MP 4: Gravitation

Time: Tuesday 16:30–17:10 Location: SPA SR125

MP 4.1 Tue 16:30 SPA SR125

Observer dependent background geometries — •Manuel Hohmann — Tartu University, Estonia

Various approaches to quantum gravity suggest a breaking of general covariance or local Lorentz invariance via the introduction of preferred foliations of spacetime or preferred timelike vector fields. Physical quantities may then obtain a non-tensorial dependence on the observer performing their measurement. We discuss observer dependent geometries which may serve as backgrounds for physical theories, in particular for gravity, and can be described in the languages of Finsler and Cartan geometry.

MP 4.2 Tue 16:50 SPA SR125

Spectral dimension of quantum geometries — •Johannes Thürigen[1], Daniele Oriti[1], and Gianluca Calcagni[2] — [1]MPI für Gravitationsphysik, Potsdam — [2]CSIC Madrid

The spectral dimension is an indicator of geometry and topology of spacetime and a tool to compare the description of quantum geometry in various approaches to quantum gravity. This is possible because it can be defined not only on smooth geometries but also on discrete (e.g., simplicial) ones. In this paper, we consider the spectral dimension of quantum states of spatial geometry defined on combinatorial complexes endowed with additional algebraic data: the kinematical quantum states of loop quantum gravity (LQG). Preliminarily, the effects of topology and discreteness of classical discrete geometries are studied in a systematic manner. We look for states reproducing the spectral dimension of a classical space in the appropriate regime. We also test the hypothesis that in LQG, as in other approaches, there is a scale dependence of the spectral dimension, which runs from the topological dimension at large scales to a smaller one at short distances. While our results do not give any strong support to this hypothesis, we can however pinpoint when the topological dimension is reproduced by LQG quantum states. Overall, by exploring the interplay of combinatorial, topological and geometrical effects, and by considering various kinds of quantum states such as coherent states and their superpositions, we find that the spectral dimension of discrete quantum geometries is more sensitive to the underlying combinatorial structures than to the details of the additional data associated with them.