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# Spectroscopy by use of modulation of optical lattices

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[キーワード] optical lattices, energy absorption, Kubo formula

Cold atoms in optical lattice are a good platform in which one can explore open questions of strongly correlated systems, and realize unknown quantum nature. However, at the same time, further development of techniques for probing microscopic structures of realized systems is also necessary. We propose a novel spectroscopy in cold atom experiments by use of periodic phase-modulation of optical lattice potentials.[1]
Corresponding to the statistics of atoms, we formulate the different observables: The energy absorption rate for bosonic atom gases, and the doublon production rate for fermionic atom gases. The formulation of these observables are implemented within the linear response theory. It is clarified that they are given by the imaginary part of the retarded current-current correlation function which corresponds to a so-called optical conductivity in electron systems. In addition, as an example, we also discuss Mott insulating state for bosons in one-, two- and three-dimension, and also compare our spectroscopy with another known spectroscopy by amplitude-modulation of an optical lattice.[2,3]

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