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The effect of (in)-distinguishability and interaction on the dynamics of bosons in a double well potential

Abstract: The inability to distinguish identical particles gives rise to many-body interference effects in quantum mechanical systems. Already in a small system of two photons, the dynamics significantly depend on the particles' mutual distinguishability, as shown experimentally by C. K. Hong, Z. Y. Ou and L. Mandel (1987). However, it remains unclear how indistinguishability affects systems of many interacting particles. We compare the evolution in various scenarios with distinguishable or indistinguishable particles trapped in a double well potential and focus in particular on the case of strong interactions. On the one hand, we identify cases where labelling the particles does not change the dynamics for symmetry reasons. On the other hand, we show that although weak interactions tend to wash out many-body interference effects, these re-emerge on long time scales in strongly interacting systems.