Strong Correlation Induced Charge Localization in Antiferromagnets

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Abstract

The fate of an injected hole in a Mott antiferromagnet is an outstanding issue of strongly correlated physics. It provides important insights into doped Mott insulators closely related to high-temperature superconductivity in cuprates. Here, we report a systematic numerical study based on the density matrix renormalization group (DMRG). It reveals a remarkable novelty and surprise for the single hole's motion in otherwise well-understood Mott insulators. Specifically, we find that the charge of the hole is self-localized by a novel quantum interference mechanism purely of strong correlation origin, in contrast to Anderson localization due to disorders. The common belief of quasiparticle picture is invalidated by the charge localization concomitant with spin-charge separation: the spin of the doped hole is found to remain a mobile object. Our findings unveil a new paradigm for doped Mott insulators that emerges already in the simplest single hole case.

About the speaker

Prof Zheng-Yu Weng obtained his PhD in 1987 at the University of Science and Technology of China. He is currently a professor at Institute for Advanced Study of Tsinghua University.