

Non-Commutative Geometry, Non-Associative Geometry and the Standard Model of Particle Physics

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Connes has developed a notion of non-commutative geometry (NCG) that generalizes Riemannian geometry, and provides a framework in which the standard model of particle physics, coupled to Einstein gravity, may be concisely and elegantly reformulated. We point out that his formalism may be recast in a way that generalizes immediately from non-commutative to non-associative geometry. In the process, several of the standard axioms and formulae are conceptually reinterpreted. This reformulation also suggests a new constraint on the finite NCG corresponding to the standard model of particle physics. Remarkably, this new condition resolves a long-standing puzzle about the NCG embedding of the standard model, by eliminating from the action a collection of 7 unwanted terms that previously had to be removed by assumption.