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Theory of quantum matter

Jeudi 26 Janvier 2023, 14 :00
LPTHE, LPTHE's library, towers 13-14, 4th floor
Domaines : hep-th

Titre : *Topological Invariants and Quantum Gravity*

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Résumé : *Very naively, quantum gravity would provide a "way" to integrate (using path integral) over all spacetime metrics. Hence, if we integrate on the metrics, finally, the only information that we could extract on the space-time would be its topological properties ! This argument is very naive but it illustrates that topology and topological invariants could play a very important role in quantum gravity. This is indeed the case for quantum gravity in 3 (space-time)dimensions where there is, for example, a very beautiful and very deep link between knot invaiants and the physical observables, a link which has been shown by Witten at the end of the 1980s. Quantifying gravity in 4 dimensions is much more involved and to date we do not know a solution to this problem. However, we can try to adapt the methods used in dimension 3 to advance in the problem, which is exactly what has been done in some approaches to quantum gravity (loop gravity and spin foam models). Here again, topological invariants play a crucial role... In this talk, I will try to show (through simple examples) the connection between topology and quantum gravity. You will then see that the structures which appear are very similar to those that appear in the analysis of the topological phases in condensed matter.*