MP 10: Quantenfeldtheorie III

Time: Thursday 14:40–16:00 Location: SPA SR125

MP 10.1 Thu 14:40 SPA SR125

Araki-Haag Approach to Scattering in Quantum Field Theories without Mass Gap — •Maximilian Duell[1] and Wojciech Dybalski[1,2] — [1]Zentrum Mathematik, Technische Universität München, D-85747 Garching, Germany — [2]Institut für Theoretische Physik, Eidgenössische Technische Hochschule Zürich, 8093 Zürich, Switzerland

Haag-Ruelle scattering theory is a mathematical framework establishing an interpretation of quantum field theories in terms of scattering reactions of particles. Within the original Haag-Ruelle theory, relying on the mass-gap assumption, Huzihiro Araki and Rudolf Haag recognized the possibility to define a large family of asymptotic observables, which provide a mathematical modelling of experimental particle detectors. On the other hand, the Haag-Ruelle method for the construction of scattering states was adapted to the setting without mass gaps by Wojciech Dybalski building on previous work by Ira Herbst and Detlev Buchholz. In this framework, we extend the work of Araki and Haag to theories without mass gaps by proving the convergence of a family of Araki-Haag detectors on scattering states. Our proof relies on the decoupling assumption as introduced by Herbst, which is also required for the construction of scattering states. We further show, that the action of the asymptotic detectors on scattering states is completely described in terms of their action on the single-particle states, which provides additional evidence for the multi-particle interpretation of the scattering states.

MP 10.2 Thu 15:00 SPA SR125

Operator Product Expansion Algebra — •Jan Holland — CPHT, Ecole Polytechnique, Paris-Palaiseau, France

The Operator Product Expansion (OPE) is a theoretical tool for studying the short distance behaviour of products of local quantum fields. Over the past 40 years, the OPE has not only found widespread computational application in high-energy physics, but, on a more conceptual level, it also encodes fundamental information on algebraic structures underlying quantum field theories. I will review new insights into the status and properties of the OPE within Euclidean perturbation theory, addressing in particular the topics of convergence and "factorisation" of the expansion. Further, I will present a formula for the "deformation" of the OPE algebra caused by a quartic interaction. This formula can be used to set up a novel iterative scheme for the perturbative computation of OPE coefficients, based solely on the zeroth order coefficients (and renormalisation conditions) as initial input.

MP 10.3 Thu 15:20 SPA SR125

Characterisation of local nets by their representation category — •Luca Giorgetti — Institut für Theoretische Physik, Universität Göttingen, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany

In the axiomatic setting of Haag and Kastler, quantum fields are described by local nets of bounded operator algebras over space-time regions. We will discuss the representation theory of the net, more specifically the DHR superselection sectors of two-dimensional conformal field theories. These admit at the same time a large number of non-trivial models and a rich representation theoretical structure. DHR representations form a braided (modular) tensor category which we conjecture to be uniquely determined by a finite set of numerical invariants ('modular data'). Moreover, the category is realised in our setting as endomorphisms of the net. Based on our present understanding of the problem, we discuss to which extent one can reconstruct the local algebras from the category, together with its action on the net.

MP 10.4 Thu 15:40 SPA SR125

Phase Boundaries in Algebraic Conformal QFT — •Marcel Bischoff[1], Yasuyuki Kawahigashi[2], Roberto Longo[3], and Karl-Henning Rehren[1] — [1]Institut für Theoretische Physik, Universität Göttingen — [2]Department of Mathematical Sciences, The University of Tokyo — [3]Dipartimento di Matematica, Università di Roma "Tor Vergata"

We will describe the structure of local algebras in relativistic conformal QFT with phase boundaries (topological defects) in two space-time dimensions. The phase boundary conditions are produced by the irreducible components of a certain universal construction.