Black holes dissolving like aspirin: How Hawking changed physics

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When Stephen Hawking postulated in the mid-1970s that black holes leak radiation, slowly dissolving like aspirin in a glass of water, he overturned a core tenet of the Universe.

Ever since Albert Einstein published his theory of general relativity in 1915, predicting the existence of black holes, it was thought they devour everything in their vicinity, including light.

Black holes, it was thought, were bottomless pits from which matter and energy could never escape.

But Hawking, sometimes described as the most influential theoretical physicist since Einstein, questioned this, saying that black holes were not really black at all and must emit particles.

In so doing, he touched on a persistent headache for physicists: Einstein's theory, which has withstood every experimental test so far, does not explain the behaviour of particles in the subatomic, "quantum" sphere.

Considered controversial at first, Hawking's black hole theory pointed to a possible bridge between the two mainstay physics theories—general relativity and quantum mechanics.

"Hawking realised that black holes, these objects that are made of gravity, because of quantum mechanics... can actually emit particles," astrophysicist Patrick Sutton of Cardiff University told AFP.

"This was the first case where we had a physical process that links gravity, this classical theory of gravity, with quantum mechanics."

The mechanism was named "Hawking radiation" after the famous scientist who died Wednesday— Einstein's birthday.

And it painted a completely new portrait of black holes.

"Stephen Hawking discovered that when the quantum laws governing the physics of atoms and elementary particles were applied to black holes, the surprising outcome was that black holes actually must emit radiation," physicist Raymond Volkas of the University of Melbourne said via the Australian Science Media Centre.

'Theory of Everything'

Hawking showed that because black holes give off radiation they actually have a temperature. And in losing mass and energy, they would slowly shrink and eventually evaporate—"a real shock" proposition, according to Sutton.

"Hawking's most important scientific legacy is his idea that black holes slowly dissolve like aspirin in a glass of water," said Lisa Harvey-Smith of the University of New South Wales.

But Hawking radiation in turn posed a new problem, the so-called "black hole information paradox".

If a black hole disappears, all the cosmological information from matter and energy that initially went into it will disappear too. But physics predicts that information can never be lost.

Hawking himself had conceded a wager on the point, having initially bet that black hole information will ultimately be lost.

"It is still the focus of theoretical interest, a topic of debate and controversy more than 40 years after his discovery," said British cosmologist Martin Rees.

A former collaborator of Hawking, he added, once described the radiation theory as causing "more sleepless nights among theoretical physicists than any paper in history."

Hawking radiation has heavily influenced the ongoing quest for "New Physics", a "Theory of Everything" that can unify general relativity with quantum mechanics.

Besides his deep imprints on theoretical physics, many credit Hawking's popularisation of science, including through his cosmology-themed book "A Brief History of Time", with motivating their own interest and careers.

"His impact on the public understanding of science is almost beyond measure," said Harvey-Smith.

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