Fast mode interface for robust and efficient coupling to slow light modes in photonic crystal waveguides

T. P. White, L. O'Faolain, D. O'Brien, D. Biallo and T. F. Krauss,
School of Physics and Astronomy, University of St Andrews, Fife KY16 9SS, UK.

Slow light applications in photonic crystal waveguides require efficient coupling methods to manage the losses associated with coupling to low group velocity modes near the band edge. In this regime, the losses not only increase with group index, but they are also sensitive to the termination of the photonic crystal at the input interface [1].

We present a two-stage coupler whereby light is first coupled from a ridge waveguide into a fast photonic crystal waveguide mode and then into the slow mode of a W1 waveguide. The fast mode interface is formed by stretching the photonic crystal lattice along the waveguide axis, thereby shifting the mode to lower frequencies. Numerical and experimental results show that this approach increases dramatically the coupling efficiency close to the band edge (see fig 1). Moreover, the coupling is found to be significantly more robust to variations in the interface termination.

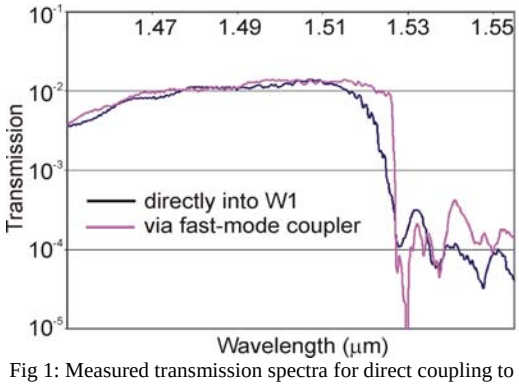

Fig 1: Measured transmission spectra for direct coupling to a W1 waveguide and coupling via a fast-mode interface

[1] Y. A. Vlasov and S. J. McNab, *Opt. Lett.*, **31**, 1 (2006).