Quantum Double and Kappa Poincaré Symmetries in 3d Gravity and Chern-Simons Theory

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Abstract

We discuss the role of classical and quantum doubles and kappa-Poincaré symmetries in 3d gravity with general cosmological constant and in Chern-Simons gauge theory.

Kappa-Poincaré symmetries have been investigated as possible symmetries of quantum gravity. While their status in four dimensions remains unclear, in three dimensions it is possible to determine explicitly if these symmetries are compatible with classical or quantised gravity. We show that, unlike the classical and quantum double symmetries which arise canonically, kappa-Poincaré symmetries are not compatible with the Chern-Simons formulation of 3d gravity. Instead, they arise in a Chern-Simons theory based on the same gauge group but with a different action. We discuss how this fact can be used to construct models with several interacting particles which exhibit kappa-Poincaré symmetries.