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Freeman Dyson, Visionary Technologist, Is Dead at 96

After an early breakthrough on light and matter, he became a writer who challenged climate science and pondered space exploration and nuclear warfare.

By George Johnson

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Freeman J. Dyson, a mathematical prodigy who left his mark on subatomic physics before turning to messier subjects like Earth's environmental future and the morality of war, died on Friday at a hospital near Princeton, N.J. He was 96.

His daughter Mia Dyson confirmed the death. His son, George, said Dr. Dyson had fallen three days earlier in the cafeteria of the Institute for Advanced Study in Princeton, "his academic home for more than 60 years," as the institute put it in a news release.

As a young graduate student at Cornell University in 1949, Dr. Dyson wrote a landmark paper — worthy, some colleagues thought, of a Nobel Prize — that deepened the understanding of how light interacts with matter to produce the palpable world. The theory the paper advanced, called quantum electrodynamics, or QED, ranks among the great achievements of modern science.

But it was as a writer and technological visionary that he gained public renown. He imagined exploring the solar system with spaceships propelled by nuclear explosions and establishing distant colonies nourished by genetically engineered plants.

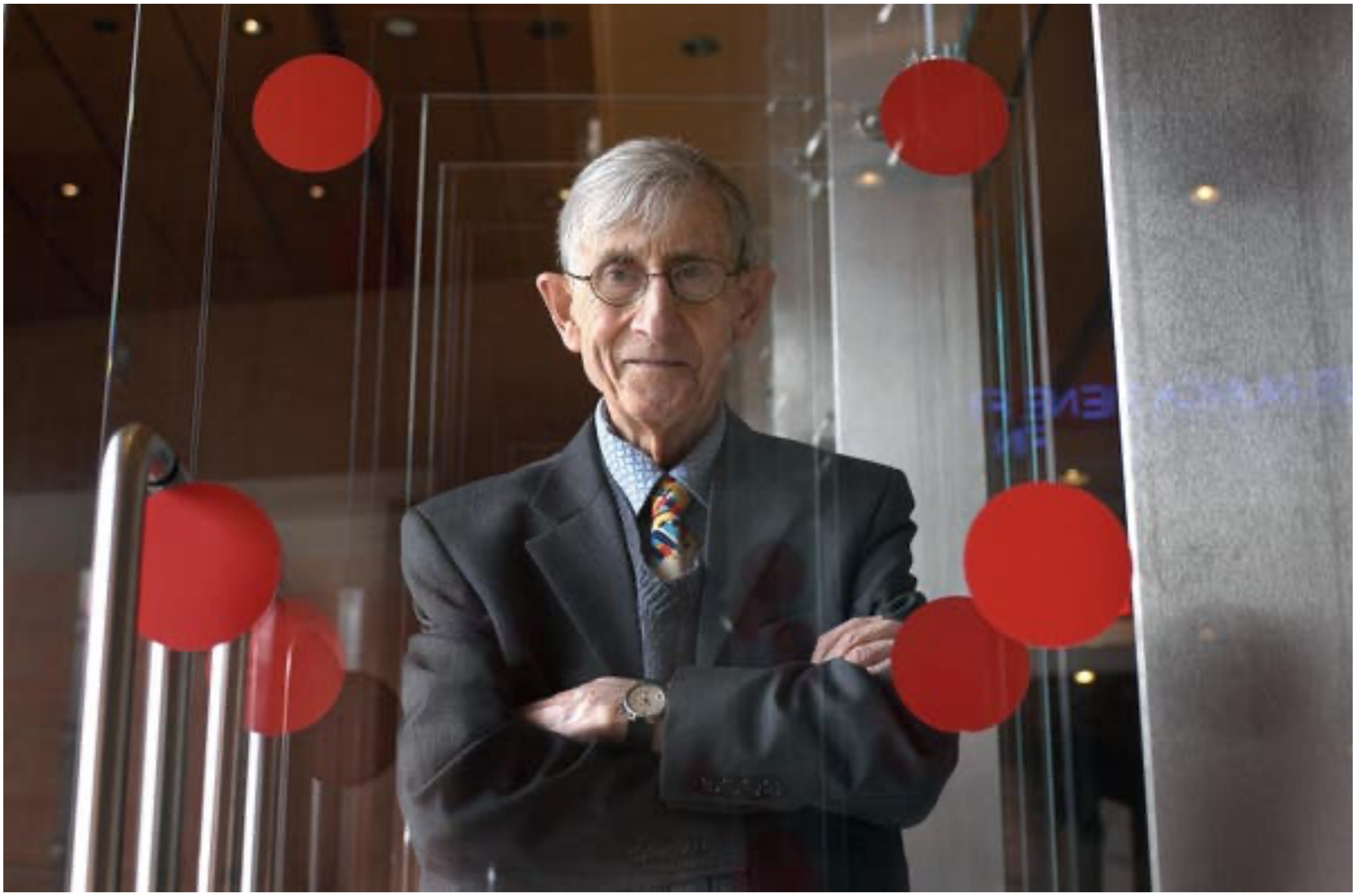
"Life begins at 55, the age at which I published my first book," he wrote in "From Eros to Gaia," one of the collections of his writings that appeared while he was a professor of physics at the Institute for Advanced Study — an august position for someone who finished school without a Ph.D. The lack of a doctorate was a badge of honor, he said. With his slew of honorary degrees and a fellowship in the Royal Society, people called him Dr. Dyson anyway.

