

Honorary Doctor of Science

Professor Alain ASPECT

Citation written and delivered by Professor LU Jian

Chancellor:

It was one of his most treasured books growing up. In *Mysterious Island* by Jules Verne, a group of enterprising engineers and scientists become trapped on a forbidding desert island but together they develop an efficient society based on their knowledge of mathematics, physics, chemistry and geology. Professor Alain Aspect read that book again and again, as only children can, relishing the adventure and the science.

The mystery and adventure of scientific exploration has stayed with Professor Aspect throughout his life. Although he didn't grow up in a particularly "scientific" household – both his parents were elementary school teachers – they shared a deep sense of rationality when approaching the world, something that Professor Aspect in turn shares with his wife, a chemist, and his two children, one of whom is an engineer and the other a medical doctor.

As with any mystery, you need a leap of faith if you are going to reach a solution. The area of science that Professor Aspect works within requires such a leap. Quantum mechanics is a discipline that even Professor Aspect admits is "outrageously counterintuitive" and can leave the most insightful of researchers scratching their heads.

Professor Aspect's most well-known experiments, for laypeople at least, confirmed in 1982 that "quantum entanglement" for twinned photon pairs was an irrefutable phenomenon. He showed that the quantum correlations observed in a pair of entangled system are beyond what can be understood by any usual explanation borrowed from the usual science.

For those not familiar with this area of physics, Professor Aspect explains entanglement by imagining twins living thousands of miles apart. The colour of their eyes is undetermined between blue and brown until the moment when you check.

If you find that one of the twins has brown eyes, then the eyes of the other twin, which were undecided, instantly turn brown, too.

Professor Aspect says this phenomenon is what happens to photons, and the term used is “quantum non-locality”. It means that whatever you do to an entangled photon will instantly affect its buddy photon, which could be billions of light years away.

How is this possible? That’s the key question. Even Einstein called quantum mechanics “spooky” in the way two entities appear to share the same properties and behaviour despite huge separating distances.

A professor at the Institut d'Optique Graduate School (Université Paris-Saclay) and at École Polytechnique, Professor Aspect graduated from École Normale Supérieure de Cachan (today Ecole Normale Supérieure de Paris Saclay) and passed his “Agrégation” in physics in 1969. He received his master’s degree from Orsay University in 1971 and his PhD from Orsay in 1983.

Following his groundbreaking work in 1982 on entangled photons, Professor Aspect went on to become the first physicist, together with Professor Philippe Grangier, to produce “heralded” single photons, i.e. single photons at identifiable moments, and showed that a single photon could be at two places at the same time.

Professor Aspect and his colleagues Dr John F. Clauser and Professor Anton Zeilinger won the Wolf Prize for Physics in 2010 for their work on the fundamental conceptual and experimental contributions to the foundations of quantum physics, and in 2012 Professor Aspect won the Einstein Medal of the Albert Einstein Society and the Niels Bohr Gold Medal for his explorations of the existence of entangled quantum states. In 2005, for his research into the field of quantum optics and atomic physics, Professor Aspect received the CNRS Gold Medal, the highest distinction for a researcher in France, in any field. His work has contributed immensely to settling the famed Einstein–Bohr debates, still considered to be among the pinnacles of intellectual thought in the philosophy of science.

These awards show that the scientific community now recognises that investigating the basic concepts of quantum physics has not been a waste of time, which was the prevailing attitude in 1974 when Professor Aspect started his research.

“We know that quantum mechanics works. Why waste your time checking it?” he was asked. But scientists who have invented and developed quantum information in recent decades are physicists who realised that entanglement is really different, and worthy of study.

City University of Hong Kong has benefited greatly from Professor Aspect’s work. He treated Hong Kong audiences to a fascinating talk as part of the France–Hong Kong Distinguished Lecture Series in 2017 with his talk titled “From the Einstein–Bohr Debate to Quantum Information: a New Quantum Revolution”. Not only that, as Senior Fellow at the Hong Kong Institute for Advanced Study (IAS) at City University of Hong Kong, he regularly flies from his home in France to work with us on matters related to quantum science and technology. His interactions with IAS enhance excitement about research on campus, which helps to spread the values of scientific knowledge in an era when such knowledge is vital for solving many of the challenges facing our planet.

Madam Chancellor, in recognition of Professor Alain Aspect’s extraordinary contributions to scientific enquiry and intellectual thought in areas such as quantum science, I request City University of Hong Kong to confer upon him the award of a Doctor of Science, *honoris causa*.