

# Role of etching depth and radiative losses on spontaneous emission into quasi-guided photonic crystal slab modes

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Spontaneous emission of a dipole in a slab waveguide mainly occurs into the guided modes. However, an enhancement of the emitted field in the vertical direction can be obtained by means of a periodic patterning of the waveguide, exploiting the coupling of the emitter to quasi-guided photonic crystal (PhC) slab modes that radiate efficiently out-of-the slab plane<sup>1</sup>.

We have theoretically studied emission processes of incoherent dipoles in a PhC slab as a function of the etching depth. This systematic analysis has been carried out by means of a guided-mode expansion method<sup>2</sup> and a Fourier-modal approach.<sup>3</sup>

As the vertical thickness of the patterned region increases, we observe a transition from a diffraction grating to a photonic crystal regime, which has remarkable consequences in the emission properties of such systems. In particular, the dependence of the emission intensity on the quasi-guided mode losses and field distribution is analyzed in detail for the case of a triangular lattice PhC slab.

[1] S. Fan et al., Phys. Rev. Lett. **78**, 3294 (1997)

[2] L. C. Andreani and D. Gerace, Phys. Rev. B **73**, 235114 (2006)

[3] D. M. Whittaker and I.S. Culshaw, Phys. Rev. B **60**, 2610 (1999)