



# Quantum: Einstein, Bohr and the Great Debate About the Nature of Reality

By Manjit Kumar

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**'This is about gob-smacking science at the far end of reason ... Take it nice and easy and savour the experience of your mind being blown without recourse to hallucinogens' Nicholas Lezard, *Guardian***

For most people, quantum theory is a byword for mysterious, impenetrable science. And yet for many years it was equally baffling for scientists themselves.

In this magisterial book, Manjit Kumar gives a dramatic and superbly-written history of this fundamental scientific revolution, and the divisive debate at its core. Quantum theory looks at the very building blocks of our world, the particles and processes without which it could not exist.

Yet for 60 years most physicists believed that quantum theory denied the very existence of reality itself.

In this tour de force of science history, Manjit Kumar shows how the golden age of physics ignited the greatest intellectual debate of the twentieth century.

Quantum theory is weird. In 1905, Albert Einstein suggested that light was a particle, not a wave, defying a century of experiments. Werner Heisenberg's uncertainty principle and Erwin Schrodinger's famous dead-and-alive cat are similarly strange. As Niels Bohr said, if you weren't shocked by quantum theory, you didn't really understand it.

While "Quantum" sets the science in the context of the great upheavals of the modern age, Kumar's centrepiece is the conflict between Einstein and Bohr over the nature of reality and the soul of science. 'Bohr brainwashed a whole generation of physicists into believing that the problem had been solved', lamented the Nobel Prize-winning physicist Murray Gell-Mann. But in "Quantum", Kumar brings Einstein back to the centre of the quantum debate. "Quantum" is the essential read for anyone fascinated by this complex and thrilling story and by the band of brilliant men at its heart.

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**Bibliography**

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### Editorial Review

From Publishers Weekly

Starred Review. With vigor and elegance, Kumar describes the clash of titans that took place in the world of physics in the early 20th century, between physicists who did and those who did not believe in the quantum—the strange concept that we now know to be the underpinning of reality. The titans in Kumar's account of the conflict are Albert Einstein and Niels Bohr. In 1900, Max Planck discovered that electromagnetic radiation and the energy of light are transmitted not in a continuous flow but in small packets called quanta (singular, quantum). Bohr applied the idea of quantum to electrons, leading to the development of quantum mechanics. Bohr's theory explained experimental results that were inexplicable in classical theory. Einstein rejected Bohr's theory overturning reality in dangerous but also thrilling ways. The clash culminated at the 1927 Solway conference. Kumar, founding editor of *Prometheus* and a consulting science editor for *Wired UK*, recounts this meaty, dense, exciting story, filled with vivid characters and sharp insights. With physics undergoing another revolution today, Kumar reminds us of a time when science turned the universe upside down. 16 pages of photos. (May)

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From [Booklist](#)

\*Starred Review\* “A first rate mind, extremely critical and far-seeing.” Einstein quickly sizes up the mental powers of Danish scientist Neils Bohr. How ironic that Bohr will demonstrate his farseeing vision most compellingly by discrediting Einstein’s own myopia! Kumar recounts Bohr’s astounding triumph over the great German theorist in their debate over quantum physics, thus illuminating a pivotal episode in modern physics. In that episode readers see how quantum mechanics integrates a range of promising but puzzling and seemingly disconnected subatomic discoveries. Readers see, for instance, how a cautious Max Planck reluctantly parcels light into discrete packets and how a befuddled Ernest Rutherford recognizes that only a radically new model of the atom can explain alpha-particle deflections. Though only specialists will understand the technical issues, Kumar keeps the main thread of his narrative accessible to the intelligent general reader, particularly clarifying how Einstein’s belief in objective reality pits him against the daringly agnostic Bohr, who leaves the mysteries of wave-particle duality veiled in statistical probabilities and abstract formulas. Intellectual exhilaration runs high as Einstein repeatedly presses Bohr—posing daunting questions about how to weigh an imaginary box of light and how to explain eerily “entangled” particles. The future of science hangs in the balance: physics becomes high drama. --Bryce Christensen

Review

Lively. . . . A wide-ranging account, written for readers who are curious about the theory but want to sidestep its mathematical complexities. . . . Fascinating. --New York Times Book Review

With vigor and elegance, Kumar. . . . recounts this meaty, dense, exciting story, filled with vivid characters and sharp insights. With physics undergoing another revolution today, Kumar reminds us of a time when science turned the universe upside down. --Publishers Weekly (starred review)

One of the best guides yet to the central conundrums of modern physics. --John Banville, Man Booker Prize winning author

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