Photoinduced pair correlations in Mott and excitonic insulators

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Recent developments in ultrafast laser spectroscopy have enabled the observation of metal-superconductivity and insulator-metal photoinduced phase transitions and have opened a new venue for the study of strongly correlated electron systems. From a theoretical point of view, however, the simulation of nonequilibrium dynamics involves complex time-evolution calculations and must therefore rely on numerical calculations, such as the time-dependent exact diagonalisation method for small clusters and dynamical mean-field theory. When considering comparisons with the above experiments, it has been desirable to develop numerical techniques for larger systems without mean-field bias.

In this talk, we present a numerical technique based on the tensor-network algorithm [1,2], which allows the computation of nonequilibrium dynamics directly in the thermodynamic limit in the case of (quasi-)one-dimensional systems with translational symmetry. The method is applied to light-induced systems of Mott [2,3] and excitonic insulators [4], revealing photoinduced insulator-to-metal phase transitions.

References

[1] S. Ejima, F. Lange and H. Fehske, SciPost Phys., **10** (2021) 077.
[2] S. Ejima, F. Lange and H. Fehske, Phys. Rev. Res., **4** (2022) L012012.
[3] S. Ejima and H. Fehske, arXiv:2301.04496.
[4] S. Ejima, F. Lange and H. Fehske, Phys. Rev. B, **105** (2022) 245126.

Figures

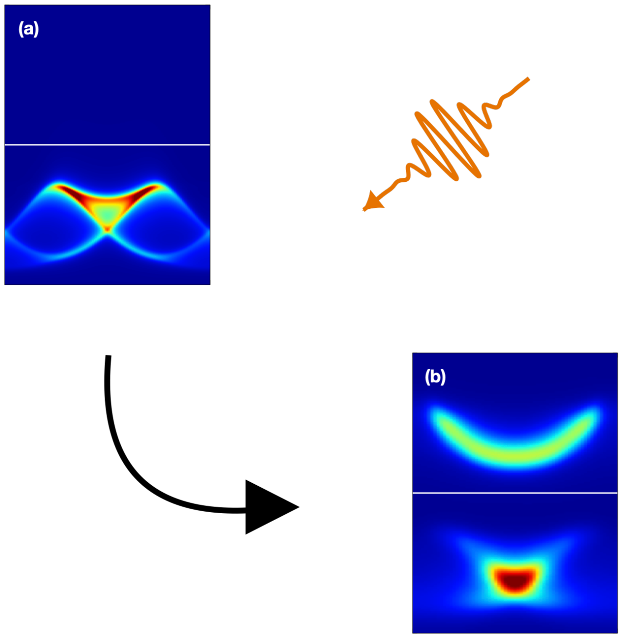

Figure 1: Photoinduced quantum phase transition from Mott (a) to superconducting-like η-pairing (b) states.