Dr. Dyson called himself a scientific heretic and warned against the temptation of confusing mathematical abstractions with ultimate truth. Although his own early work on QED helped bring photons and electrons into a consistent framework, Dr. Dyson doubted that superstrings, or anything else, would lead to a Theory of Everything, unifying all of physics with a succinct formulation inscribable on a T-shirt.

In a speech in 2000 when he accepted the Templeton Prize for Progress in Religion, Dr. Dyson quoted Francis Bacon: "God forbid that we should give out a dream of our own imagination for a pattern of the world."

Relishing the role of iconoclast, he confounded the scientific establishment by dismissing the consensus about the perils of man-made climate change as "tribal group-thinking." He doubted the veracity of the climate models, and he exasperated experts with sanguine predictions they found rooted less in science than in wishfulness: Excess carbon in the air is good for plants, and global warming might forestall another ice age.

In a profile of Dr. Dyson in 2009 in The New York Times Magazine, his colleague Steven Weinberg, a Nobel laureate, observed, "I have the sense that when consensus is forming like ice hardening on a lake, Dyson will do his best to chip at the ice."



Dr. Dyson in 2008. He imagined exploring the solar system with spaceships propelled by nuclear explosions and establishing distant colonies nourished by genetically engineered plants. Tania/Contrasto, via Redux

Dr. Dyson's distrust of mathematical models had earlier led him to challenge predictions that the debris from atomic warfare could blot out the sun and bring on a devastating nuclear winter. He said he wished that were true — because it would add to the psychological deterrents to nuclear war — but found the theory wanting.

For all his doubts about the ability of mortals to calculate anything so complex as the effects of climate change, he was confident enough in our toolmaking to propose a technological fix: If carbon dioxide levels became too high, forests of genetically altered trees could be planted to strip the excess molecules from the air. That would free scientists to confront problems he found more immediate, like the alleviation of poverty and the avoidance of war.

He considered himself an environmentalist. “I am a tree-hugger, in love with frogs and forests,” he wrote in 2015 in The Boston Globe. “More urgent and more real problems, such as the overfishing of the oceans and the destruction of wildlife habitat on land, are neglected, while the environmental activists waste their time and energy ranting about climate change.” That was, to say the least, a minority position.

He was religious, but in an unorthodox way, believing good works to be more important than theology.

“Science is exciting because it is full of unsolved mysteries, and religion is exciting for the same reason,” he said in his Templeton Prize acceptance speech. “The greatest unsolved mysteries are the mysteries of our existence as conscious beings in a small corner of a vast universe.”

