Design of Bidirectional Subwavelength Slit Coupler for THz Surface Plasmons

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For NUSOD, Newark, Sep. 25, 2007

Highlight

Introduction

- *Part 1 Introduction*
- **Part 2 Design of the Plasmonic Surface Wave Splitter**
- **Part 3 Bidirectional Subwavelength Slit Coupler for THz Surface Plasmons**

- **Era of Electronics**



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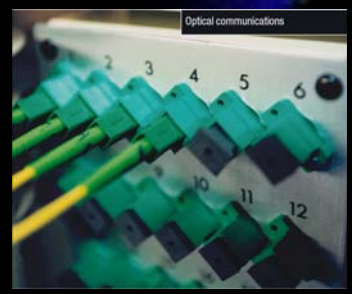
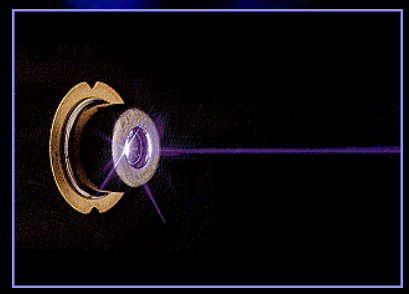
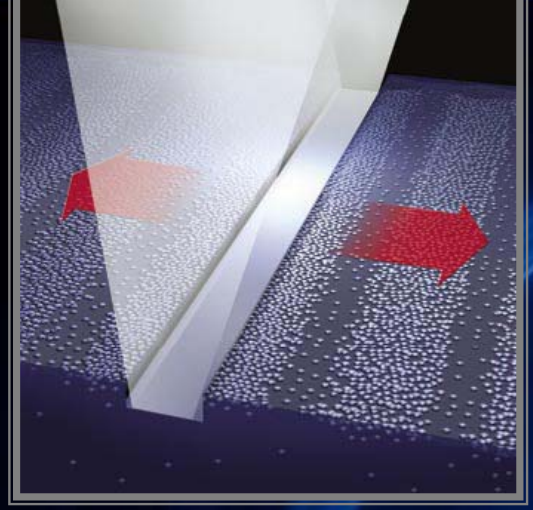
Part 1 Introduction

