

## **From Einstein's intuition to quantum bits: a new quantum age?**

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In 1935, with co-authors Podolsky and Rosen, Einstein discovered a weird quantum situation, where particles in a pair are so strongly correlated that Schrödinger called them “entangled”. By analyzing that situation, Einstein concluded that the quantum formalism was incomplete. Niels Bohr immediately opposed that conclusion, and the debate lasted until the death of these two giants of physics.

In 1964, John Bell produced the famous inequalities that have allowed experimentalists to settle the debate, and to show directly that the revolutionary concept of entanglement is indeed a reality.

Based on that concept, a new field of research has emerged, quantum information, where one uses quantum bits, the so-called “qubits”. In contrast to classical bits, which are either in state 0 or state 1, qubits can be simultaneously in state 0 and state 1. Entanglement between qubits enables conceptually new methods for processing and transmitting information. Large scale practical implementation of such concepts might revolutionize our society, as did the laser, the transistor and integrated circuits, some of the most striking fruits of the first quantum revolution, which began with the 20th century.