MP 8: Quantum Mechanics

Zeit: Mittwoch 15:00–16:15 Raum: JUR H

MP 8.1 Mi 15:00 JUR H

Pseudorelativistic operators in the limit of strong magnetic fields — •Doris Jakubassa-Amundsen — Math. Institut, LMU München

Relativistic one-electron ions serve as a tool for probing the description of many-electron systems by means of pseudorelativistic operators. The two operators considered are the Chandrasekhar operator which allows for relativistic kinematics in place of the Laplace operator, and the no-pair Brown-Ravenhall operator which results from a projection of the Dirac operator onto the electronic subspace.

When the ions move in a locally bounded magnetic field of the type $(0, 0, B(|x_1|^d + |x_2|^d))$ with $d \geq 0$, both pseudorelativistic operators obey a scaling property which relates an increasing field B to a decreasing particle mass. It is strictly shown that, when B goes to infinity, the binding energy of the ground state (existing as a discrete state for $d \leq d_0$ where d_0 increases with nuclear charge) increases with a power law B^s with $s = 1/(2+d)$. This contrasts the logarithmic increase with B in the nonrelativistic ($d = 0$) case.

MP 8.2 Mi 15:25 JUR H

Regularity of Eigenstates in Regular Mourre-Theory — Jacob Møller[1] and •Matthias Westrich[1,2] — [1]Dept. of Mathematics, University of Aarhus, Denmark — [2]Institut für Mathematik, Johannes-Gutenberg Universität Mainz, Deutschland

Our presentation gives an abstract method for proving that eigenstates of a self-adjoint operator H lie in the domain of the conjugate operator A. Conjugation means here that H and A have a positive commutator in the sense of Mourre. The only requirement is the C^k-regularity of H.

Regarding integer k, our result is optimal. Using this method, we obtain cutoff-independent bounds and under a boundedness assumption of the multiple commutators we prove analyticity of the eigenstates with respect to $\exp(-itA)$.

We illustrate the relevance of this method in a physical application.

MP 8.3 Mi 15:50 JUR H

Rigorous Foundation of the Brockett-Wegner Flow — •Volker Bach[1] and Jean-Bernard Bru[2] — [1]Institut für Mathematik FB 08; Universität Mainz; 55099 Mainz — [2]Department of Mathematics, University of the Basque Country UPV/EHU, Leioa, Spain

The Brockett-Wegner flow was found independently by Brockett and Wegner in the early 1990ies to diagonalize self-adjoint matrices by a time-dependent Schrödinger equation. The lecture will discuss the mathematical foundation of this flow and its application to the diagonalization of quadratic operators in quantum field theory (a warm-up application which represents an alternative to a Bogolubov transformation).