Effect of an atom on a quantum guided field in a weakly driven fiber-Bragg-grating cavity

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Abstract

We study the interaction of an atom with a quantum guided field in a weakly driven fiber-Bragg-grating (FBG) cavity. We present an effective Hamiltonian and derive the density-matrix equations for the combined atom-cavity system. We calculate the mean photon number, the second-order photon correlation function, and the atomic excited-state population. We show that, due to the confinement of the guided cavity field in the fiber cross-section plane and in the space between the FBG mirrors, the presence of the atom in the FBG cavity can significantly affect the mean photon number and the photon statistics even though the cavity finesse is moderate, the cavity is long, and the probe field is weak.

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