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Brownian-huygens propagation: Discrete local random-walk extensions that perfectly replicate the wave equations of QFT, and their relevance to feynman's information density paradox

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We discuss the recent discovery of simple extensions of (branching) random walks on random graphs -- for which particle phases are solely plus or minus one (representing particles and antiparticles, respectively) -- and whose net expected particle density satisfies the classical wave equation and Klein-Gordon equation in the continuum limit, in any number offdimensions. Such systems easily generate quasi-probability densities that are positive for sufficiently macroscopic scenarios (but which may be negative at microscopic scales, as with Wigner's quasi-probabilities, thereby circumventing the restrictions associated with Bell's inequality).

The discreteness of the model in space, time and phase allows for the resolution of an information-density paradox posed by Feynman with regard to standard quantum field theories.

We also discuss some peculiarities of this model alongside their counterparts in standard QFT -- in particular, momentary violations of the Pauli Exclusion Principle for wavefunctions where the principle has been mandated, even in the absence of gravity or any other outside field interactions, suggesting comparable instances of zero-gravity fermion-to-boson collapse in standard theories at sufficiently small distances.

Biography

Hrvoje J. Hrgovčić received his PhD in physics from the Massachusetts Institute of Technology, studying under Tommaso Toffoli at the Information Mechanics group (founded by Ed Fredkin) at MIT's Laboratory for Computer Science.