MP 4: Quantenmechanik, Symmetrien, Integrable Systeme und Quanteninformationstheorie

Zeit: Dienstag 17:00–19:00 Raum: KIP SR 1.403

MP 4.1 Di 17:00 KIP SR 1.403

New knot and link invariant operators from plethystic branchings — •Bertfried Fauser — Max Planck Institut für Mathematik, Inselstr. 22-26, D-040130 Leipzig, Germany

We show that the character ring Hopf algebras of centralizer subgroups of $GL(n)$, in the stable limit $n \to \infty$, are braided monoidal tensor chategories. Using the induced braiding, we can colour knots and links using representations of any such subgroups. We show that all Reidemeister moves of ambient isotopy are fulfilled and explain how we can obtain knot and link invariants from this setting.

Joint work with P.D. Jarvis, Hobart, Ronald C. King, Southampton.

MP 4.2 Di 17:30 KIP SR 1.403

Quasi doubly-periodic solutions to a generalized Lame equation — •Michael Pawellek — Institut für Theoretische Physik III, Universität Erlangen-Nürnberg, Staudtstr.7, D-91058 Erlangen

We consider a generalization of the Lame equation, which can be written as a 1-d Schroedinger equation with quasi doubly-periodic potential depending on five parameters. We introduce a generalization of Jacobi's elliptic functions and show that polynomial solutions in terms of these functions only for a finite set of values for these five parameters exist. For this purpose we also establish a relation to the generalized Ince equation.

MP 4.3 Di 18:00 KIP SR 1.403

Adiabatic quantum algorithms as quantum phase transitions: 1^{st} versus 2^{nd} order — •Ralf Schuetzhold and Gernot Schaller — Institut für Theoretische Physik, Technische Universität Dresden, D-01062 Dresden, Germany

In the continuum limit (large number of qubits), adiabatic quantum algorithms display a remarkable similarity to sweeps through quantum phase transitions. We find that transitions of second or higher order are advantageous in comparison to those of first order. With this insight, we propose a novel adiabatic quantum algorithm for the solution of 3-satisfiability (3-SAT) problems (exact cover), which is significantly faster than previous proposals according to numerical simulations (up to 20 qubits). These findings suggest that adiabatic quantum algorithms can solve NP-complete problems such as 3-SAT much faster than the Grover search routine (yielding a quadratic enhancement), possibly even with an exponential speed-up.

MP 4.4 Di 18:30 KIP SR 1.403

Structure and dynamics of the cubic anharmonic oscillator — •Andrey Surzhykov and Ulrich Jentschura — Max–Planck–Institut für Kernphysik, Heidelberg, Germany

In many areas of atomic, nuclear and solid state physics, the need arises to study the quantum mechanical tunneling of a particle trapped in either a double well [1] or in a metastable potential well. One of the well–known models for such a metastable well is the harmonic oscillator perturbed by a cubic term gx^3, where g is the coupling constant. In fact, the mathematical analysis of the cubic anharmonic oscillator is a rather difficult task since the bound states of the (unperturbed) harmonic potential become *resonances* with a final width under the cubic perturbation. A large number of methods have been proposed for the resonance calculations. In our talk, for example, we show that the standard Rayleigh–Schrödinger perturbation series, if properly resummed by using the generalized Borel–Padé method, may well reproduce not only the position of the resonances but also their widths. An alternative approach, known as dilation transformation method, deals with the complex scaling [2]. Apart from the evaluation of the energy spectrum, this method provides a natural access to generalized eigenfunctions of the cubic oscillator. We demonstrate how the proper set of these eigenfunctions may be utilized for the numerical integration of the time–dependent Schrödinger equation and, hence, for studying the dynamics of the wavepackets in the metastable potential wells.

[1] A. Surzhykov *et al.*, Phys. Rev. B **74**, 205317 (2006).
[2] N. Moiseyev, Phys. Rep. **302**, 211 (1998).