FERMION SPECTRUM OF BOSE–FERMI–HUBBARD MODEL IN THE PHASE WITH BOSE–EINSTEIN CONDENSATE

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S u m m a r y

We investigate the fermion spectrum within the Bose–Fermi–Hubbard model used for the description of boson-fermion mixtures of ultra-cold atoms in optical lattices. We used the method based on the Hubbard operator approach for an on-site basis. The equation for fermion Green's function in the Bose–Fermi–Hubbard model is built; Green's functions of higher orders are decoupled in the Hubbard-I approximation (the case of the strong on-site interaction). The corresponding spectral densities are calculated. In the case of hard-core bosons, the condition of appearance of additional bands in the fermion spectrum is investigated. It is shown that these bands exist only in the state with a Bose–Einstein condensate and appear because of the mixing of states with different numbers of bosons. These additional bands can be interpreted as a manifestation of composite excitations (when the appearance of a fermion on the site is accompanied by the simultaneous creation (or annihilation) of a boson).