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The path integral picture of quantum systems

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The imaginary time path integral "formalism" was introduced in 1953 by Feynman to understand the superfluid transition in liquid helium. The equilibrium properties of quantum many body systems is isomorphic to the classical statistical mechanics of cross-linking polymer-like objects. With the Markov Chain Monte Carlo method, invented by Metropolis et al., also in 1953, a potential way of calculating properties of correlated quantum systems was in place. But calculations for many-body quantum systems did not become routine until computers and algorithms had become sufficiently powerful three decades later. Once such simulations could happen, it was realized that simulations provided a deeper insight into boson superfluids, in particular the relation of bose condensation to the polymer end-to-end distance, and the superfluid density to the polymer "winding number." Some recent developments and applications to supersolids, and helium droplets will be given. Finally, limitations of the methodology e.g. to fermion systems are discussed.