

Quantum Walks Disprove Theories Based on Classical Trajectories

Monday, 23 March 2015 12:15 (45 minutes)

We report on a stringent test of the nonclassicality of the motion of a massive quantum particle, which propagates on a discrete lattice. Measuring temporal correlations of the position of single atoms performing a quantum walk, we observe a 6σ violation of the Leggett-Garg inequality. Our results rigorously excludes (i.e., falsifies) any explanation of quantum transport based on classical, well-defined trajectories. We use so-called ideal negative measurements—an essential requisite for any genuine Leggett-Garg test—to acquire information about the atom's position, yet avoiding any direct interaction with it.

Reference

C. Robens, W. Alt, D. Meschede, C. Emary, and A. Alberti, Ideal Negative Measurements in Quantum Walks Disprove Theories Based on Classical Trajectories, *Phys. Rev. X* 5, 011003 (2015).

Presenter: ALBERTI, Andrea (University of Bonn)

Session Classification: Quantum interferometry