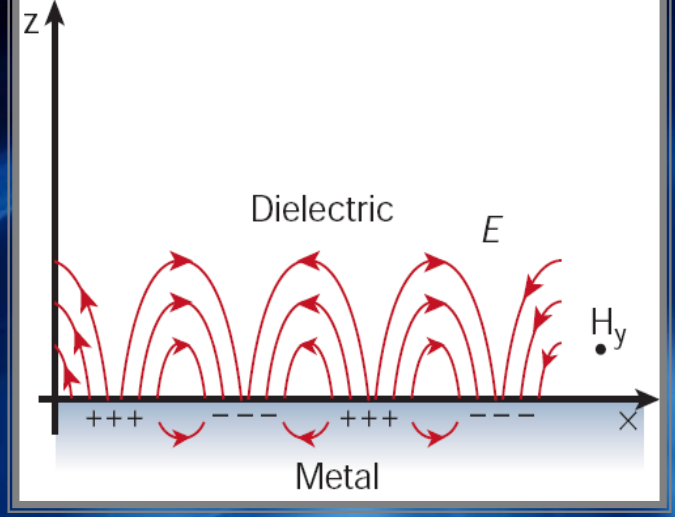
- ***Era of Photonics?***

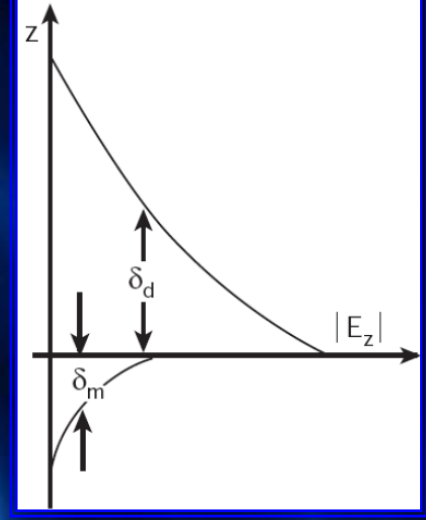






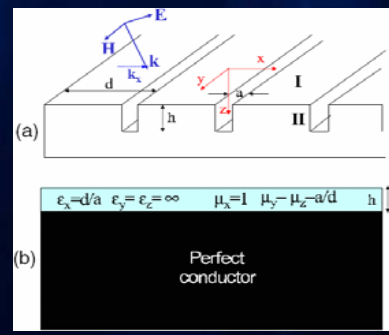


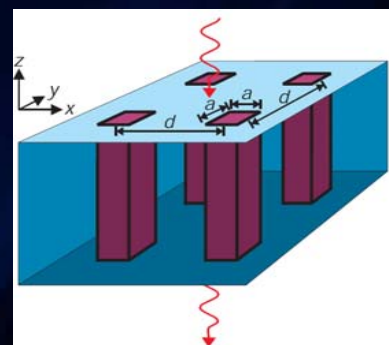




Part 1 Introduction

***Spoof* SPPs: The concept of "designer" surface modes opens opportunities to control and direct radiation at surfaces within a subwavelength region, especially for GHz to THz frequencies.**





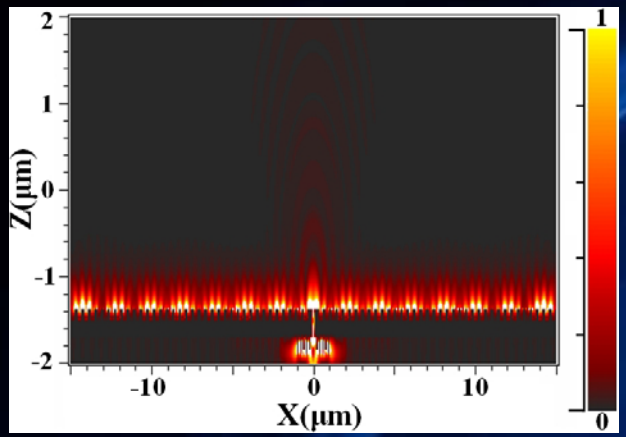
- J. B. Pendry, *et. al.* "Mimicking surface plasmons with structured surfaces," Science vol. **305**, pp.847 (2004).
- F. J. Garcia-Vidal, L. Martin-Moreno, and J. B. Pendry, J. Opt. A: Pure Appl. Opt. **7**, S94 (2005).

