Prof. Stephen W. Hawking
Lucasian Professor of Mathematics

Most important awards, prizes and academies

Awards: Adams Prize; Eddington Medal, Royal Astronomical Society; Pius XI Medal, The Pontifical Academy of Sciences; Dannie Heinemann Prize; William Hopkins Prize; Maxwell Medal and Prize; The Hughes Medal; The Einstein Award of the Strauss Foundation; The Albert Einstein Medal; Commander of the British Empire; Gold Medal, Royal Astronomical Society; Wolf Prize in Physics; Prince of Asturias Awards; Companion of Honour; Julius Edgar Lilienfeld Prize, American Physical Society; Aventis Book Prize; Michelson Morley Award, Case Western Reserve University; Smithson Bicentennial Medal; Copley Medal, Royal Society. *Academies*: Royal Society; Pontifical Academy of Sciences; US National Academy of Sciences.

Summary of scientific research

I started research in gravitation and cosmology in 1962 at Cambridge under the supervision of Dr. D.W. Sciama. My first major work was on the question of whether there was a singularity, a point of infinite density and space-time curvature, at the beginning of the present expansion phase of the universe. Together with Roger Penrose I was able to show that there would be such a singularity in any reasonable cosmological model if the general theory of relativity was correct. The singularity would be a beginning of the universe, a place where the laws of physics break down. In 1970 I started to work on black holes. These are regions of space-time in which the gravitational

field is so strong that nothing can escape. They are formed when burnt out stars or larger objects collapse. I was one of the people whose combined work proved the 'no hair' theorem which showed that a black hole would settle down to a state that depended only on the mass and angular momentum of the hole. I also showed that the event horizon, the boundary of the black hole, always increased in area as matter fell into the hole. This suggested a connection between the area and the thermodynamic concept of entropy, which became more definite in 1974 when I showed that quantum mechanics would cause small black holes to create and emit particles as if they were hot bodies. Since 1974 I have worked mainly on the problem of unifying gravity and quantum mechanics. With others at Cambridge I developed a Euclidean approach which is now generally accepted. I have been interested in the extra degree of predictability that gravity introduces because the topology of space-time can change. I have also done quite a lot of work on the very early universe. I worked on the inflationary model and more recently on the initial boundary conditions of the universe. I have suggested that the boundary conditions of the universe are that it has no boundary. This would mean that there was no singularity and no single event that could be identified as the creation. Instead one could say that the universe was created quantum mechanically from nothing.

Main publications

Books: Hawking, S.W., *The Large Scale Structure of Space-Time*, Cambridge University Press (1973); Hawking, S.W., *Is the End in Sight for Theoretical Physics?*, Cambs Univ. Press (1980); Hawking, S.W., *A Brief History of Time*, Bantam Press (1988); Hawking, S.W., *Black Holes and Baby Universes and Other Essays*, Bantam Books (1993); Hawking, S.W., *The Nature of Space and Time*, Princeton University Press (1996); Hawking, S.W., *The Large, the Small, and the Human Mind*, Cambridge University Press (1997); Hawking, S.W., *The Universe in a Nutshell*, Bantam Press (2001); Hawking, S.W., *On The Shoulders of Giants. The Great Works of Physics and Astronomy*, Running Press (2002); Hawking, S.W., *Information Loss in Black Holes*, Cambridge University Press (2005); Hawking, S.W., *God Created the Integers: The Mathematical Breakthroughs That Changed History*, Running Press (2005); Hawking, S.W., *A Briefer History of Time*, Bantam Books (2005); L. Hawking, S.W. Hawking, *George's Secret Key to the Universe*, Doubleday (2007). *Articles*: Hawking, S.W., Occurrence of Singularities in Open Universes, *Phys. Rev. Lett.*, 15, p. 689 (1965); Hawking, S.W., Perturbations of an Expanding Universe, *Astrophys. J.*, 145, p. 544 (1966); Hawking, S.W., The Singularities of Gravitational Collapse and Cosmology, *Proc. Roy. Soc.*, A314, p. 529 (1970); Hawking, S.W., Black Holes in General Relativity, *Commun. Math. Phys.*, 25, p. 152 (1972); Hawking, S.W., The Four Laws of Black Hole Mechanics, *Commun. Math. Phys.*, 31, p. 161 (1973); Hawking, S.W., Particle Creation by Black Holes, *Commun. Math. Phys.*, 43, p. 199 (1975); Hawking, S.W., Zeta Function Regularization of Path Integrals in Curved Space-Time, *Commun. Math. Phys.*, 56, p. 133 (1977); Hawking, S.W., Spacetime Foam, *Nucl. Phys. B.*, 144, p. 349 (1977); Hawking, S.W., The Quantum State of the Universe, *Nucl. Phys. B.*, 239, p. 257 (1984); Hawking, S.W., The Origin of Structure in the Universe, *Phys. Rev. D.*, 31, p. 8 (1985).