MP 11: Quantum Field Theory in Curved Spacetime

Zeit: Mittwoch 8:30–9:50 Raum: 30.45: 201

MP 11.1 Mi 8:30 30.45: 201

Local thermal equilibrium for quantum fields on cosmological spacetimes — •Michael Gransee[1,2], Alexander Knospe[2], and Rainer Verch[2] — [1]MPI Mathematics in the Sciences, Leipzig — [2]Universität Leipzig

We investigate the consistency of local thermal equilibrium for scalar and Dirac fields on cosmological spacetimes with respect to general covariance and the Hadamard renormalization prescription for the stress-energy tensor. The renormalized stress-energy tensor fulfilling the local thermal equilibrium condition has a thermal part, a dynamical part and a purely geometrical part. The latter contains the renormalization freedom. Since the thermal part differs from the total stress-energy, one finds a temperature dependence on cosmological time which has a stronger singularity in the limit of early cosmological times than in the classical treatment of radiation.

MP 11.2 Mi 8:50 30.45: 201

Quantization of the Electromagnetic Potential in Asymptotically Flat Spacetimes — •Daniel Siemssen — II. Institut für theoretische Physik der Universität Hamburg, Hamburg, Deutschland

In quantum field theory on curved spacetimes there exists, in general, no preferred choice of a vacuum state. Using a holographic approach it has been shown that one can construct a distinguished Hadamard state for the free scalar field in asymptotically flat spacetimes. Applying the same methods, I will discuss how to construct a BMS invariant state for the electromagnetic potential on past null infinity of an asymptotically flat spacetime and how the pull-back to the bulk yields a Hadamard state.

MP 11.3 Mi 9:10 30.45: 201

Quantum Pressure Inequalities — •Jan Zschoche[1,2] and Rainer Verch[2] — [1]MPI-MIS, Leipzig, Germany — [2]Univ. Leipzig, Leipzig, Germany

It is known that pointwise energy inequalities are violated in quantum field theory. Such inequalities restrict the magnitude of pressure (also negative pressure) with respect to the energy density. We modify the known quantum energy inequalities, which provide state-independent lower bounds on space-time averages of the energy density, to obtain a priori bounds on space-time averages of pressure for quantum fields on curved space-time.

MP 11.4 Mi 9:30 30.45: 201

Physics in vortex spacetimes: from the core to infinity — •Piotr Marecki — Uni Duisburg-Essen

In the talk I will continue to develop the subject already reported upon in the 2010 DPG Frühjahrstagung, namely the study of physical and mathematical problems related to the behavior of (classical and quantum) fields in "rotating spacetimes". The discussion is based upon an analogy between scalar fields in curved spacetimes and sound-waves propagating on irrotational background flows of fluids. As discussed in 2010 a typical superfluid vortex provides a good arena to study some of the most important issues expected to arise. (Essential points will be repeated in the introduction.) In this talk I will focus on the relation between sound scattering on a vortex and the Bohm-Aharonov scattering, and also on the issue of extending the "radial operator" to the core of the vortex. In the latter case I will make contact with the standard theory of extensions of non-essentially-selfadjoint operators (for singular potentials), and discuss how the parameter specifying the chosen extension influences scattering characteristics.