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# STRUCTURES JOUR FIXE

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“Probabilistic Cellular Automata for  
Fermionic Quantum Field Theories“

November 25, 2022 1:30 PM

**HYBRID:** Great lecture hall in Philosophenweg 12 and  
Zoom. Meeting ID: 935 6549 3662, Code: 928036  
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## ABSTRACT

Occupation numbers of fermions take the values zero or one - they can be associated with the bits of an automaton. The updating of a probabilistic automaton is characterised by a step evolution operator acting on a wave function, whose square is the probability distribution for bit configurations. Certain discretised fermionic quantum field theories have the same evolution operator and wave function as a suitable automaton. All observables are identical to the ones of the probabilistic automaton. This identifies a genuine quantum theory with a classical probabilistic theory, with far reaching conceptual consequences. All quantum laws or axioms follow from classical probability theory. We describe explicitly automata for simple fermionic models with interactions in two dimensions. The map to an automaton may provide a new access to non-equilibrium quantum field theory for fermions.

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