Optimal vertical emission of photonic crystal slab line-defect cavities with a bottom DBR reflector

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For a photonic crystal (PC) slab cavity containing a single quantum dot, there are two ways to improve the emission efficiency. Lateral outcoupling [1] and vertical outcoupling using a DBR mirror under this structure [2]. Here we use the 3-D Finite-Difference Time-Domain (FDTD) model to analyze the last method (see Fig.1). Prelimiliary calculations of the E_X-field distribution have indicated that the GaAs/AlAs DBR bottom mirrors placed underneath a PC slab at half-wavelength (λ/2) and one-wavelength (λ) can obtain very efficient vertical emission. In addition, more than 90% of the emitted photons can be collected without any effect on the cavity Q [2].

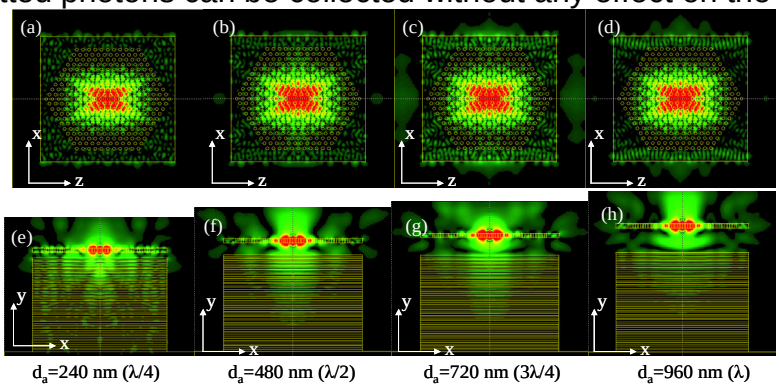

Fig. 1: E_X-field distributions in the photonic crystal microcavities with a bottom DBR reflector.

[1] E. Waks and J. Vuckovic, *Optics Express* **13**, 13, 5064-5073 (2005).
[2] J. Vuckovic, D. Englund, D. Fattal, E. Waks, and Y. Yamamoto, *Physica E*, **31**, 2 (2006).