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Quantum Optimal Transport and Sobolev Spaces

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In the context of proving the semiclassical mean-field limit from the N-body Schrödinger equation to the Hartree-Fock and Vlasov equations, a crucial component is obtaining inequalities uniform in the Planck constant and the number of particles. These inequalities are the analogue of the estimates obtained in the corresponding kinetic models of classical statistical mechanics.

Hence, in this presentation, I will introduce analogous tools and inequalities within the realm of quantum mechanics, such as operator versions of optimal transport and Sobolev spaces on the phase space, and the corresponding classical inequalities. We will in particular see that the quantum analogue of Sobolev inequalities yield uncertainty inequalities concerning the Wigner–Yanase skew information, and that the latter also plays a significant role in controlling a quantum Wasserstein "self-distance".

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