



Seminar of the Work Group
Nonlinear Partial Differential Equations
SS 23

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Seminar room: SR 3.068

On Rigorous Derivation of the Hartree Equation from Quantum Many-Body Systems

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Abstract

One of the reasons that the NLS equation is famous is that it is an approximate model arising from many different physical contexts like magnetohydrodynamics, optics or many-body quantum systems. Often it is assumed that the approximation is good and the properties of NLS itself are intensely investigated. But how can one prove that the NLS is a good approximation or even to begin with how can one rigorously formulate the question of approximation? In this talk I will explain how to formulate this question for a variant of the NLS equation which is the Hartree equation. I will rigorously formulate the question of approximation in the context of quantum many-body systems. I will then discuss the old results of Pickl and Knowles and Pickl whose arxiv variants can be found in <https://arxiv.org/abs/0907.4464> <https://arxiv.org/abs/0907.4313>. These papers have the simplest existing proof of convergence of many-body Schrödinger dynamics towards the Hartree dynamics. The importance of such a result relies on the fact that the quantum many-body dynamics is, in contrast to the Hartree equation, very far from being numerically computable with today's existing computational power. Purpose of the talk will be an introduction to the subject and is going to partially be based on the attached Bachelor Thesis which presents a simplified version of the above papers.