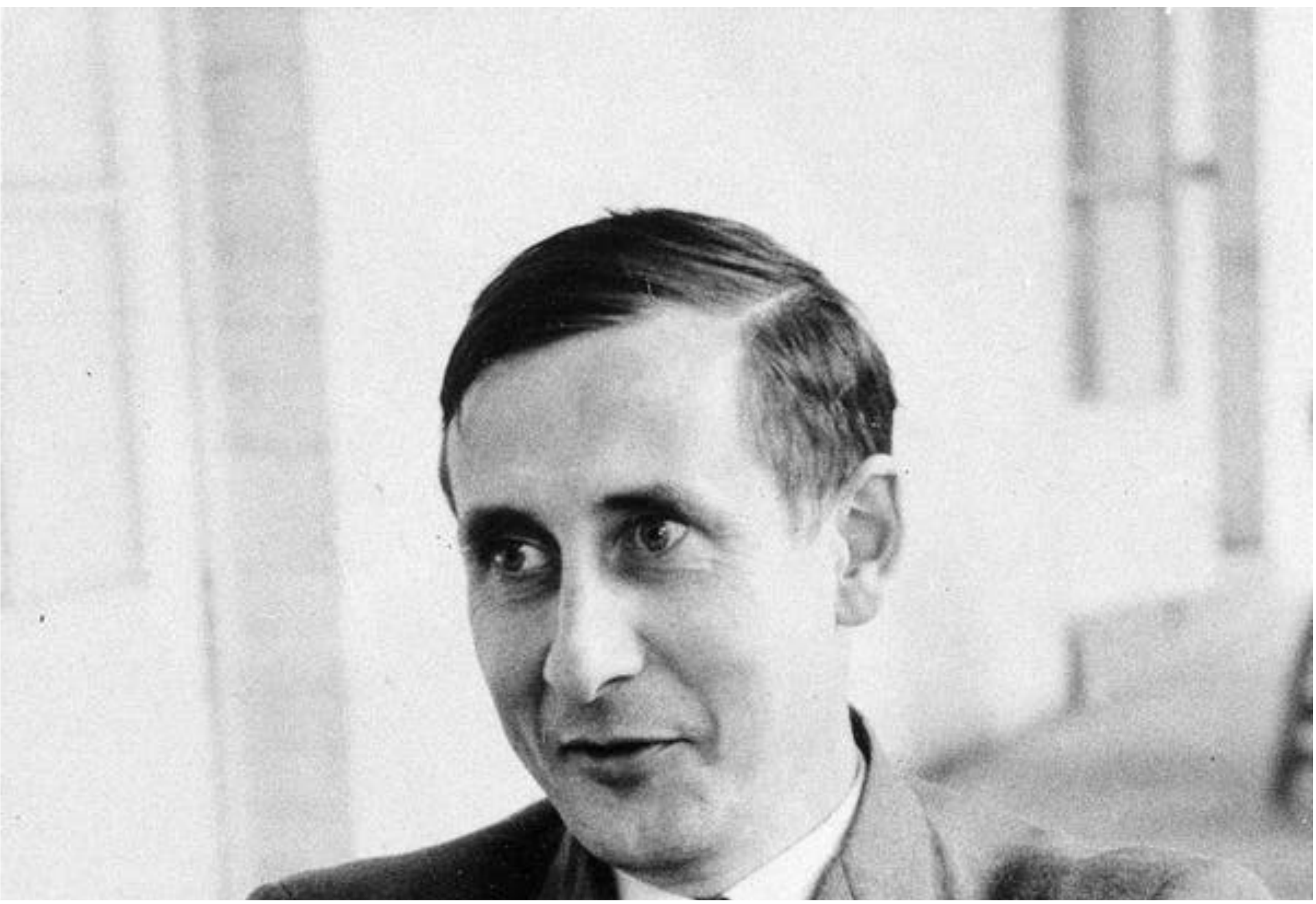
Freeman John Dyson was born on Dec. 15, 1923, in the Berkshire village of Crowthorne, England. His father, George Dyson, was a composer and conductor. In the family archives is an unfinished novel Freeman began writing when he was 8 years old about an imaginary expedition to the moon to observe the impending impact of an asteroid. (Later in life he probably would have devised, at least on paper, a means of heading off the celestial crash.) The boy’s reading included, in addition to Jules Verne, nonfiction by James Jeans and Arthur Eddington, British physicists with a flair for popularization and a literary bent.

After finishing high school at Winchester College, where his father taught music, he entered the University of Cambridge, Trinity College, and excelled in mathematics.

Looking for a way to serve the war effort while satisfying his pacifist leanings, he took leave in 1943 to work as a civilian scientist for the Royal Air Force Bomber Command. He was charged with using mathematics to plan more efficient bombing campaigns. Years later, in an interview with the physicist and historian Silvan S. Schweber, he agonized over what he saw as his own moral cowardice, comparing himself to Nazi bureaucrats “calculating how to murder most economically.”

Excited by the theoretical frontiers opened by wartime research on nuclear fission, Dr. Dyson returned to Cambridge and concentrated on becoming a physicist. With a bachelor’s degree in mathematics, he entered the graduate physics program at Cornell in 1947, studying under Hans Bethe, who had been a leader of the Manhattan Project.

It was while touring the United States the following summer that Dr. Dyson resolved a pressing problem in theoretical physics.



