

The spin foam lectures

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Abstract

The lectures will explain the construction of state sum models in dimensions 1,2,3 and 4 that determine topological quantum field theories and quantum gravity models. The lectures will start by explaining the famous Ponzano-Regge model of quantum gravity in dimension 3, and explore both the mathematical formalism and the physical results of the theory, including the asymptotic formula. There will be a lecture devoted to the extension of the theory to quantum gravity models in 4-dimensional space-time, explaining the progress made and the current difficulties. Then the lectures will return to the issue of observables and defects in the models, by which method coupling to matter fields is incorporated. The methods will be illustrated by introducing the simpler state sum models in dimensions 1 and 2 that model Dirac fermions on a circle and defect lines in two-dimensional Yang-Mills theory.