MP 7 Symmetrien, integrable Systeme und Nichtkomm. Geometrie

Zeit: Mittwoch 17:00–18:30 Raum: P1-02-111

MP 7.1 Mi 17:00 P1-02-111

Matrix-differential-operator symmetries of the Dirac equation with external electromagnetic fields — •Stephan Balliel-Zakowicz — Departement of Mathematics, ETH Zurich, 8092 Zurich, Switzerland — Institut für Theoretische Physik, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, 35392 Giessen

Symmetries of the Dirac equation with external electromagnetic fields are considered. The focus is set on symmetry generators in the form of first-order matrix-differential operators (MDOs), of which the generators of Lie point symmetries are an important but not exhaustive subclass. These MDOs generate one-parameter groups of transformations leaving the space of solutions of the Dirac equation invariant and may thus be employed to find new solutions from known ones. Given an arbitrary external electromagnetic field, the general condition for the existence of a first-order symmetry MDO and–if one exists–its structure are expressed in a covariant form.

The results are then applied to the case of an external plane electromagnetic wave, for which all first-order symmetry MDOs are presented explicitly. The action of some of these operators on a wavefunction can be calculated analytically. This transformation involves derivatives as well as an integration over the wavefunction, which is in stark contrast to the much simpler action generated by Lie point symmetries. As has been long known, the external plane-wave field admits the analytical solutions found by and named after Volkov [1]. These solutions show a rather trivial transformation behavior under the above symmetry generators.

[1] D. M. Volkov, Z. Phys. **94**, 250 (1935).

MP 7.2 Mi 17:30 P1-02-111

Diagonalizing 1-d interacing particle systems — •Heiner Kohler — Universität Heidelberg

We present a new first–quantization approach to construct wave functions for a certain class of exactly solvable one–dimensional interacting many–body systems. This class comprises the Calogero-Moser-Sutherland Hamiltonians but also particles with δ interaction. We construct coordinate representations of creation and anihilation operators for the elementary exitations and thereby essentially diagonalize the complete many body Hamiltonian. Our construction, alternative to the Bethe Ansatz, is in principle not restricted to local interactions. It is especially well suited to construct states representing particle hole excitations with respect to the many body ground state. It provides a different aspect on the underlying integrable structure of the models under consideration. A group theoretical interpretation is also given.

MP 7.3 Mi 18:00 P1-02-111

Lokal nichtkommutative Raumzeiten — •Stefan Waldmann — Institut für Mathematik, Johann Wolfgang Goethe-Universität, Robert-Mayer-Str. 6-10, 60325 Frankfurt — Fakultät für Mathematik und Physik, Physikalisches Institut, Hermann Herder Straße 3, D 79104 Freiburg

In diesem Vortrag werde ich über ein gemeinsames Projekt mit Dorothea Bahns zu lokal nichtkommutativen Raumzeiten berichten. Bei den üblichen Formulierungen wird meist nur eine geometrisch triviale Raumzeit, also ein flacher Minkowski-Raum betrachtet, welcher durch ein Weyl-Moyal-Sternprodukt nichtkommutativ wird. Hier liefert das globale und konstante Sternprodukt die bekannten Schwierigkeiten des UV/IR Mixings. In unserem Zugang hingegen wird für jeden Punkt eine eigene kleine Umgebung der Nichtkommutativität konstruiert: Damit werden zum einen geometrisch nichttriviale Raumzeiten zugänglich, zum anderen reproduziert das Model bei großen Abständen die klassische Geometrie. Ich werde in diesem Vortrag die gundlegenden Konstruktionen vorstellen und einige Spezialfälle diskutieren: Insbesondere die Beziehung von formalen und konvergen ten Deformation sowie die nichtkommutative Längenmessung.