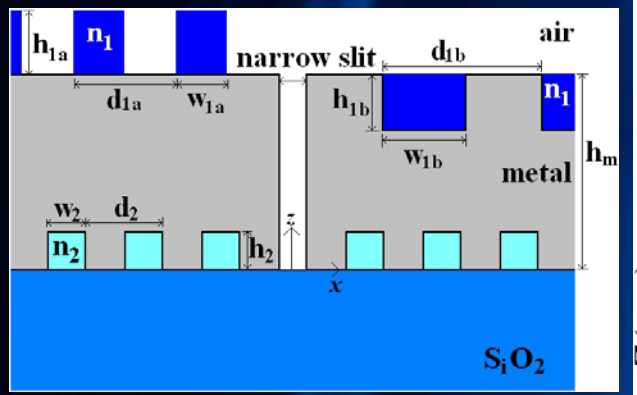
Highlight

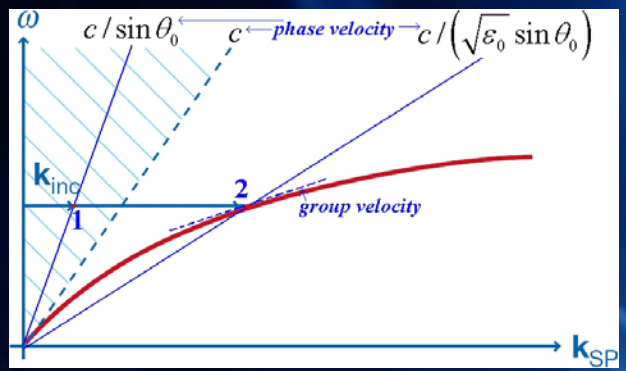
Principles of the Design

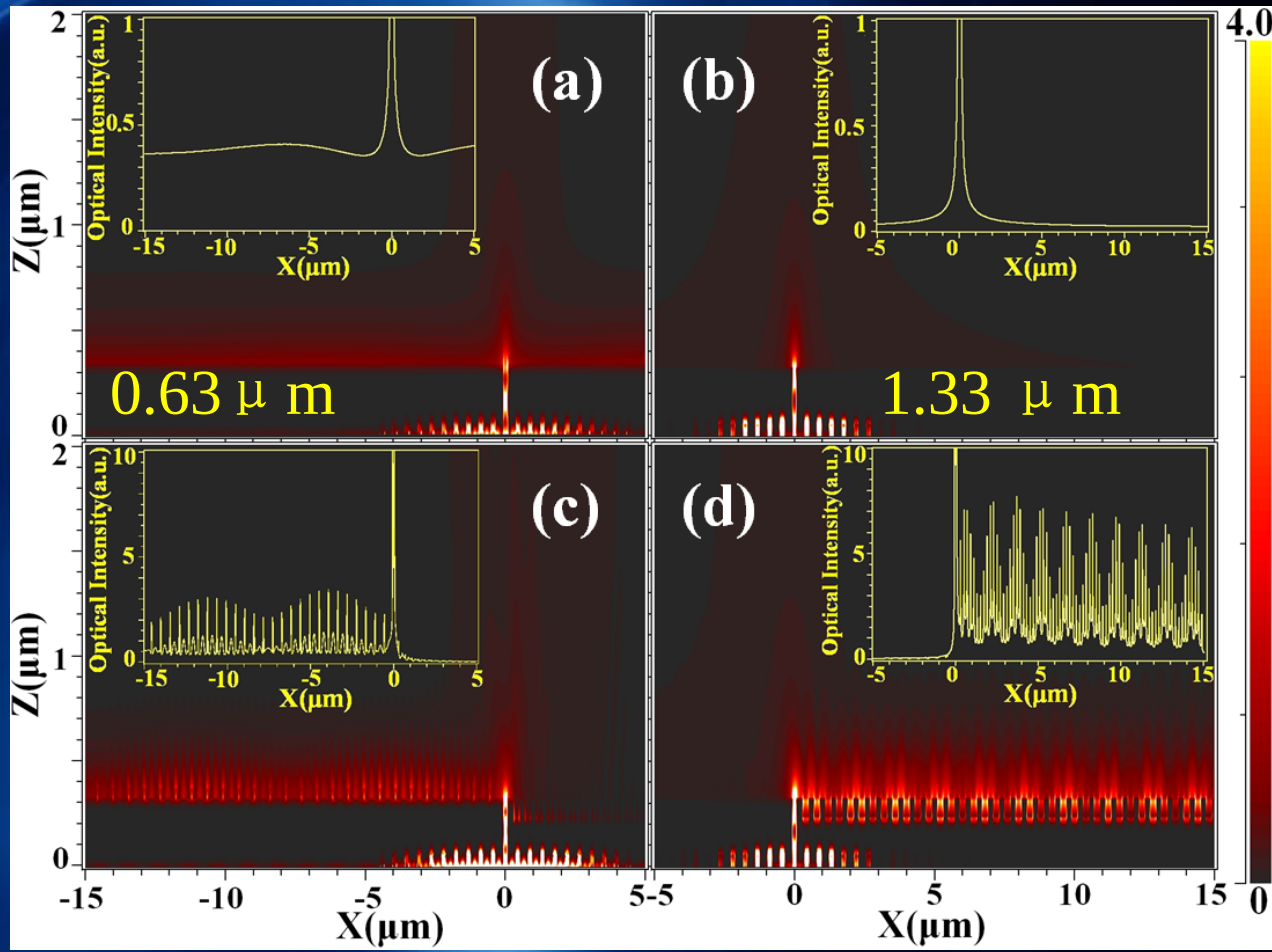
- **Part 1 Introduction**
- *Part 2 Design of the Plasmonic Surface Wave Splitter*
- **Part 3 Bidirectional Subwavelength Slit Coupler for THz Surface Plasmons**

