Polaritons in a nonideal array of microcavities with ultracold quantum dots

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The report is devoted to elucidation of the effect of point-like defects on polariton dispersion in a 1D and 2D microcavity array with embedded one-level quantum dots. It is shown that the presence of vacancies in the microcavity (resonator) and atomic (quantum dots) subsystems results in a substantial renormalization of polariton spectrum and thus in a considerable alteration of optical properties of the structure. Introduction of defects leads to an increase in the effective masses of polaritons and hence to a decrease of their group velocity. Our model is primarily based on the virtual crystal approximation, which is often employed to examine quasiparticle excitations in sufficiently simple disordered superstructures. More complex systems usually require the use of more sophisticated methods such as the (one- or multinode) coherent potential approximation, the averaged T-matrix method and their various modifications. The obtained numerical results contribute to our understanding of composite polaritonic structures and the prospects of their utilization for construction of solid-state devices with controllable propagation of electromagnetic waves.

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