Quantum Physics, Public and Private Information, and the Lost Literature of Antiquity

Speaker: Professor Charles Bennett
IBM, USA

Date: Thursday, 29 August 2013

Time: 6:30 pm - 7:30 pm

Venue: LT33, Block S17, Level 2
Faculty of Science
National University of Singapore
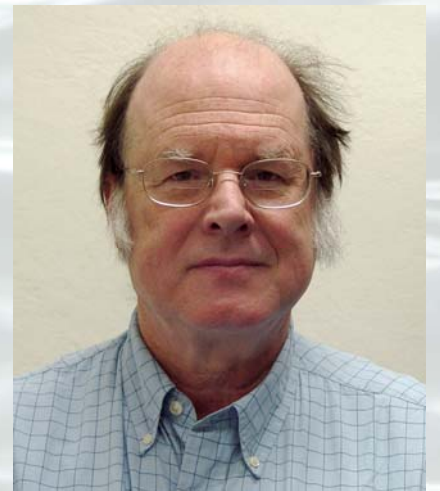10 Lower Kent Ridge Road
Singapore 119076

Free Admission

Abstract

Quantum information theory provides a coherent picture of the emergence and decay of correlations, even in macroscopic systems exhibiting few traditional quantum hallmarks. It helps explain why the future is more uncertain than the past, and how some information remains private or is quickly forgotten, while other information becomes ever more public and durable. The most evanescent information, such the path of a particle in the famous two-slit experiment, may best be viewed as never having existed. Less private kinds of information include classical secrets, facts known only to a few, or information---like the lost literature of antiquity---that once was public but has been forgotten over time. Finally there is information that has been replicated and propagated so widely as to be infeasible to conceal and unlikely to be forgotten. Modern information technology has caused a proliferation of such information, eroding personal privacy while at the same time deterring crime and tyranny. It might seem that whenever information is amplified to the point of becoming macroscopic and classical, it becomes permanent and ineradicable. But we argue that most once-classical information about the past---for example the pattern of drops in last week's rainfall---escapes from the earth in outgoing radiation, becoming nearly as ambiguous, from a terrestrial perspective, as the path of an unobserved particle.

About the Speaker

Charles H. Bennett was born in 1943, the son of music teachers. He received his PhD from Harvard in 1971.
In 40 years at IBM Research Division he has worked on various aspects of the relation between physics and information. In 1973, building on the work of IBM's Rolf Landauer, he showed that general-purpose computation can be performed by a thermodynamically reversible apparatus that avoids throwing away information about past logical states; and 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, allowing secure communication between parties who share no secret information initially, and with the help of John Smolin 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," in which the complete information in a system is decomposed into a classical message and quantum entanglement, then reassembled from these ingredients in a new location to produce an exact replica of the original quantum state that was destroyed in the sending process.
Lately he has become interested in the emergence of classical correlations and computationally complex behavior from quantum laws, arguing that thermal disequilibrium is necessary for this emergence, and that most classical information created on earth, e.g. the pattern of sand grains on a beach, is transient, eventually escaping into space as thermal radiation.
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, the Okawa Prize, and four honorary doctorates. He is married with three grown children and seven grandchildren. His hobbies are photography and music.

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