UHM High Energy Physics Seminar

Quantum lattice gas algorithmic representation of gauge field theory

by Prof. Jeffrey Yepez (University of Hawaii)

Tuesday, 20 September 2016 from **15:00** to **16:00** (Pacific/Honolulu)
at Watanabe (112)

Description In this talk I present a quantum lattice gas algorithm to efficiently model a system of Dirac particles interacting through an intermediary gauge field. The algorithm uses a fixed qubit array to represent both the spacetime and the particles contained in the spacetime. Despite being a lattice based algorithm, Lorentz invariance is preserved down to the grid scale, with the continuum Dirac Hamiltonian generating the local unitary evolution even at that scale: there is nonlinear scaling between the smallest observable time and that time measured in the quantum field theory limit, a kind of time dilation effect that emerges on small scales but has no effect on large scales. The quantum lattice gas algorithm correctly accounts for the anticommutative braiding of indistinguishable fermions---it does not suffer the Fermi-sign problem. It provides a highly convergent numerical simulation for strongly-correlated fermions equal to a covariant path integral, presented here for the case when a Dirac particle's Compton wavelength is large compared to the grid scale of the qubit array.

A preprint of this work may be found at https://arxiv.org/abs/1609.02225 .