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Interacting few body-systems in magnetic fields

The study of interacting and correlated few-body systems in magnetic fields reveals a rich spectrum of quantum states. Methods developed in the context of nuclear and molecular physics (time-dependent variational principle, coherent state dynamics) shed light on the many-particle spectrum in terms of classical trajectories and the classification in terms of permutation symmetries.

I will discuss two ways to map a quantum-mechanical interacting many-body system to a classically interacting system with full consideration of the Pauli principle. The mappings make it possible to obtain the many-body eigenstates with a much reduced computational effort. One approach is a generalization of coherent-state dynamics used before for vibrational wavefunction to a many body system, and the second approach employs a thermodynamic mapping along the lines of Laughlin's construction for the fractional Quantum Hall effect. Both approaches yield surprisingly good results for large (200 electrons) and small (3 electrons) quantum systems in magnetic fields.