MP 4: Quantum Field Theory II

Time: Wednesday 11:00–12:15 Location: KH 02.013

Invited Talk MP 4.1 Wed 11:00 KH 02.013

Exact Schwinger functions for a class of bounded interactions in $d \geq 2$ — •Wojciech Dybalski — AMU Poznan, Poland

We study scalar Euclidean quantum field theories with interactions defined by bounded, measurable functions. We assume that these functions have well-defined limits at both positive and negative infinity. In the spirit of the Buchholz-Verch approach we start from a large class of field renormalization functions and look for choices admitting interesting UV behaviour. We exhibit choices for which all connected Schwinger functions, except perhaps for the two-point function, exist non-perturbatively in the UV limit. Moreover, we obtain closed form formulas for these Schwinger functions demonstrating non-Gaussianity of the field. The remaining challenge of rigorously controlling the two-point function is also discussed. (Based on CMP(2025)406:211).

Invited Talk MP 4.2 Wed 11:30 KH 02.013

L4 bound for the energy density in thermal field theory — •Daniela Cadamuro — Institute for Theoretical Physics, University of Leipzig

Lower bounds to the energy density are of fundamental importance for physics (laws of thermodynamics, stability of spacetimes, etc) and for mathematics (self-adjointness of quantum fields, etc). In the case of thermal field theory, where particles and holes are both present and contribute to the energy density of the system, it is not expected that the energy density, or rather the Liouvillian density, fulfills energy inequalities in the usual sense. However, when the estimate is weighted with the modular Hamiltonian of the theory, a certain positivity is retained. We call this a quantum L4 inequality. We will show that in the thermal representation of the free massive scalar field, such an inequality is fulfilled by the quantum generator of the time evolution of the theory in this sector.

MP 4.3 Wed 12:00 KH 02.013

Inertial Repulsion from Quantum Geometry — •Maike Fahrensohn and Matthias Geilhufe — Condensed Matter and Materials Theory Division, Department of Physics, Chalmers University of Technology, 41258 Göteborg, Sweden

We derive a repulsive, charge-dipole-like interaction for a Dirac particle in a rotating frame, arising from a geometric $U(1)$ gauge symmetry associated with the Berry phase [1]. The Lagrangian of this system includes a non-inertial correction due to centrifugal field coupling. By imposing gauge symmetry and treating it as a full gauge theory, the Lagrangian is extended to include Berry connection and curvature terms. Upon integrating out the geometric gauge field, the effective action is obtained. This leads to the emergence of a repulsive, long-range effective interaction in the Lagrangian. Explicitly, in the non-inertial frame of the observer, the geometric gauge invariance effectively leads to a repulsive Coulomb-interaction in momentum space. In real space, the inertial repulsion manifests in a $1/|r|^2$ potential, which is symmetric about the origin of rotation and mirrors charge-dipole interaction.

[1] Maike Fahrensohn and R. Matthias Geilhufe. Inertial Repulsion from Quantum Geometry. 2025. arXiv: 2511.03510.