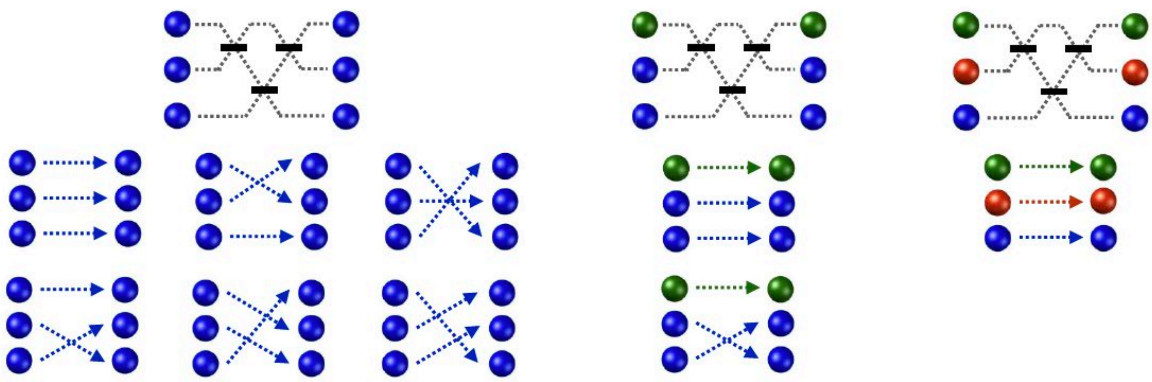
PHYSIKALISCHES KOLLOQUIUM

AM 08. JANUAR 2024 UM 17 UHR C.T.

IM GROßEN HÖRSAAL



INDISTINGUISHABILITY IN QUANTUM MANY-BODY DYNAMICS: WHY NO DIFFERENCE MAKES A DIFFERENCE

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Our description of a quantum system must not change upon exchanging identical particles. This basic requirement has far-reaching consequences for the behaviour of many-particle systems. It must be taken into account when counting states of identical particles, resulting in either Bose-Einstein or Fermi-Dirac statistics for non-interacting systems in equilibrium. Out of equilibrium, particle indiscernability additionally implies indistinguishability of many-particle paths between initial and final states of a system: Because we cannot tell which particle of the final state corresponds to which particle of the initial state, the transition amplitudes associated with the different alternatives must be summed coherently. This gives rise to intricate many-particle interference effects in the dynamics.

In this talk, I will first introduce the concept of many-particle interference by explaining how it arises in the paradigmatic Hong-Ou-Mandel effect. I will then discuss some of the more recent developments in the theory of many-particle interference, focusing on our studies of its role in interacting many-body dynamics. By endowing the particles with an internal degree of freedom, we can tune their degree of indistinguishability and thus control the level of many-particle interference. In this way, we are able to systematically assess the imprint of many-particle interference on many-body quantum evolution, e.g. in the Bose-Hubbard model, and to set it apart from interaction-induced effects.