

Citation

For pioneering work on quantum cryptography, and outstanding contributions to the advancement of modern quantum information theory as one of the founders

Dr. Charles H. Bennett

Position and Organization :

IBM Fellow and Research Staff Member
IBM Thomas J. Watson Research Center
International Business Machines Corporation

Doctorate : Ph.D. (Harvard Univ., 1971)

Date of Birth : April 7, 1943

Brief Biography :

1964 BA, Brandeis Univ.
1971 Ph.D., Harvard Univ.
1970 Argonne National Laboratory
1972 IBM Research
1995 IBM Fellow

Main Awards and Honors :

Fellow of the American Physical Society
1997 Member of the National Academy of Sciences
2006 Rank Prize
2008 Harvey Prize

Main Achievements :

Dr. Charles H. Bennett has concentrated on a re-examination of the physical basis of information, applying quantum physics to the problems surrounding information exchange. He has played a major role in elucidating the interconnections between physics and information, particularly in the realm of quantum computation, but also in cellular automata and reversible computing. With Gilles Brassard, he developed a method for sending messages with secrecy guaranteed by quantum physics. Bennett is one of the founders of quantum cryptography and quantum information theory, contributing many core ideas.

He was born in 1943, the son of music teachers, and attended Croton-Harmon High School, Brandeis University (BA, 1964), and received his Ph.D. from Harvard in 1971 for molecular dynamics studies (computer simulation of molecular motion) under the late David Turnbull, continuing this research as a postdoctoral researcher under the late Aneesur Rahman at Argonne National Laboratory.

Since coming to IBM Research in 1972, he has worked on various aspects of the relation between physics and information. In 1973, building on the work of IBM's late Rolf Landauer, he showed that computations can be performed by a logically and thermodynamically reversible apparatus, and in principle can be performed with arbitrarily little energy dissipation per step. In 1982 he proposed the currently accepted resolution of the Maxwell's demon paradox, attributing the demon's inability to violate the Second Law to the thermodynamic cost of destroying, rather than acquiring, information.

In collaboration with Gilles Brassard of the University of Montreal he developed a practical system of quantum cryptography (BB84), and with the help of their students built a working demonstration of it in 1989.

In 1993 Bennett and Brassard, in collaboration with Claude Crepeau, Richard Jozsa, Asher Peres, and William Wootters, discovered "quantum teleportation," an effect in which the complete information in an unknown quantum state is decomposed into purely classical information and purely quantum correlations (entanglement), sent through two separate channels, and later reassembled in a new location to produce an exact replica of the original quantum state that was destroyed in the sending process. In 1995-7, working with Smolin, Wootters, IBM's David DiVincenzo, and other collaborators, he helped found the quantitative theory of entanglement and introduced several techniques for faithful transmission of classical and quantum information through noisy channels. These techniques, together with quantum teleportation, became the basic building blocks for quantum information processing, and especially fault tolerant quantum computation.

With IBM colleagues DiVincenzo, Linsker, Smolin, and Donkor he devised practical methods using physical interactions to protect audio/visual and other recordings of real-time processes from falsification, pre-, or post-dating.

Bennett is an IBM Fellow, a Fellow of the American Physical Society, and a member of the US National Academy of Sciences. He is a recipient of the Rank Prize, the Harvey Prize, and hold honorary doctorates from Masaryk University, University of Gdansk, University of Bristol, and ETH-Zurich.

For pioneering work on quantum cryptography, and outstanding contributions to the advancement of modern quantum information theory as one of the founders, Dr. Charles H. Bennett is hereby awarded the Okawa Prize.

He is married with three grown children and six grandchildren. His wife is retired from having directed a housing mobility program in Yonkers, New York. His main hobbies are photography and music.