Plasmonics Surface Wave Splitter









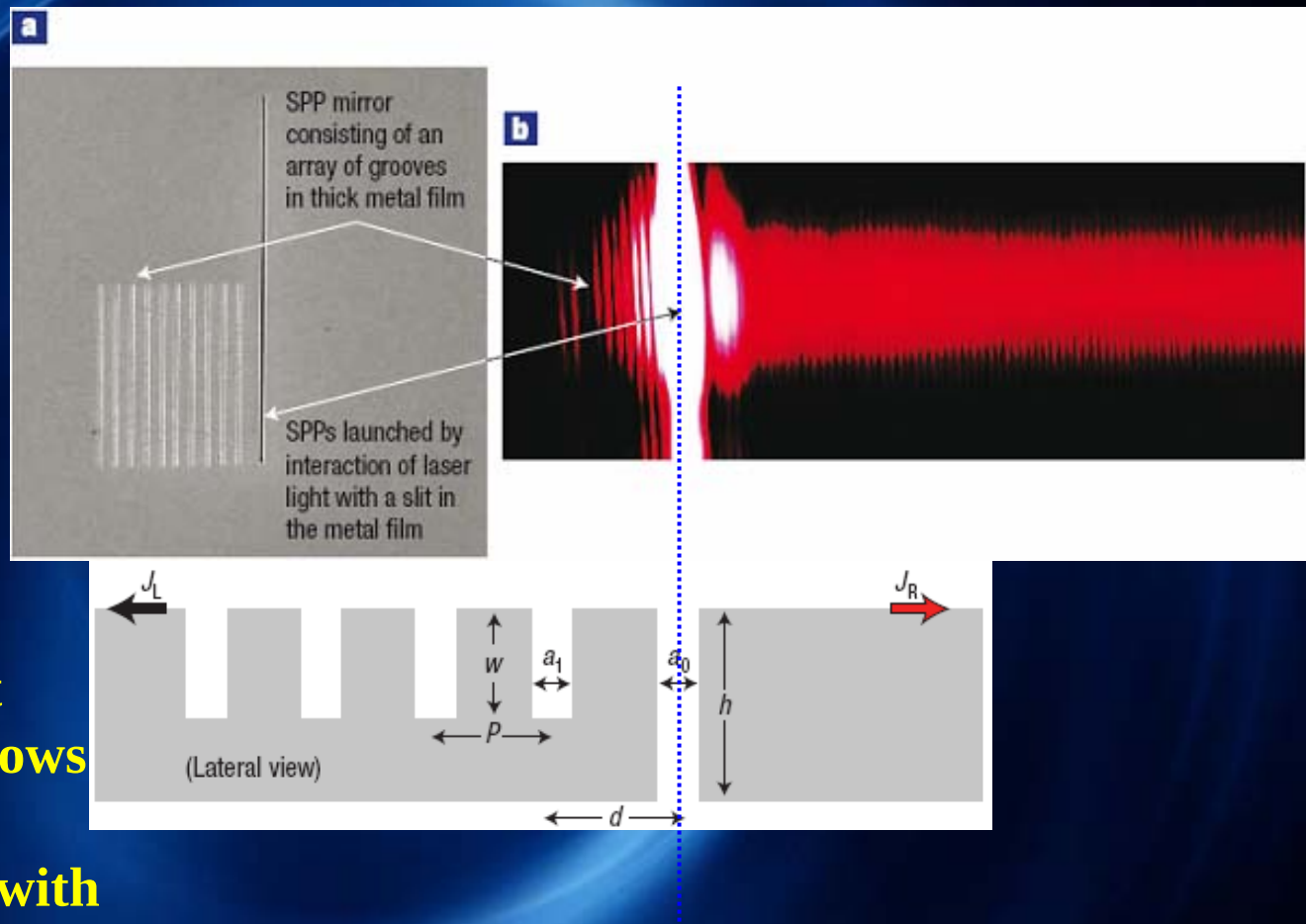
In Visible and near IR spectrum

Q. Gan, *et. al.* Appl. Phys. Lett. **90**, 161130 (2007) (April 16, 2007)

Efficient unidirectional nanoslit couplers for surface plasmons

- Asymmetric surface structures on the two sides of the slit
- Use the 1D grating structure as DBR reflector

Careful choice of the distance between the slit and the groove array allows the reflected SPPs to constructively interfere with the SPPs traveling in the opposite direction — the direction the authors wish them to travel.



