From multi-particle interference to quantum computers

Artur Ekert
Oxford, UK

The theory of classical universal computation was laid down in 1936, was implemented within a decade, became commercial within another decade, and dominated the world's economy half a century later. Quantum information technology is a fundamentally new way of harnessing nature. It is too early to say how important a way this will eventually be, but we can reasonably speculate about its impact on computation and data security. Quantum computers use the quantum interference of different computational paths to enhance correct outcomes and suppress erroneous outcomes of computations. A common pattern underpinning quantum algorithms can be identified when quantum computation is viewed as multi-particle interference. I will use this approach to explain the basic concepts of quantum computation and review some of the new developments in the field.