

Joint Quantum Institute Seminar
April 7, 2008 at 12:30
Physics 1201

**“Quantum Walks on Circles in Phase Space via
Cavity QED”**

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We show how a quantum walk in phase space can be implemented via cavity quantum electrodynamics where only the cavity field (i.e. the walker) needs to be driven and measured; the atom is indirectly controlled via Jaynes-Cummings coupling. Decoherence can be tuned so the transition from quantum to classical walk can be observed, which provides confirmation of the quantum nature of the walk. In contrast to previous proposals for cavity quantum electrodynamic realizations, the walker (i.e. the cavity field) is not confined to one circle in phase space (i.e. fixed mean energy) but rather leaps to other circles in phase space. Despite this complication, the quantum enhancement of walker diffusion can be cleanly observed and rigorously explained, thereby enabling the first experimental realization of a single-walker quantum walk. Two implementations are discussed: a realization in cavity quantum electrodynamics and an alternative using superconducting circuit quantum electrodynamics with a Cooper Pair Box.

Collaborators: Peng Xue (Calgary) and Alexandre Blais (Sherbrooke).

Host UMD: Luis Orozco