ulm university universität
uulm

Einladung
zum
Physikalischen Kolloquium

Montag, 31.10.2011
16:15 Uhr in N24/H13

Professor Giacomo Mauro D'Ariano

Foundations of Quantum Mechanics and Quantum Optics
Dipartimento di Fisica „A Volta", Pavia, Italien

A Quantum-Digital Universe
Quantum Cellular Automata approach to
Quantum Field Theory: a proposal

Can Reality be simulated by a Quantum Computer? Is Reality made of something more than interacting quantum systems? In this talk we will explore the idea of replacing quantum field theory by a giant quantum computation, i.e. an underlying Planck-scale Quantum Cellular Automata (QCA). I will illustrate mechanisms of emergence of physics from the QCA in 1+1 dimensions. We will see that Dirac's is just the equation describing the free flow of information, leading to an informational definition of inertial mass and Planck constant. I will then illustrate the emergence mechanism of Minkowsian space-time from the QCA, how the field Hamiltonian comes out, and how quantum fields are actually eliminated in favor of qubits, leaving a theory that is quantum ab-initio. For larger dimensions ancillary qubits are needed playing the role of an associated Majorana field. The digital nature of the field leads to an in-principle observable consequences, e.g. a mass-dependent refraction index of vacuum---a general feature due to unitariety in the discrete.

Ab 15.45 Uhr Kaffee, Tee und Kekse vor dem Hörsaal H13

Organisation: **Prof. Marti, Tel.: 23011**
Dr. Retzker, Tel.: 22902
Host: **Prof.Calarco, Tel.: 22832**