Quantifying interactions

J.K. Pachos

University of Leeds, UK

Interacting bosons or fermions give rise to some of the most fascinating phases of matter, including high-temperature superconductivity, the fractional quantum Hall effect, quantum spin liquids and Mott insulators. While these systems are promising for technological applications, they also present conceptual challenges as they require approaches beyond mean-field and perturbation theory. I will present a general framework for identifying the free theory that is closest to a given interacting model in terms of their ground state correlations. I will quantify the distance between them using the entanglement spectrum. When this interaction distance is small, the optimal free theory provides an effective description of the low energy physics of the interacting model. This construction of the optimal free model is non-perturbative in nature, thus it offers a new theoretical framework for investigating strongly correlated systems.