Quantum search algorithm with many bosons in optical lattices

DAVID FEDER, University of Calgary — One approach to implementing quantum algorithms is the quantum walk (QW). In the continuous-time formulation, the QW is equivalent to the time-evolution of a quantum state under the influence of a discrete-space Hamiltonian. Building on a duality between many boson systems and weighted graphs, I will discuss how one can implement a QW search algorithm with ultracold bosons confined in optical lattices. By applying a specified external potential (using an external laser), the atoms in a shallow lattice will evolve from the uniformly populated ground state to all occupying one particular site. The results indicate that quantum algorithms exhibiting polynomial speed-up should be feasible with current experimental technology.