

Nonlinear optics in wavelength-size waveguides: how far can the conversion efficiency be pushed?

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When their size approach the wavelength of light propagating in them, waveguides exhibit favorable properties such as high nonlinearity and strong confinement. These properties have been used for a variety of nonlinear effects, including supercontinuum generation, second-, third- and one-third- harmonic generation, pulse shaping and nonlinear switching.

Although simulations predicted conversion efficiencies well in excess of 30% for most of harmonic generation, experiments showed conversions of a fraction of a percent, at best.

This talk will discuss harmonic generation in wavelength-size waveguides and limitations to the practical achievement of theoretical efficiency. In particular, intrinsic surface roughness due to thermal surface waves frozen during fabrication provide a constantly changing detuning from the ideal phase matching conditions, considerably reducing the overall efficiency for waveguides longer than 1mm.