Joel Morley and Robert Flack

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Joel Morley and Robert Flack
University College London, UK

Observing the average trajectories of particles in a double slit interferometer

The 1988 work on weak values by Aharonov et al, introduced a new kind of quantum variable [1]. This created new perspectives when it came to the limits of quantum uncertainty. More recently, Kocsis et al [2] had used these techniques experimentally, claiming to have reconstructed the trajectories of photons after passing through an interferometer. This was done without destroying the interference pattern, an act apparently forbidden by standard quantum mechanics. We aim to replicate Kocsis experiment using atoms. A ready made magneto-optical trap can routinely cool and trap, metastable argon atoms to the mK range[3]. The ultra-cold temperatures offers particles with a large De Broglie wavelength. Here we present our intended method of reconstructing the atoms trajectories, while maintaining the interference pattern, as they fall below the slits.

[1] Y. Aharonov, D. Z. Albert, L. Vaidman, Phys. Rev. Lett. 60, 1351-4 (1988)
[2] S. Kocsis et al., Science, 332, 1170-73 (2011)
[3] P. Edmunds, P. Barker, Phys. Rev. Lett. 113, 183001 (2014)

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