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Title: A simple Proof of convergence towards the Hartree dynamics in Sobolev trace norms

Abstract: The derivation of the Hartree equation from many-body systems of Bosons in the mean field limit has been very intensively studied in the last couple of years. However, very few results exist showing convergence of the k-th marginal of the N-body density matrix to the projection to the k-fold tensor product of the solution of the Hartree equation in stronger trace norms like the energy trace norm. This issue is from a physical view point very important because one can then approximate expectation values of certain observables of the N-body system by means of the Hartree equation with relaxation of the very restrictive assumption that the observables are bounded operators. In the talk we will focus on the non-relativistic case with Coulomb interaction. We prove, assuming only the natural H^1-regularity of the initial data, convergence in the energy trace norm without rates, and convergence in any other weaker Sobolev trace norm with rates. Our proof is simple and uses the functional a_N introduced by Pickl which counts the particles that are not in the Hartree state. Time permitting we will discuss extensions of the result in the semirelativistic case, in the case with a magnetic field and in the case of presence of two kinds of condensates. The talk will be based on two works, one is joint work with Michael Hott and the other with Michael Hott and Dirk Hundertmark.