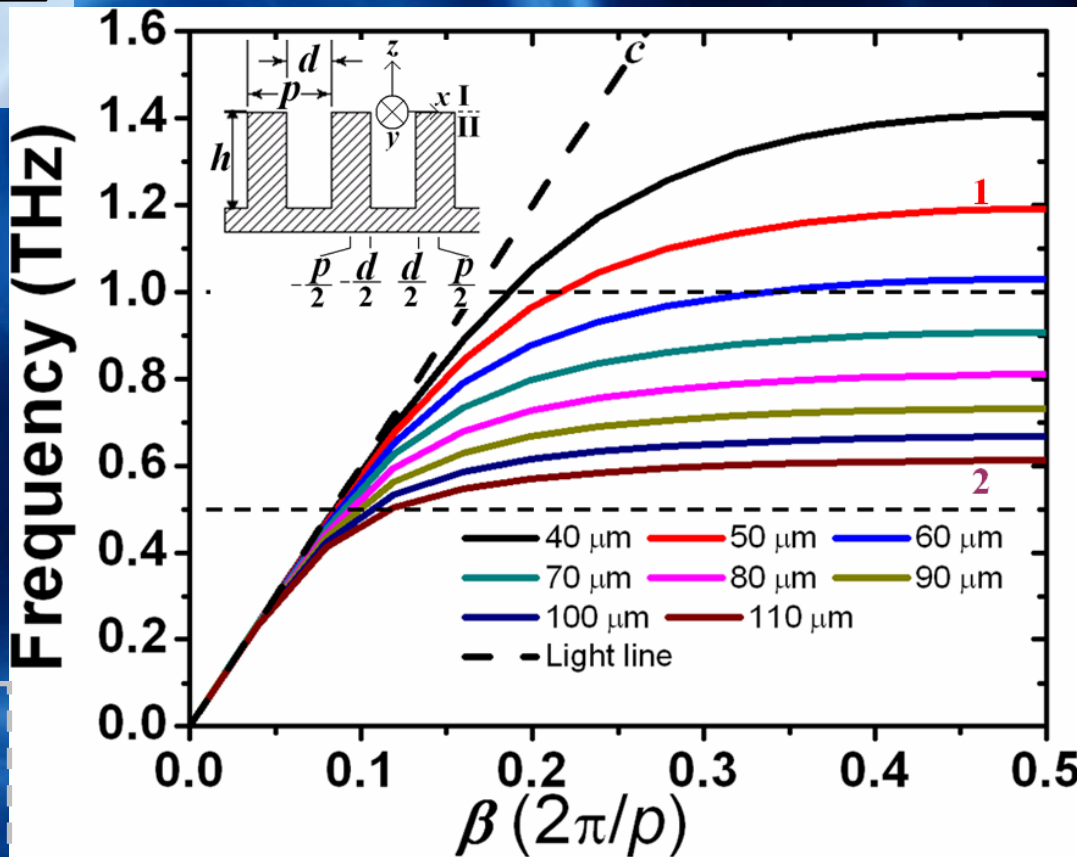
In Visible and near IR spectrum

Lopez-Tejeira, *et. al.* Nature Physics **3**, 324 (2007) (May 1, 2007)

Dispersion curves of the metal grating structures

Eigenvalue equation of the 1D groove array

$$\frac{d}{p}\sum_{n=-\infty}^{\infty}\frac{1}{\tau_n h}\left(\operatorname{sinc}\frac{\beta_n d}{2}\right)^2=\frac{\cot kh}{kh}$$



