MP 6: Quantenfeldtheorie I

Time: Wednesday 9:30–10:30 Location: HFT-FT 101

MP 6.1 Wed 9:30 HFT-FT 101

Twisted spectral triple for the standard model — •Pierre Martinetti — Università di Trieste

Because the Higgs mass is below 130 GeV, there is an instability in the electroweak vacuum which might be problematic for the coherence of the standard model of elementary particles. The stability can be restored by assuming there is another scalar field, suitably coupled to the Higgs. Recently, Connes and Chamseddine have noticed that this new field also makes the computation of the Higgs mass in commutative geometry compatible with the experimental mass. More specifically, into the spectral triple of the standard model, the new field is obtained by turning the neutrino Majorana mass into a field. However the usual way to turn a constant into a field (the so-called fluctuation of the metric) does to work in this case, because of one of the condition defining a spectral triple (the first order condition). We show how to overcome this difficulty by twisting the spectral triple, following a procedure proposed in a completely different context by Connes and Moscovici some years ago.

MP 6.2 Wed 9:50 HFT-FT 101

The BV formalism for the BRST quantization of matrix models: a noncommutative geometric approach. — •Roberta A. Iseppi — Radboud University, Nijmegen, The Netherlands

In recent years noncommutative geometry has given proof of being an interesting mathematical framework to describe gauge theories: the strong connection between noncommutative geometry and gauge theories lies in the fact that gauge theories are naturally induced by spectral triples, which are the main technical device in contemporary noncommutative geometry. It is then reasonable to try to insert in the setting of noncommutative geometry also procedures which have been developed for the analysis of gauge theories. One of these is the BV approach to the BRST quantization of non-abelian gauge theories.

We present a method to incorporate this approach in the framework of noncommutative geometry. We restrict to a U(2)-gauge invariant matrix model: through the introduction of a so-called BV-spectral triple we describe the minimally-extended theory, obtained by inserting the minimal number of ghost fields. An interesting aspect of this approach is that it gives a "geometric interpretation" for all the physical properties of the ghost fields such as their bosonic or fermionic character, which have a natural translation in terms of the spectral triple itself.

MP 6.3 Wed 10:10 HFT-FT 101

Hartle-Hawking-Israel states for radiating static black holes — •Ko Sanders — Universität Leipzig, ITP

The discovery of black hole radiation (Hawking, 1975) was soon followed by the conjecture that a free scalar quantum field on a (Schwarzschild) black hole admits a (unique) ground state, which restricts to a thermal state at the Hawking temperature in the exterior region (Hartle and Hawking, 1976; Israel, 1976). This conjecture was later extended to more general static black holes and interacting fields (Jacobson, 1994) and the state is known as the Hartle-Hawking-Israel state (HHI-state). In the cases where such a state exists, it provides a relatively simple and direct link between the geometry of (e.g.) a black hole and the thermal properties of the Hawking radiation.

After a brief review of previous results, we will discuss our recent proof of the existence of such a HHI-state and its main properties in the rather general setting of static spacetimes with a bifurcate Killing horizon (arXiv:1310.5537). The key idea of the proof is simple: the Killing time variable, which defines the Wick rotation, becomes ill-defined near the Killing horizon, so we systematically replace it by a Gaussian normal coordinate. The crucial task is to establish the analogs of analyticity and reflection positivity in this new coordinate. This requires detailed arguments from geometry and analysis.