# MP 6: Quantenfeldtheorie

Zeit: Mittwoch 17:00–19:00 Raum: KGI-HS 1023

MP 6.1 Mi 17:00 KGI-HS 1023

**Wedge-Local Quantum Field Theory** — •Gandalf Lechner[1], Detlev Buchholz[2], and Harald Grosse[3] — [1]Erwin-Schrödinger-Institut für Mathematische Physik, Wien, Österreich — [2]Universität Göttingen — [3]Universität Wien

In the construction of relativistic quantum field theories, field operators which are not point-localized, but rather localized in wedge-shaped regions of dimensional Minkowski space, are a novel tool.

In two dimensions, such fields have led to the solution of the inverse scattering problem for factorizing S-matrices, i.e. the construction of integrable models with prescribed scattering operators. Recently, covariant families of wedge-local fields have also been established in higher dimensions. Although the connection between such objects and the S-matrix is less direct in higher dimensions, wedge-local quantum fields still provide a useful tool for the characterization of local observables and local interactions.

In this talk, a survey of the underlying ideas, results and perspectives of this approach is given.

MP 6.2 Mi 17:20 KGI-HS 1023

**Phase space structure and the uniqueness of the vacuum in QFT** — •Wojciech Dybalski — University of Göttingen, Germany

It is shown that only one vacuum state can be prepared with a finite amount of energy in any theory which satisfies a recently proposed phase space condition. This new criterion, which is verified in free field theory, restricts correlations between spatially separated regions. Conclusions about time-like asymptotic structure of physical states are derived.

MP 6.3 Mi 17:40 KGI-HS 1023

**Conformal correlation functions in four dimensions: new insights** — •Karl-Henning Rehren[1], Nikolay M. Nikolov[2], and Ivan Todorov[2] — [1]Institut für Theoretische Physik, Univ. Göttingen — [2]INRNE, Sofia, Bulgarien

It is well known that conformal correlation functions are essentially functions of the conformal cross ratios, with some constraints on their singularity structure. Otherwise, little is known about these functions. Assuming Huygens' principle, a much stronger restriction is established which can be cast into the form of a universal third order differential equation for the most singular terms. Nontrivial solutions can occur only at more than five point correlations. A nontrivial six-point solution is presented and discussed.

MP 6.4 Mi 18:00 KGI-HS 1023

**Solutions of the semiclassical Einstein equations with possible interpretations in cosmology.** — Claudio Dappiaggi, Klaus Fredenhagen, and •Nicola Pinamonti — II. Institut fuer Theoretische Physik, Universitaet Hamburg, Luruper Chaussee 149, D-22761 Hamburg, Germany

In addressing the problem of the definition of a semiclassical Einstein equation, the renormalization of the stress tensor plays a crucial role. We review in detail the case of a scalar field with general mass and general coupling with gravity, where the underlying quantum state is of Hadamard type. Using the ambiguity present in the point splitting procedure, Wald's axioms can be satisfied. We discuss the solutions of the semiclassical Einstein equation with high symmetry: in general they depend upon the quantum state. By means of the proposed method some solution of de Sitter type could arise even if we have not used any cosmological constant. Furthermore these solutions turn out to be stable. Even if the discussed model is very simple it shows that quantum effect are not negligible in addressing similar problems. We discuss some of the implications in cosmology.

MP 6.5 Mi 18:20 KGI-HS 1023

**Quantum Energy Inequalities from Local Thermal Equilibrium** — •Jan Schlemmer and Rainer Verch — Inst. f. Theoretische Physik, Universität Leipzig, 04009 Leipzig

This talk will be about the relation between a certain notion of local thermality for states of the free scalar field on curved spacetime backgrounds and quantum energy inequalites. For states fulfilling the condition of local thermality we will present two results obtained together with for arbitrary curvature coupling: First a Quantum Weak Energy Inequality and second an expression for potential violations of the Averaged Null Energy Inequality, which involves only terms with a direct physical interpretation for the states under consideration. Furthermore this expression shows that examples proposed to point out limits to Quantum Energy Inequalities for nonminimally coupled scalar fields are already the worst case for the set of locally thermal states.

MP 6.6 Mi 18:40 KGI-HS 1023

**Field Theory in Goedel-type Spacetimes** — •Piotr Marecki — Institut für Theoretische Physik, Universität Leipzig, 04009 Leipzig

I will discuss mathematical aspects of the massless scalar field in spacetimes of Goedel type. Due to their high symmetry, these spacetimes might provide an arena for the next step of development of concrete models of quantum fields in curved spacetimes, such as these developed already for the de Sitter spacetime. While the motion of the sources of Goedel spacetimes (dust with non-vanishing vorticity) is physically interesting and not too-implausible, a difficulty with causality is encountered: sufficiently large regions of Goedel spacetimes posses CTCs. A complete picture of the classical solutions of the wave equation, which will be presented, sheds some light on the seriousness of this difficulty from the point of view of classical field theory and provides a link to known treatments of quantum fields in simple non-globally hyperbolic spacetimes such as time-like cylinders etc. I shall present an algebraic construction of the solutions based on the symmetry-generators of Goedel-type spacetimes and a connection to the analysis of unitary irreducible representations of SU(1,1).