

MP 4: Quantum Field Theory on Curved Spacetime

Zeit: Dienstag 15:00–16:15

Raum: JUR H

MP 4.1 Di 15:00 JUR H

QFT in stationary, axisymmetric spacetimes: lessons from vortex models — •PIOTR MARECKI — Universität Leipzig, Leipzig, Deutschland

Constructions of QFT of scalar fields in (stationary) spacetimes with ergospheres usually encounter peculiarities, most of which can be traced to the non-positivity of the classical energy functional. Not only are these difficulties of constructive nature, but they are known to be related to deep physical phenomena, which are speculated to take place in such spacetimes (ergosphere instabilities, Klein-paradox instabilities). We shall report on results, related to the above issues, achieved in the context of “spacetimes” taken from the analog-gravity correspondence (“acoustic spacetimes”). A spacetime of an acoustic irrotational vortex (stable, abundant configurations of rotating superfluids) provides an arena, where (in our opinion) the aforementioned QFT problems can be explicitly attacked, and - on the other hand - offers an unambiguous interpretation of results (by its experimental accessibility). Some functional-analytic problems related to properties of Krein-symmetric operators are uncovered in the analysis.

MP 4.2 Di 15:25 JUR H

Generalised free fields in curved spacetime. — •KO SANDERS — Institute for theoretical physics, Göttingen (D)

Quantum field theory in curved spacetime can be conveniently for-

mulated in the general axiomatic setting of locally covariant quantum field theory (LCQFT). We raise the question whether the local and (smoothly) covariant axioms of LCQFT reduce to Wightman field theory in Minkowski spacetime with all its analytic structure. This is of some interest, because no-go results like the Jost-Schroer Theorem in Wightman theory, which prevent the construction of interacting quantum fields, are often based on arguments involving analytic continuation.

We illustrate our question by the simplest example of a non-free quantum field: the generalised free scalar field. We give a local and covariant definition of these fields and discuss what non-local (but natural) assumption is needed to make them reduce exactly to the generalised free fields of Wightman theory. We especially point out where analytic continuation finds its origin.

MP 4.3 Di 15:50 JUR H

Analytical solutions of the geodesic equation in axially symmetric space-times — •EVA HACKMANN and CLAUS LÄMMERZAHN — ZARM, Universität Bremen

In recent years, the theory of elliptic and hyperelliptic functions was rediscovered for the purpose of analytically solving geodesic equations in various space-times. In this talk we will present the general mathematical methods and illustrate the procedure for the example of the geodesic equation in Kerr and Kerr-de Sitter space-times, which can then easily be adapted to all type-D space-times.