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Suppression and Revival of Weak Localization of Ultra-Cold Atoms by Manipulation of Time-Reversal Symmetry¹

ALAIN ASPECT, Institut d'Optique Palaiseau

In the early 1980's, observation of a magneto-resistance anomaly in metallic thin films was attributed to the phenomenon of weak localization of electrons and to time-reversal symmetry breaking due to a magnetic field acting upon charged particles. We have observed weak localization of ultra-cold atoms in a 2D configuration, placed in a disordered potential created by a laser speckle. In order to manipulate time-reversal symmetry with our neutral atoms, we take advantage of the slow evolution of our system, and we observe the suppression and revival of weak localization when time reversal symmetry is cancelled and reestablished. References: K. Muller, J. Richard, V. V. Volchkov, V. Denechard, P. Bouyer, A. Aspect, and V. Josse, "Suppression and Revival of Weak Localization through Control of Time-Reversal Symmetry," *Physical Review Letters* 114 (20) (2015) and references in.

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