Constructive Symmetry Breaking

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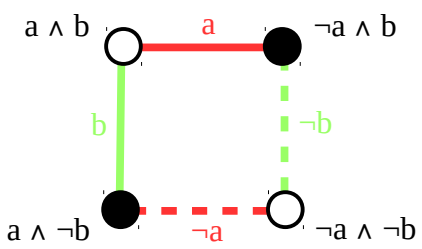
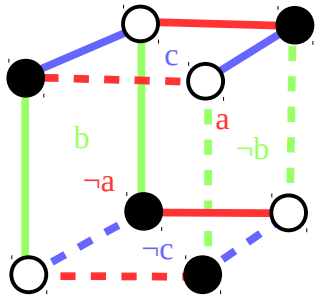
In this paper I introduce a conjecture that intrinsic constraints of constructive mathematical languages leads to symmetry breaking in all computational theories of physical particles using simple primitives.

A proof in Propositional Logic[1] might be thought of as assigning the value `true` to every vertex in a hypercube. However, when comparing Propositional Logic with Constructive Logic[2], one can encode the information of proofs on the hypercube in a different way, along hypersurfaces instead of vertices:





3D or higher are Adinkra diagrams due to odd parity of 4-cycles

A hypersurface associated with a variable is 1 dimension less than the dimension of the hypercube. When assigning a unique variable and its opposite to each hypersurface, one gets an Adinkra diagram[3].

Adinkra diagrams are used to represent equations of supersymmetry in particle physics.
Each loop around the edges of a square in the graph has odd parity.
This is because each hypersurface is uniquely associated with a variable.

This way of encoding information onto hypersurfaces of a hypercube contains redundant information. In Propositional Logic, one can prove `¬¬a` from `a`, therefore when the hypersurface `a` is associated with a truth value, for example `true`, one can derive that the truth value of `¬a` is `false`.

However, in Constructive Logic, there is no double negation elimination. This means that the truth value of `¬a` can not be derived from the truth value of `a`. With other words, information encoded on the hypersurface associated with `a` can not be used to fully determine information encoded on the hypersurface associated with `¬a`.

There is a deep theorem about constructive logic and computer programs, which is called the Curry-Howard correspondence[4]. This means that types are theorems and programs are proofs. Constructive logic puts a constraint on which programs that can be constructed.

In Path Semantics[5], the core axiom implies that all mathematical languages have constraints of associations. It is imaginable that computation itself of physical particles will be constrained when the entire theory is using the same primitives for computation, like the hypergraphs in Wolfram Physics[6].

Conjecture: Interpreted in the context of foundations of physical particles, supersymmetry will be broken in constructive mathematical languages, independent of the rules used to describe the models.

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