Quantum computing on an everyday PC

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Scientists have successfully simulated a collision of two laser beams from an atom laser using an everyday desktop computer.

Professor Peter Drummond, from the Australian Research Centre of Excellence for Quantum-Atom Optics at The University of Queensland, and Dr Piotr Deuar, from Van der Waals Zeeman Institute in Holland, have achieved this using an everyday PC rather than a supercomputer.

“Such raw calculations have commonly been assumed intractable, once the number of atoms approaches even a few dozen,” Professor Drummond said.

“This is because the complexity of the mathematical description grows rapidly with the number of atoms.”

The research recently appeared in the prestigious US journal *Physical Review Letters* receiving an editor's commendation as being of special interest.

“Up until now, approximations have been essential in obtaining any predictions for macroscopic quantum mechanical systems, like lasers or superconductors,” Professor Drummond said.

“We have now succeeded in simulating the collision of two beams from an atom laser, each with hundreds of thousands of particles.

“This is a major accomplishment, because one of the main arguments

for the task of developing quantum computers has been that they might be able to tackle this type of problem, if built.

“The method used is to randomly sample the complexity of moving between adjacent points in time with a specially tailored "random walk", rather than following all the tiny details.

Professor Drummond said there was a catch though, with the randomness eventually swamping everything and the simulation must be stopped.

“However, the time before this happens is long enough to discover the way that large numbers of atoms interact at ultra-low temperatures,” he said.

“Since quantum computers are still in the future, the approach of using smarter computer software on existing computers seems the only way to make progress on such frontier problems in physics at the present time.”

Professor Drummond said the resulting predictions are being tested in the latest experiments underway in Paris and at The Australian National University.

Source: University of Queensland