U of Toronto experiment named top breakthrough of 2011 by Physics World

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Aephraim Steinberg and colleagues at the Centre for Quantum Information and Quantum Control at the University of Toronto had the top physics breakthrough of the year according to *Physics World* magazine.

Steinberg led an international team in applying a modern measurement technique to the historical two-slit interferometer experiment in which a beam of light shone through two slits results in an interference pattern on a screen behind. That famous experiment and the 1927 debates between Niels Bohr and Albert Einstein, seemed to establish that you could not watch a particle go through one of two slits without destroying the interference effect: you had to choose which phenomenon to look for. Thus the quantum mechanics quandary: how can we know reality if we cannot measure it without distorting it?

With their new experiment, Steinberg's group did what the physics textbooks said was impossible. They succeeded in experimentally reconstructing full trajectories which provide a description of how light particles move through the two slits and form an interference pattern. Their description of the experiment was published in *Science* and resulted in coverage by the world's science media, including a feature in *Physics World*.

"By applying a modern measurement technique to the historic experiment, we were able to observe the average particle trajectories undergoing wave-like interference, which is the first observation of its

kind. This result should contribute to the ongoing debate over the various interpretations of quantum theory," said Steinberg. "It shows that long-neglected questions about the different types of measurement possible in quantum mechanics can finally be addressed in the lab, and weak measurements such as the sort we used in this work may prove crucial in studying all sorts of new phenomena."

With regards to the being named top breakthrough of the year, Steinberg said, "When I was a graduate student, I told a mentor of mine that I was perplexed and fascinated by quantum mechanics and wished to spend my career studying it. He nodded and replied, 'That's all right in a young physicist – hopefully you'll grow out of it.' So what pleases me most about this honour is how much times have changed. *Physics World* is recognizing the study of the foundations of quantum mechanics as a respectable, even important endeavour. I hope that lifting taboos about what questions one can still ask will lead to continued discoveries about the implications of quantum mechanics and perhaps in the long term even new applications, as has been the case in the realm of quantum information processing."

More information: http://physicsworld.com/cws/article/news/46193

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