

Professor Stephen Hawking

1942-2018: a tribute

■ Emma Hill

Amongst a flood of tributes following the announcement of Stephen Hawking's passing on the 14th March 2018 at the age of 76, we wanted to take a moment to reflect on his remarkable life and legacy to science education.



Credit: Twocoms / Shutterstock.com.
Hawking pictured in 2015.

On The Big Bang and Black Holes

'My goal is simple. It is a complete understanding of the universe, why it is as it is and why it exists at all.'

Professor Stephen Hawking

Hawking's first major breakthrough came in 1970, when he and Roger Penrose applied the mathematics of black holes

¹ The career of Stephen Hawking
<https://bit.ly/2vnwTzu>

² BBC 100 Greatest Britons <http://bit.ly/100brits>

to the universe. Hawking realised that black holes were like the Big Bang in reverse – and that meant that the maths he'd used to describe black holes also described the Big Bang. This was in accordance with Einstein's theory of general relativity, which states that the universe must have begun as a singularity – a point in space where gravity is so strong that 'everything vanishes into nothing'. The proof that Hawking and Penrose developed was a key step in confirming the Big Bang theory, the now widely accepted hypothesis that everything was created from a cosmic expansion 13.8 billion years ago.

In 1974, Hawking proposed that black holes should emit heat, due to quantum effects near the event horizon. This has come to be known as 'Hawking Radiation'. An Institute of Physics (IOP)¹ article explains that *'the "empty" space is actually filled with pairs of virtual particles popping into and out of existence and, whereas they would normally vanish effectively instantaneously, in this case, for each pair, one is trapped by the black hole and the other escapes. If enough time passes, black holes will radiate away all their energy and completely evaporate.'*

See our top picks opposite about Hawking's life and work to find out more.

On famous scientists

'Remember to 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.'

Professor Stephen Hawking

In a recent issue of *Primary Science* (no. 151, Jan/Feb 2018), we looked at famous scientists to understand the context of science as a human endeavour. Editor Leigh Hoath says *'It is imperative that children have a sense of the contributions made to their lives by scientists from the past and there is great scope for looking at the famous scientists of today'*.

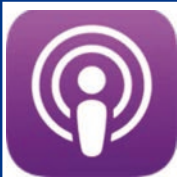
Hawking has been chief amongst those in the science hall of fame and is placed just below Queen Elizabeth II in 25th place as one of the greatest Brits ever². It reminds us that science and scientists should not remain behind closed doors and must be part of our public dialogue. We should give students the opportunity to go beyond the news headlines, be inspired and understand the work of these scientists.



Credit: MatiasDelCarmine / Shutterstock.com

Resources on Hawking's life and work

There is a huge catalogue of media content that has celebrated the life and work of Hawking. Here are some of our top picks:



Hawking's BBC Reith Lectures

'Do black holes have no hair?' and 'Black holes ain't as black as they are painted'

As part of the BBC's flagship annual lecture series, Hawking presented two highly accessible sessions that take us through the history of scientific thinking about black holes.

Available on BBC iplayer: <https://bbc.in/23ka4V5>



On the best selling (and least understood) book...

***A Brief History Of Time* by Stephen Hawking**

Though we wouldn't necessarily recommend this for all our students, there are some great passages that link to A-level physics specifications. Chapter 6 covers an introduction to black holes in an accessible way. (Curriculum link: **Astrophysics**)



Principia Space Diaries – Chapter 5

Why explore the universe? Professor Hawking needs your help!

Part of a sequence of activities (Key Stages 1-3, ages 5-14), the activity is introduced with a video narrated by Professor Hawking explaining the Earth as an ideal habitat. Students are invited to ask what is happening to our planet? What would a habitat on another planet look like?

(Curriculum link: **Habitats**) <https://bit.ly/2qL4caa>



George's Cosmic Treasure Hunt

by Lucy Hawking and Stephen Hawking

Did you know that Stephen Hawking also co-wrote bedtime stories for children, addressing some of science's biggest questions, with his daughter, Lucy? This book is a physics adventure story in which the hero, George, takes off on a journey across the solar system and beyond.



New Scientist (open-access article)

A brief history of Stephen Hawking: A legacy of paradox

A great overview of Hawking's contributions to science, covering his work on the Big Bang and Hawking Radiation. <https://bit.ly/2J6uqvo>



Credit: NASA. Stephen Hawking (pictured 2007) enjoys zero gravity during a flight aboard a modified Boeing 727 aircraft owned by Zero Gravity Corporation.

On mind over matter

'I want to show that people need not be limited by physical handicaps as long as they are not disabled in spirit.'

Professor Stephen Hawking

In a tribute, Penrose described Hawking 'as a true symbol of the triumph of mind over matter'. Diagnosed at the age of 21 with Amyotrophic Lateral Sclerosis (ALS), also known as Motor Neurone Disease (MND), Hawking was an active role model for those with disabilities. He undertook a suborbital flight in 2007 to show the potential of people living with a disability. This serves to teach us all a lesson in determination, leading to a question for ourselves and our students – 'What is it you think you can and can't do?'

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