

The Washington Post
August 28, 2015

Jacob Bekenstein, towering theoretical physicist who studied black holes, dies at 68

by [Martin Weil](#)

Jacob Bekenstein, one of the world's foremost theoretical physicists, who used the power of thought to explore the invisible objects that are ranked among the wonders of the universe — black holes — died Aug. 16 in Helsinki. He was 68.

The New York Times reported that the cause of death was a heart attack, citing confirmation by the Hebrew University in Jerusalem. Dr. Bekenstein was a longtime professor at the university and was in Finland for a lecture.

He was at home in many realms of physics that were beloved by science fiction writers and were located at the frontiers of his discipline. In addition to black holes, they included quantum mechanics and general relativity, which is a theory of gravity.

Among fellow scientists he was known as a founder of the field of black hole thermodynamics. That area of endeavor is considered significant in the search for an overarching theory embracing gravitation and quantum mechanics.

To physicists, his reputation rested to a great degree on contributions he made to describing the true and complex nature of black holes. At one time, it was believed that absolutely nothing escaped black holes, that they would take in everything, emit nothing and become ever increasingly massive.

That belief was founded on Einstein's general relativity. It cloaked them in mystery and gave them a hold on the popular imagination. But owing in great measure to Dr. Bekenstein's work and to the application of quantum theory, that view has been substantially altered.

What Dr. Bekenstein did, aided by a great deal of mathematics, was to draw an analogy between the boundaries of black holes and the important physics concept known as entropy.

If black holes imprisoned everything that fell into them, their boundaries could only increase, never decrease. As never decreasing was the way science understood entropy, a concept linked to the second law of thermodynamics and, in a way, to the inexorability of disorder.

But if the boundary of black holes shared the characteristics of entropy, then reasoning based on thermodynamics — the physics of heat — would suggest that it would also have a temperature. And that, in turn, would require it to give off radiation.

Physicist Stephen Hawking, an expert on black holes, disputed the idea. It seemed, Hawking wrote, that the area of the black hole's "event horizon," which is essentially its boundary surface, "could not be regarded as its entropy."

But in his celebrated 1988 book, "A Brief History of Time," Hawking recanted. Of Dr. Bekenstein, he wrote, "it turned out in the end that he was basically correct."

On reconsidering Dr. Bekenstein's proposals, Hawking produced a startling idea. He proposed that radiation was in fact being emitted from the event horizon or its vicinity. This radiation is widely known as Hawking radiation. However, it is often referred to as "Bekenstein-Hawking radiation" in recognition of the contributions of both men. It is so faint as to have defied efforts to detect it, but it has ramifications throughout the world of physics.

Dr. Bekenstein was highly regarded among his peers, but his many accomplishments never brought him to public prominence.

Among the achievements was the proof that limits existed on the amount of information that could be stored within a given boundary. That boundary is known as the "Bekenstein bound."

In 2012, he received the prestigious Wolf Prize in Physics. This year, the American Physical Society awarded him its Einstein Prize. The honor recognized his groundbreaking work on black hole entropy and the pathways it opened to understanding of the cosmos.

Jacob David Bekenstein was born in Mexico City on May 1, 1947. His parents were Jews who had fled Eastern Europe.

He moved to the United States, became a citizen in 1968 and obtained a bachelor of science degree in 1969 from what was then the Polytechnic Institute of Brooklyn (now the New York University Polytechnic School of Engineering).

He received a PhD in 1972 from Princeton University, where he studied under one of the world's leading theorists, [John Archibald Wheeler](#), who is credited with coining the term "black holes."

After his doctoral work, Dr. Bekenstein was a fellow from 1972 to 1974 at the Center for Relativity at the University of Texas at Austin. He then moved to Israel and became a professor

at Ben-Gurion University of the Negev. In 1990, he joined the faculty at Hebrew University in Jerusalem. Over the years, he often served as a visiting scholar at American universities.

Dr. Bekenstein is survived by his wife, Bilha Bekenstein; three children, Yehonadav, Uriya and Rivka Bekenstein; a sister, Bella; and six grandchildren, according to the Times.

Although many scientists are not, he was known as a religious man and a believer.

“I look at the world as a product of God,” he was quoted as saying in the Israeli newspaper Haaretz. “He set very specific laws and we delight in discovering them through scientific work.”

@2015 The Washington Post