MP 7 Integrability and Variational Methods

Zeit: Mittwoch 12:05–13:05 Raum: TU MA141

Fachvortrag MP 7.1 Mi 12:05 TU MA141

Noncompact $SL(2,R)$ spin chains — •Marc Kirch[1] and Alexander N. Manashov[2,3] — [1]Institut für theoretische Physik II, Ruhr-Universität Bochum, D-44780 Bochum — [2]Institut für theoretische Physik, Universität Regensburg, D-93040 Regensburg — [3]Department of theoretical physics, St.-Petersburg State University, 199034, St.-Petersburg, Russia

We consider completely integrable spin chain models whose spin operators are the generators of unitary representations of the noncompact group $SL(2,R)$. Within the framework of the Quantum Inverse Scattering Method we construct $\mathcal{R}$-operators, being solutions to the Yang-Baxter equation. These act on the corresponding vector spaces on wich the representations are realized. Examine the possible combinations of representations, the solutions exhibit different properties. Using the method of the separated variables and the Baxter Q-operator technique we construct and solve a spin chain model realized on the principal continuous series representation of $SL(2,R)$. The main motivation for the study of such objects comes from the remarkable fact that various dilatation operators, governing the scaling behaviour of some composite field operators in certain (SUSY) Yang-Mills theories, have been found to be integrable. In fact they are in one to one correspondence with the Hamiltonian of a completely integrable spin chain - among them those with a noncompact symmetry group.

Fachvortrag MP 7.2 Mi 12:25 TU MA141

Higher Orders of Large-D Expansion From Variational Perturbation Theory — •Axel Pelster[1] and Sebastian Brandt[2] — [1]Fachbereich Physik, Universität Duisburg-Essen, Essen, Germany — [2]Department of Physics, Campus Box 1105, Washington University St. Louis, MO 63130-4899, USA

We derive recursively the perturbation series for the ground-state energy of the D-dimensional anharmonic oscillator and resum it using variational perturbation theory. Extrapolating the exponentially-fast converging approximants, we extract the coefficients of the large-D expansion to higher orders. The calculation effort is much smaller than in the standard field-theoretic approach based on the Hubbard-Stratonovich transformation.

Fachvortrag MP 7.3 Mi 12:45 TU MA141

The Dirichlet Hopf algebra of arithmetics: From numbers to renormalization — •Bertfried Fauser — Max-Planck-Institut für Mathematik, 04103 Leipzig

We study the coalgebraic counterparts of addition and multiplication. This allows to construct two Hopf convolutions, also called Hopf gebras, for both addition and multiplication. Neither of this convolutions is forming a Hopf algebra, however, the multiplicative convolution embodies the Dirichlet convolution of number theoretic functions. There is an opportunity to introduce a new coalgebra structure, called renormalized, such that a nice Hopf algebra structure emerges in such a way that the primitive elements are identical. A subtraction scheme, which might be related to renormalization in quantum field theory, allows to use the nice algebra for computations while actually dealing with the original Hopf convolution. There is a deeper relation of addition and multiplication which relies on n-categories. We give as examples the normal ordering in quantum mechanics and its relation to Stirling numbers and Baxter operators as also the construction of the renormalization coproduct employed in renormalization of quantum fields. An outlook will show how quantum field theoretic methods may be used in number theory.