Dr. Dyson in 1963. A theory he presented as a graduate student on quantum electrodynamics ranks among the great achievements of modern science. Associated Press

Richard Feynman, a young professor at Cornell, had invented a novel method to describe the behavior of electrons and photons (and their antimatter equivalent, positrons). But two other physicists, Julian Schwinger and Sin-Itiro Tomonaga, had each independently devised a very different way. Each of these seemed to satisfy the requirements of both quantum mechanics and special relativity — two of nature's acid tests. But which one was correct?

While crossing Nebraska on a Greyhound bus, Dr. Dyson was struck by an epiphany: The theories were mathematically equivalent — different ways of saying the same thing. The result was QED. Feynman called it "the jewel of physics — our proudest possession."

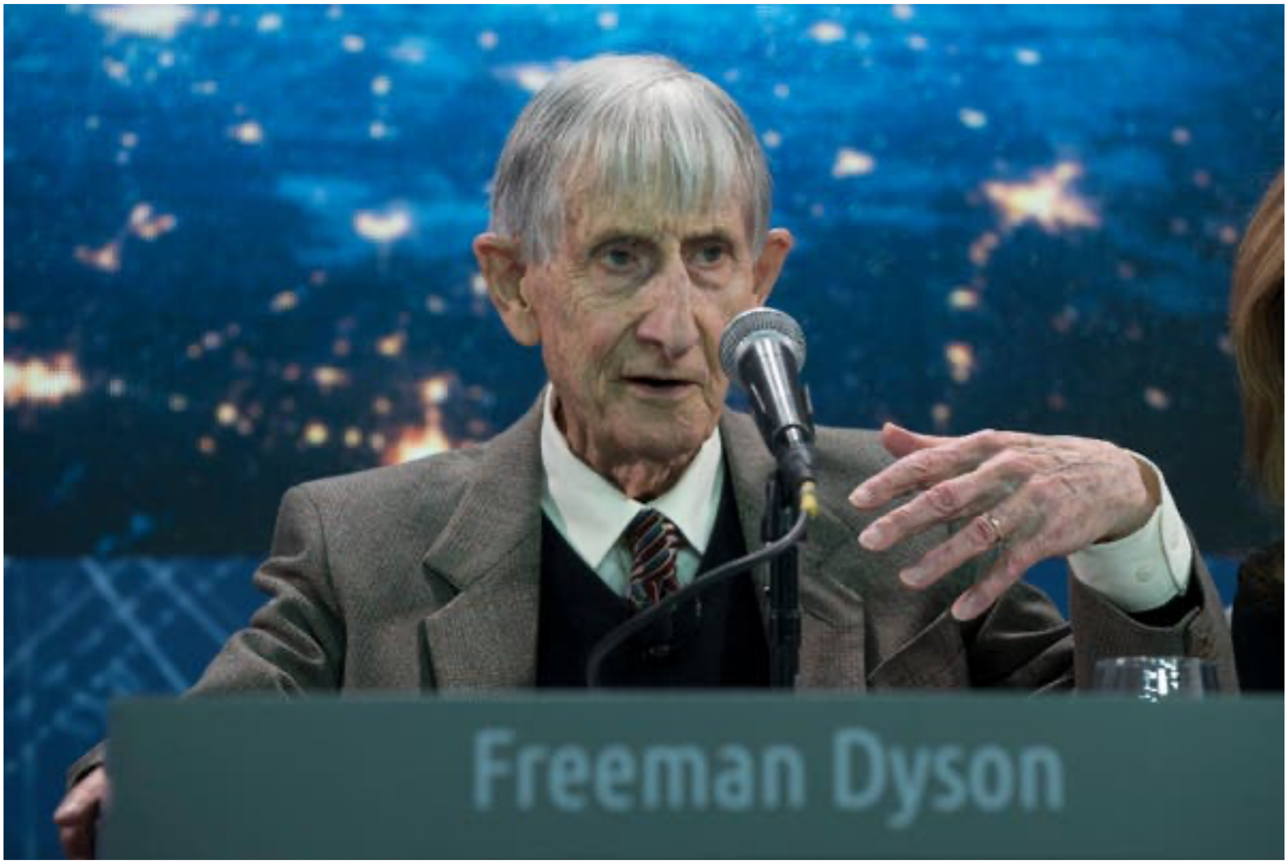
By the time Dr. Dyson published the details in 1949, a doctorate must have seemed superfluous. He was appointed professor of physics at Cornell in 1951. Teaching, he soon realized, was not for him. In 1953, he became a scholar at the Institute for Advanced Study, where he spent the rest of his career.

