CATEGORIES OF QUANTUM AUTOMATA AND N–LUKASIEWICZ ALGEBRAS IN RELATION TO DYNAMIC BIO-NETWORKS, (M,R)-SYSTEMS AND HIGHER DIMENSIONAL ALGEBRA §V2

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1. Abstract

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Key words and phrases. Quantum Automata Category, Quantum Computation and Higher Dimensional Algebra; Quantum Logics and n-Lukasiewicz Logic Design of Quantum Automata; Technological Realization of Quantum Automata and Quantum Computers with n-Lukasiewicz VLSI boards; Generalized (M,R)-Systems, Dynamic Bio-Networks in Categories, via Functors and Natural Transformations; Quantum Double Groupoids and 2-Categories of Quantum Automata and Quantum Computers; Universal Properties/ Bicompleteness of Quantum Automata Category; Bio-simulation 'No-Go' Theorem for Closed Quantum Automata.

Abstract.

Universal decomposition, performance and categorical properties will be presented for *quantum automata* in the form of three new theorems for the category of quantum automata [1][1], *quantum computers* [2] , $Q_{a,c}$, and their related quantum logics based on an extension of *n-Lukasiewicz algebra* [3] as well as their applications [4]. The category of quantum automata and quantum computers is first defined, and then a complete proof is provided for the existence of unique limits and colimits in this category. Both the new category of quantum automata and the category of Boolean automata (abstract sequential machines) are therefore *bicomplete*. However, as expected from standard quantum theory, the objects in $Q_{a,c}$, have associated Hilbert spaces with quantum operator algebras suitable for quantum computations. New definitions are, therefore, introduced for the *quantum groupoid state–space* [5] and the operator algebra of a quantum automaton and quantum computer. These novel concepts are then compared with generalized, dynamic bio-networks of self-organized metabolic– replication– duplication (Enzyme-RNA-DNA =: **Generalized (M,R)–systems** in refs. [6], [7], [8] and [9]) that are considerably more complex than a 'thermodynamically closed', quantum automaton. The important question of bio-simulation and modelling (refs. [10]–[11]) using quantum computations is also here addressed, and a 'no-go' conjecture regarding the impossibility of completely simulating open, complex bio-network systems by subcategories of closed quantum automata is put forward. The possible extensions of quantum automata categories to higher dimensions through *2-categories* [12] of double groupoid [13] quantum automata, their functors and natural transformations of such functors are proposed together with the suggestion of several, potential realizations through technological implementation of quantum automata and quantum computers by n-Lukasiewicz logic designs based on existing *n-Lukasiewicz VLSI* boards and /or *nano-automata* [14].

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