The age of quantum information

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Today's computers, which are based on classical mechanics, process information coded in long streams of 1s and 0s.

Computers have become faster and faster at processing these values over recent decades but a new report, The age of the qubit: A new era of quantum information in science and technology, published today, Thursday 15 September, by the Institute of Physics (IOP) explains how physicists are working towards computers that can deal with more than one value at a time and force a paradigm shift in the speed and power of computers.

Excitement was first stirred in the early 1980s when Richard Feynman, the Nobel-Prize winning American quantum physicist, suggested exploiting quantum interactions to carry information.

The advantage of using quantum interactions is that, once controlled and encoded, the quantum states of electrons and photons are capable of carrying exponentially more information than any system in classical mechanics.

Due to quantum states and the probabilistic nature of quantum mechanics, bits of quantum information (qubits) are not just a long line of 1s and 0s being processed one at a time, but rather bundles of 1s and 0s that can be processed all at the same time.

IOP's report on quantum information processing includes examples of research teams, many of which are based in the UK, who are now

grappling with ways to increase the lasting-power (or coherence) of fragile qubits which are known to collapse when they interact with the environment.

While the long-term goal of the first quantum computer is still at least a couple of decades away, the research has spun-off exciting advances in other areas, not least in secure communication.

Quantum cryptography – based on entangled quantum states – was used at the World Cup in South Africa and is being picked up by banks around the world, and other security conscious entities, for the secure sharing of data.

Professor Sir Peter Knight, incoming President of IOP, said, "This booklet is the perfect guide to anyone interested in the future potential of quantum information, the nature of the challenges faced by those working towards a quantum computer, and the contemporary gains we're already reaping from the research undertaken over the past couple of decades."

Provided by Institute of Physics