# Experimental and numerical demonstration of a plasmonic nanoantenna embedded in a silicon waveguide gap

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**Abstract**

Plasmonic nanoantennas have been integrated in dielectric waveguides in recent experiments. If the metallic nanostructure is placed on top of the waveguide [1], the excitation of the nanostructure by the evanescent tail of the waveguide mode is enabled, that results in small interaction efficiencies (<10%) and low power contrasts (< 2) between maxima and minima at the waveguide output. Moreover, the output power depends on the response of the waveguide-nanostructure system, since the evanescent field of the waveguide top boundary contains a remarkable longitudinal component [2] and this prevents to properly identify the performance of the isolated nanostructure.

In this work, we present and demonstrate a new strategy to illuminate and measure the response of isolated subwavelength metallic nanostructures integrated in a silicon photonics circuit. Our concept is schematically described in Fig. 1. A very small gap separates two silicon waveguides with rectangular cross-section, being the plasmonic nanostructure placed in the middle of it, that ensures a maximum interaction of the propagating light field with the nanostructure [3]. When illuminated, part of the light scattered by the nanostructure will be emitted towards the input port (backscattering) or towards the output port (forward scattering), being the rest of scattered field radiated out of the waveguide. Besides, the metallic nanostructure can also absorb a large amount of the incoming power, especially when an LSP resonance is excited. Additionally, the nanostructure response is characterized by a crossing between the transmission and reflection spectra in the wavelength region close to the LSPR, that can be considered as a signature of the excitation of the LSP resonance.

In summary, we demonstrate numerically and experimentally [4] that embedding a plasmonic nanoantenna in a silicon waveguide gap enables the full excitation of the nanostructure, rising a high interaction efficiency and achieving a contrast beyond 10 dB in transmission (50 dB in numerical simulations). This results pave the way for exploiting the properties of isolated nanoantennas and plasmonic resonators in applications including biosensing or switching.

**References**

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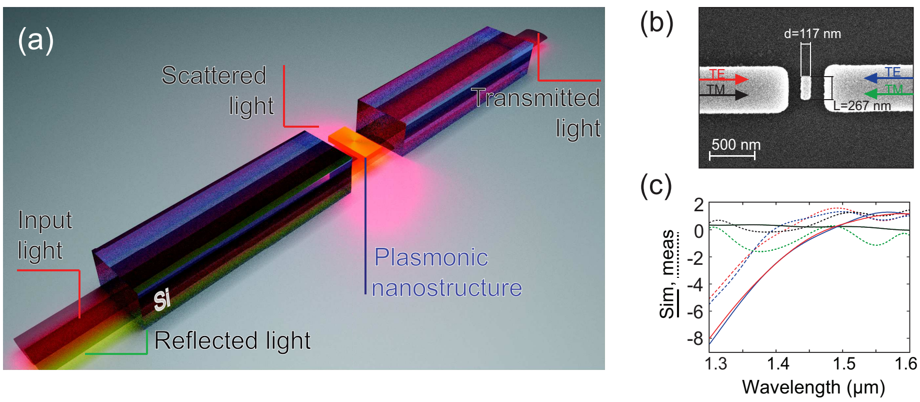


**Figure 1.** (a) Scheme of the proposed structure. (b) SEM image of the fabricated structure. (c) Simulated and measured transmission spectra.