Dynamics of Bose condensates in an optical lattice with a basis[1]

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Dynamics of atomic Bose-Einstein condensates in an optical lattice with a basis is investigated. For a 1D optical lattice of two types of potential barrier within a unit cell, similar to the case of a crystal lattice with two-atom basis in a unit cell, acoustic as well as optical phonons can propagate along the lattice of atom clouds. These are in addition to in-phase and out-of-phase collective excitations of the condensates. The dispersions of phonons depend crucially on the relative size of two tunneling amplitudes (J_1 and J_2) across the two barriers and the ratio of J_1, J_2 to the repulsion U between the atoms. Using a variational method, the effect of condensate breathing modes on the phonons is studied in details. The dynamic structure factor of the system is also studied.

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