Ferguson's handling of it is thin. She says little about the influential physicists with whom he interacted, including Charles Misner, Robert Geroch, Brandon Carter and John Archibald Wheeler. The book barely mentions Hawking's relation to his research supervisor, Dennis Sciama, who shaped the successful general-relativity research group at Cambridge in the 1960s.



Stephen Hawking: An Unfettered Mind/His Life and Work
KITTY FERGUSON
Palgrave/Bantam: 2011. 320 pp./356 pp. $27/£20

The second epoch, from 1973 to 1979, saw Hawking's adventurous and initially controversial, but later vindicated, work on quantum field theory in a curved space-time. The core is his innovative paper integrating quantum field theory, general relativity and thermodynamics to establish that black holes emit black-body radiation — now known as Hawking radiation. This unexpected result is uniquely his, and is a major achievement that has stood the test of time. He also made important contributions to studying the beginnings of the growth of structure during the inflationary expansion of the early Universe.

Stephen Hawking in 1986, a time when his ideas became more speculative, sparking much debate.

I. BERRY/MAGNUM PHOTOS

The third era, from 1980 on, was more speculative. Hawking tested big ideas in a creative way, causing much interest and stimulating much activity. But he did not achieve the same level of acceptance for these ideas in the scientific community as he had earlier. They include the 'no-boundary' idea that hypothesizes that the Universe would start without a singularity in a domain where only space existed, as well as his proposals for space-time wormholes. He also proposed that quantum information that has fallen into a black hole is lost at the end of its lifetime. This is a challenging claim for quantum orthodoxy, and has led to much debate.

The fourth period sees Hawking's emergence as a globally admired public figure. He has written an array of popular books, starting in 1988 with the legendary *A Brief History of Time* (Bantam), and has given numerous interviews and talks involving an extraordinary amount of worldwide travel. Hawking's latest book, *The Grand Design* (Bantam, 2010), co-authored with physicist and writer Leonard Mlodinow, considers whether the 'multiverse' concept might explain why the Universe appears the way it does, and why it harbours life (for a review see *Nature* **467,** 657–658; 2010). That solution is still speculative for several reasons, one being that string theory — essential to the version of the concept that he supports — is not experimentally confirmed.

Hawking has recently advocated space travel as a necessity for the survival of the human race, and discussed life elsewhere in the Universe. He suggests that life may be common but that intelligent life is rare. Ferguson goes into Hawking's public pronouncements on issues outside physics — such as his reductionist views on the way the mind works and confusingly varied statements on religion — which can be viewed with caution given that they lie outside his area of expertise.

Ferguson's sympathetic and informed take on an individual who has enriched human knowledge against the odds is an excellent summing-up, as Hawking approaches his 70th birthday, of his unique and creative contribution to both science and humanity. ■

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