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Analysis of the single-particle excitation spectrum of ultracold fermions in 1D optical lattices ATSUSHI YAMAMOTO, SUSUMU YAMADA, MASAHIKO MACHIDA, CCSE, Japan Atomic Energy Agency — We present single-particle excitation spectra of ultracold fermions in one-dimensional(1D) optical lattices by using dynamical density-matrix renormalization group (DDMRG) method. Our model is described by a Hubbard model with the harmonic trap potential. We find that the spectra show many kinds of intriguing structures owing to the harmonic trap potential and on-site interaction. In an analysis of weakly-interaction regimes, we find that the spectrum structure changes from a typical Hubbard band as obtained from periodical 1D lattice to band branching as increasing the trap potential, and finally, we observe clear discrete bound-state levels. On the other hand, in case of strongly-interacting regimes, we confirm the multiple flat bound-state levels lying above 1D Tomonaga-Luttinger (TL) liquid spectrum on a central Mott-plateau phase surrounded by metallic regions. Furthermore, we also investigate spectral changes as a metallic state partially emerges at the center region and find one-dimensional TL spectrum breakdown with an emergence of a new dispersive band due to the central metal portion. The observed features are closely related with the spectral changes when doping into Mott insulator. We will show the more details of spectra in 1D fermionic optical lattices by comparing non-trapped uniform 1D spectra.

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