

Abstract

The three main evolutions of physics in the twentieth century have a suggestive family resemblance. Each introduces a new kind of non-commutativity. The new non-commutativity in special relativity was that of boosts, in general relativity and the standard model gauge theories that of infinitesimal translations, and in quantum theory that of filter operations. The seminal work of Segal, which stimulated the present work, pointed out that further changes of this kind are necessary for stability and suggested one. Our main goal is finiteness, not stability, but the stabilizing changes Segal suggested lead ultimately to a finite quantum theory, including one of spacetime. Such a theory has been sought by physicists since the formulation of quantum theory.

By gently modifying the commutation relations of an existing quantum theory one produces a simpler theory with the existing quantum theory as a suitable limiting case, and with nearly the same continuous symmetries.