



Contribution ID: 22

Type: **not specified**

Massive spinning fields in 3d quantum gravity

Thursday, 19 December 2024 15:20 (30 minutes)

While understanding the consequences of quantising gravity remains an ongoing challenge, valuable insights have been gained by considering models in lower dimensions. In particular, I shall focus on Einstein gravity in 2+1d, which is known to be related to Chern-Simons theories, with a gauge group dependent on the sign of the cosmological constant. Unlike in 3+1d where gravitational waves are an important feature, Einstein gravity in 2+1d is a topological theory. Despite this, the theory retains a number of interesting features present in 3+1d gravity, such as the (potentially spinning) BTZ black hole. In this talk I will review the connection between 2+1d gravity and Chern-Simons theory, both in the classical and quantum cases. I will then discuss some recent work which focuses on how massive matter fields on the gravitational side may be included in the Chern-Simons construction.

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Session Classification: Gravity and Black Holes