Many-body correlations in one-dimensional optical lattices with alkaline-earth(-like) atoms

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We explore the rich nature of correlations in the ground state of ultracold atoms trapped in state-dependent optical lattices [1]. In particular, we consider interacting fermionic ytterbium or strontium atoms, realizing a two-orbital Hubbard model with two spin components. We analyze the model in one-dimensional setting with the experimentally relevant hierarchy of tunneling and interaction amplitudes by means of exact diagonalization and matrix product states approaches, and study the correlation functions in density, spin, and orbital sectors as functions of variable densities of atoms in the ground and metastable excited states. We show that in certain ranges of densities these atomic systems demonstrate strong density-wave, ferro- and antiferromagnetic, as well as antiferroorbital correlations.

References:

[1] V. Bilokon, E. Bilokon, M. C. Bañuls, A. Cichy, A. Sotnikov, arXiv:2302.10854.

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