

Theory CANADA 4 Conference
Conférence Théorie CANADA 4
4-7 June/Juin, 2008

Quantum Graphity: A Model of Emergent Locality

Fotini MARKOPOULOU
Perimeter Institute for Theoretical Physics
University of Waterloo
35, King St. N.
Waterloo, Ontario N2J 2W9
CANADA

fotini@perimeterinstitute.ca

Abstract

Quantum graphity is a background-independent model for emergent macroscopic locality, spatial geometry and matter. The states of the system correspond to dynamical graphs on N vertices. At high energy, the graph describing the system is highly connected and the physics is invariant under the full symmetric group acting on the vertices. We present evidence that the model also has a low-energy phase in which the graph describing the system breaks permutation symmetry and appears to be ordered, low dimensional and local. Consideration of the free energy associated with the dominant terms in the dynamics shows that this low-energy state is thermodynamically stable under local perturbations. The model can also give rise to an emergent $U(1)$ gauge theory in the ground state by the string-net condensation mechanism of Levin and Wen. We also reformulate the model in graph-theoretic terms and compare its dynamics to some common graph processes.