Dr. Dyson did not begrudge Feynman, Schwinger and Tomonaga the Nobel they received in 1965. "I think it's almost true without exception if you want to win a Nobel Prize, you should have a long attention span, get hold of some deep and important problem and stay with it for 10 years," he told The Times Magazine in 2009. "That wasn't my style."

He preferred to move from problem to problem, both theoretical and practical. In the late 1950s, consulting for General Atomics in San Diego, he helped design the Triga reactor, which is used for scientific research and nuclear medicine, and worked on Project Orion, which aimed to explore the solar system with an enormous spaceship powered by exploding nuclear bombs.

With the signing of the Limited Nuclear Test Ban Treaty of 1963, Dr. Dyson's dreams of reaching Saturn by 1970 were put to rest. Despite his disappointment, he came to support the treaty and, sometimes as a member of Jason, an elite group of scientific advisers, consulted with the government on disarmament and defense.

But his interests were not moored to the earth's surface. Any advanced civilization, he observed in a paper published in 1960, would ultimately expand to the point where it needed all the energy its solar system could provide. The ultimate solution would be to build a shell around the sun — a Dyson sphere — to capture its output. Earthlings, he speculated in a thought experiment, might conceivably do this by dismantling Jupiter and reassembling the pieces.



Dr. Dyson in 2016. He turned full force to writing in the late 1970s. Karsten Moran for The New York Times

In the meantime Dr. Dyson supported more conventional kinds of solar power, but he proposed that astronomers searching for extraterrestrial intelligence keep an eye out for heat radiating from occluded suns. For mankind's own colonial efforts, he suggested the Dyson tree, altered genetically to grow on comets and generate a breathable atmosphere.

He also continued with less fanciful work. He and a colleague, Andrew Lenard, won a bottle of Champagne for proving that the Pauli exclusion principle, which states that no two fermions (electrons are an example) can occupy the same state, accounted for the stability of matter. In 1965 Dr. Dyson received a Dannie Heineman Prize, often considered the next best thing in physics to a Nobel.

Little about the world, profound or mundane, escaped his curiosity. Among his work is a short paper deriving a mathematical equation — beautiful in his eyes — describing the seam of a baseball.

In the late 1970s Dr. Dyson turned full force to writing. Anyone with an interest in science and an appreciation for good prose is likely to have some Dysons on the shelf: “Disturbing the Universe,” “Weapons and Hope,” “Infinite in All Directions,” “The Sun, the Genome and the Internet.”

He also entered literature in a different way. He appeared in John McPhee’s book “The Curve of Binding Energy” (1974), a portrait of Ted Taylor, the nuclear scientist who led the Orion effort, and in Kenneth Brower’s “The Starship and the Canoe” (1978). In a memorable scene, Mr. Brower wrote of Dr. Dyson’s reunion with his son, George, who had turned his back on high technology to live in a treehouse in British Columbia and build a seafaring canoe. George Dyson later returned to civilization and became a historian of technology and an author. Dr. Dyson’s daughter Esther Dyson is a well-known Silicon Valley investor.

In addition to them and Dr. Dyson’s daughter Mia, he is survived by his second wife, Imme Dyson; their three other daughters, Dorothy Dyson, Emily Dyson Scott and Rebecca Dyson; a stepdaughter, Katarina Haefeli; and 16 grandchildren. Dr. Dyson’s marriage to the mathematician Verena Huber ended in divorce. She died in 2016.

Dr. Dyson’s mind burned until the end. In 2012, when he was 88, he collaborated with William H. Press on a paper about the prisoner’s dilemma, a mathematical concept important to understanding human behavior and the nature of evolution.

In his 90s, Dr. Dyson was still consulting for the government — on nuclear reactor design and the new gene-editing technology called CRISPR. In 2018, the year he turned 95, his book “Maker of Patterns: An Autobiography Through Letters” was published.

In his Templeton lecture, Dr. Dyson proposed that the universe is guided by “the principle of maximum diversity,” guaranteeing that it unfolds in a way that is “as interesting as possible.” Whatever its merit as a physical law, the principle goes far in describing the course of his extraordinary life.

Julia Carmel contributed reporting.

Correction: Feb. 28, 2020

An earlier version this obituary referred incorrectly to Dr. Dyson's daughter Esther Dyson. She is a Silicon Valley investor, not a Silicon Valley consultant.