

Strong modification of effective nonlinear response of subwavelength metal hole arrays by controlling hole shape

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Subwavelength metal hole arrays can exhibit extraordinary (linear) transmission [1] resulting in huge field enhancements inside the holes. We have previously shown that this intriguing phenomenon can be enhanced by tailoring the shape of the holes [2]. We now find that the concomitant increase of the local optical intensity leads to an expected enhancement of nonlinear processes like second harmonics generation by up to 2 orders of magnitude. However, it is also found that the shape of the holes can even affect the structure's effective nonlinear susceptibility itself. We find that a "hot" hole shape exists for which the nonlinear susceptibility is increased by more than an order of magnitude. The increase in nonlinear response can be attributed to slow light inside the holes which results in an increased light-matter interaction [3].

- [1] T.W. Ebbesen, *et al.*, *Nature* **391**, 667 (1998).
- [2] K.J. Klein Koerkamp, *et al.*, *Phys. Rev. Lett.* **92**, 183901 (2004).
- [3] J.A.H. van Nieuwstadt, *et al.*, *Phys. Rev. Lett.* **97**, 146102 (2006).