

## MP 4 Quantum Field Theory and String Theory

Zeit: Dienstag 14:00–16:00

Raum: TU MA043

**Fachvortrag**

MP 4.1 Di 14:00 TU MA043

**Cohomological gauge theories with special holonomy** — ●BODO GEYER — Institut f. Theoret. Physik, Univ. Leipzig, Augustusplatz 10-11

From Minkowskian 10D super Yang-Mills theory, by dimensional reduction and continuous Weyl-rotation, the 8D Euclidean, cohomological Spin(7)-invariant action  $S_{\text{cohom}}^{N_T=1}$  is derived, and by reduction to 7D the cohomological  $G_2$ -invariant action  $S_{\text{cohom}}^{N_T=2}$  with global SU(2) symmetry is obtained. Compatibility of chirality with generalized self-duality and octonionic algebra is shown. Using the chiral primary operator and the 8D analogue of the Pontryagin invariant a cohomological extension of  $S_{\text{cohom}}^{N_T=1}$  has been constructed.

**Fachvortrag**

MP 4.2 Di 14:20 TU MA043

**Quantized equations of motion and currents in noncommutative theories** — ●TOBIAS REICHENBACH — Konradstr. 58a, 04315 Leipzig

In this talk, quantized equations of motion and currents, that means equations on the level of Green's functions, are studied within different perturbative approaches to noncommutative quantum field theories.

Time-space noncommutativity poses remarkable difficulties. The perturbative approach via modified Feynman rules has been shown to violate unitarity. Therefore, another approach has been suggested which is manifestly unitary (TOPT). We study equations of motion and currents on the level of Green's functions within this framework, and find that the classical equations are not longer valid. This causes e.g. the violation of Ward identities in NCQED.

To cure this problem, a modified time-ordering has been proposed, which we present. We derive equations of motion in the new framework.

Another approach uses retarded functions. We introduce it and analyze unitarity as well as equations of motion and currents. Both are disturbed for the same reason. We propose a modified theory which is unitary and preserves the classical equations of motion and currents on the quantized level.

**Fachvortrag**

MP 4.3 Di 14:40 TU MA043

**Perturbative Aspects of Spectral Representations for Unitary QFTs on Space/Time NC Spaces** — ●CHRISTOPH DEHNE — ITP, Leipzig University (Vor dem Hospitaltore 1, D – 04103 Leipzig)

We construct spectral representations for unitary quantum field theories on Space/Time noncommutative spaces and investigate the spectral measure for different Feynman rules perturbatively. Explicitly, we show how to compute nonlocal counterterms, if space does not commute with time.

**Fachvortrag**

MP 4.4 Di 15:00 TU MA043

**Spontaneous particle creation within the external field approximation of QED** — ●NIKODEM SZPAK — Institut für Theoretische Physik, J.W.Goethe Universität Frankfurt, 60054 Frankfurt/Main

It is expected that strong electrodynamic fields in QED may lead to destabilization of the vacuum if the strength of the electric field exceeds some threshold. However, rigorously, the question is still open. We treat the problem within an external field approximation of QED and study model fields in order to understand the problems appearing in the proofs. We define the spontaneous particle creation by the adiabatic limit and study it analytically and numerically. We also review the present state of the theory concerning spontaneous particle creation and report on the open theoretical problems.

**Fachvortrag**

MP 4.5 Di 15:20 TU MA043

**Geometry of spin-field couplings on the worldline** — ●JENS HÄMMERLING and HOLGER GIES — Institut für theoretische Physik, Philosophenweg 16, 69120 Heidelberg

We derive a geometric representation of spin-field couplings within the worldline approach to perturbative QFT. This results in a spin factor that associates the information about spin with zigzag motion of the fluctuating field. We concentrate on the case of QED in external fields where we obtain a purely geometric representation of the Pauli term. As an illustrative example, we rederive the well-known Heisenberg-Euler action from the interplay between spin factor and holonomy.

**Fachvortrag**

MP 4.6 Di 15:40 TU MA043

**Nonabelian 2-Forms: Strings, Loop Space, Gerbes and 2-Bundles** — ●URS SCHREIBER — Universität Duisburg-Essen, 45177 Essen

The higher-order generalization of gauge theory involves nonabelian 2-forms coupled to worldsheets instead of 1-forms coupled worldlines. Such theories arise notably on stacks of M/NS 5-branes.

The investigation of such higher gauge theories involves a fascinating interplay between the physics of strings and mathematical concepts like fiber bundles over loop spaces, categorified fiber bundles (2-bundles) and nonabelian gerbes.

We give a brief overview and present recent insights.