

Projects for Computational Physics

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Harmonic Oscillator with Path Integral MC on the Lattice

Project Description

The path integral formalism for quantum mechanics (and for quantum field theories as well) can be considered as a generalisation of the action principle of classical mechanics. However, analytic solutions for energy eigenvalues and probability densities derived from the corresponding wave functions exist only for very few problems. The most prominent one is the harmonic oscillator. This constitutes the need for other methods of dealing with systems beyond the analytically solvable case, such as e.g. the an-harmonic oscillator including a 4th order term in the potential. One possibility for studying such systems non-perturbatively is Monte-Carlo simulation, which can be applied to many problems in modern field theories, including cases where conventional perturbation theory fails.

Literature

- [1] “A statistical approach to quantum mechanics”, Creutz and Freedman, Annals Phys.132:427, 1981
- [2] almost any textbook on quantum mechanics