Electromagnetic excitations in a non-ideal microcavity lattice

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The advent of optoelectronic devices utilizing various recent advances in photonics such as the harvesting of light by nanophotonic waveguides or quantum information processing has elevated the importance of the correct theoretical understanding of nanocrystalline photonic structures. A special class of photonic crystals featured by a strong coupling between quantum excitations (excitons) and optical fields is called polaritonic crystals. Examples of polaritonic structures are spatially periodic systems of coupled microcavities (resonators) as well as by the arrays of quantum dots embedded within photonic nanostructures. Lately, there has been a growing interest for optical modes in microcavity arrays with embedded quantum dots. Basing on our previously developed concepts of non-ideal polaritonic structures in the present work we study the effect of random uneven spacing of cavities on the dispersion characteristics of electromagnetic excitations in 1D and 2D microcavity lattices. More specifically, we consider the case of polaritonic excitations in a non-ideal two-sublattice tunnel-coupled microcavity system with embedded quantum dots as well as the case of exciton-like excitations in the system of quantum-dot-free cavities. Our results contribute to the modeling of the new class of functional materials, namely the so-called polaritonic systems (microcavity arrays with embedded quantum dots) where controlling of propagation of electromagnetic excitations is accomplished by an appropriate introduction of structural defects.

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