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Commutator Estimates and Semiclassical Mean-Field Limits with Singular Potentials

Friday, November 7, 2025 9:00 AM (45 minutes)

Due to the singularity of the interactions, the derivation of the Vlasov-Poisson equation with Coulomb or gravitational interaction remains an open problem. There have been recent advances in the study of singular potentials, which now allow the treatment of square-integrable interaction potentials. On the quantum side, a key ingredient in the strategy is the use of propagation of uniform-in-hbar commutator estimates, which are the quantum analogue of the Sobolev regularity for classical phase space densities
In this talk, I will discuss the properties of these quantum Sobolev spaces, and show their applications to semiclassical mean-field limits, as well as to the study of ground states, such as the spectral projections on the negative eigenvalues of Schrödinger operators with non-smooth potentials. In particular, they allow us to obtain quantitative Weyl laws in phase space in strong topologies.

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