K. Zhang, D. Li, *Electromagnetic Theory for Microwaves and Optoelectronics* (Springer-Verlag, Berlin Heidelberg 1998).

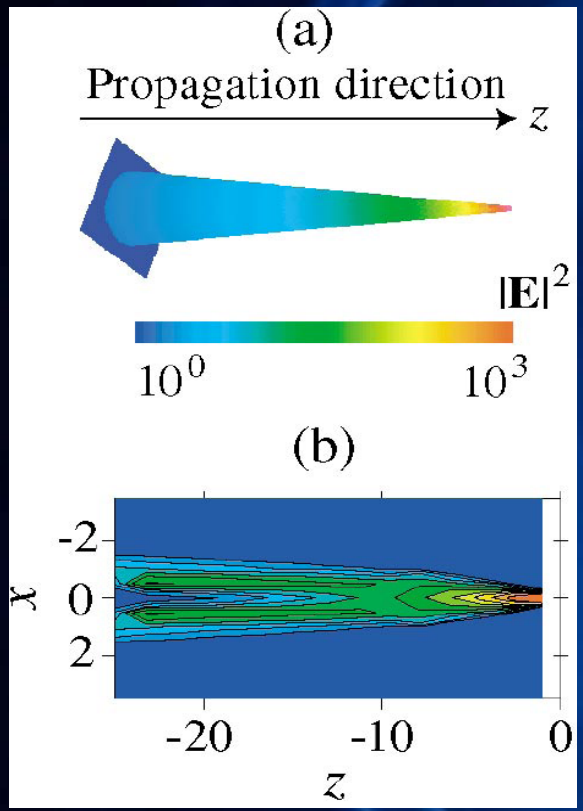
Highlight

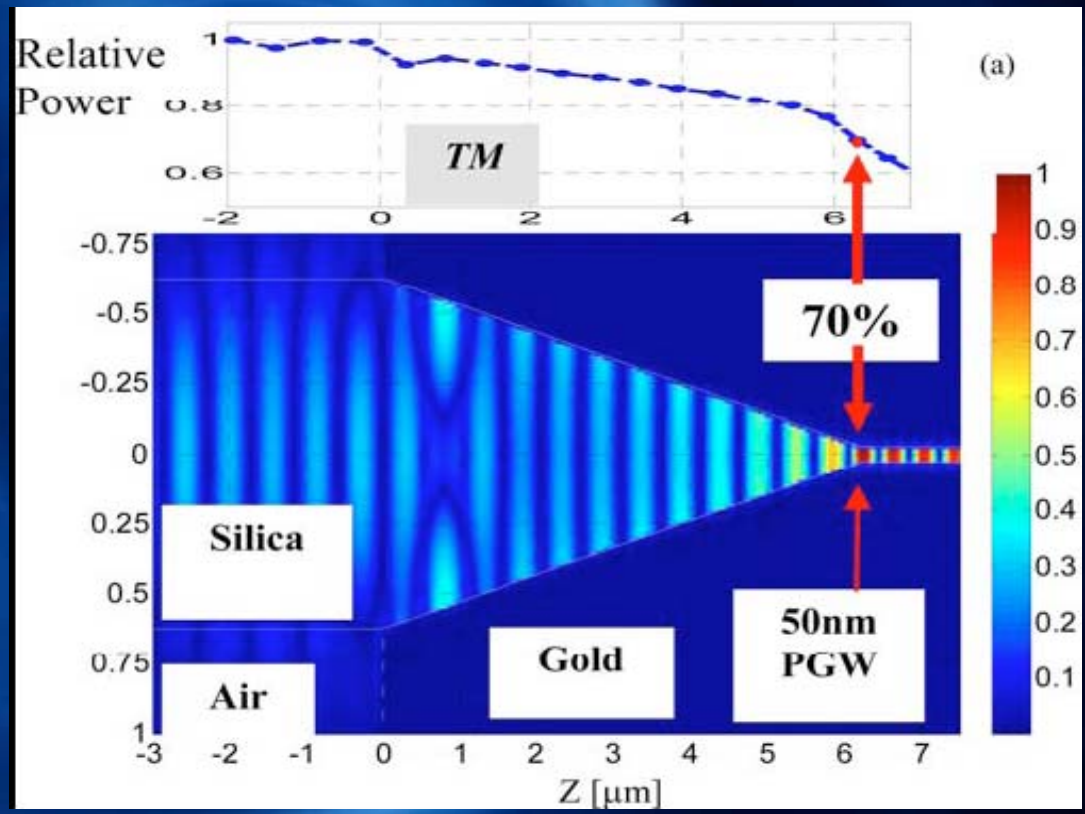
THz Surface Plasmons

- **Part 1 Introduction**
- **Part 2 Design of the Plasmonic Surface Wave Splitter**
- ***Part 3 Bidirectional Subwavelength Slit Coupler for THz Surface Plasmons***

Bidirectional Subwavelength Slit Coupler for THz Surface Plasmons

Coupler Part:



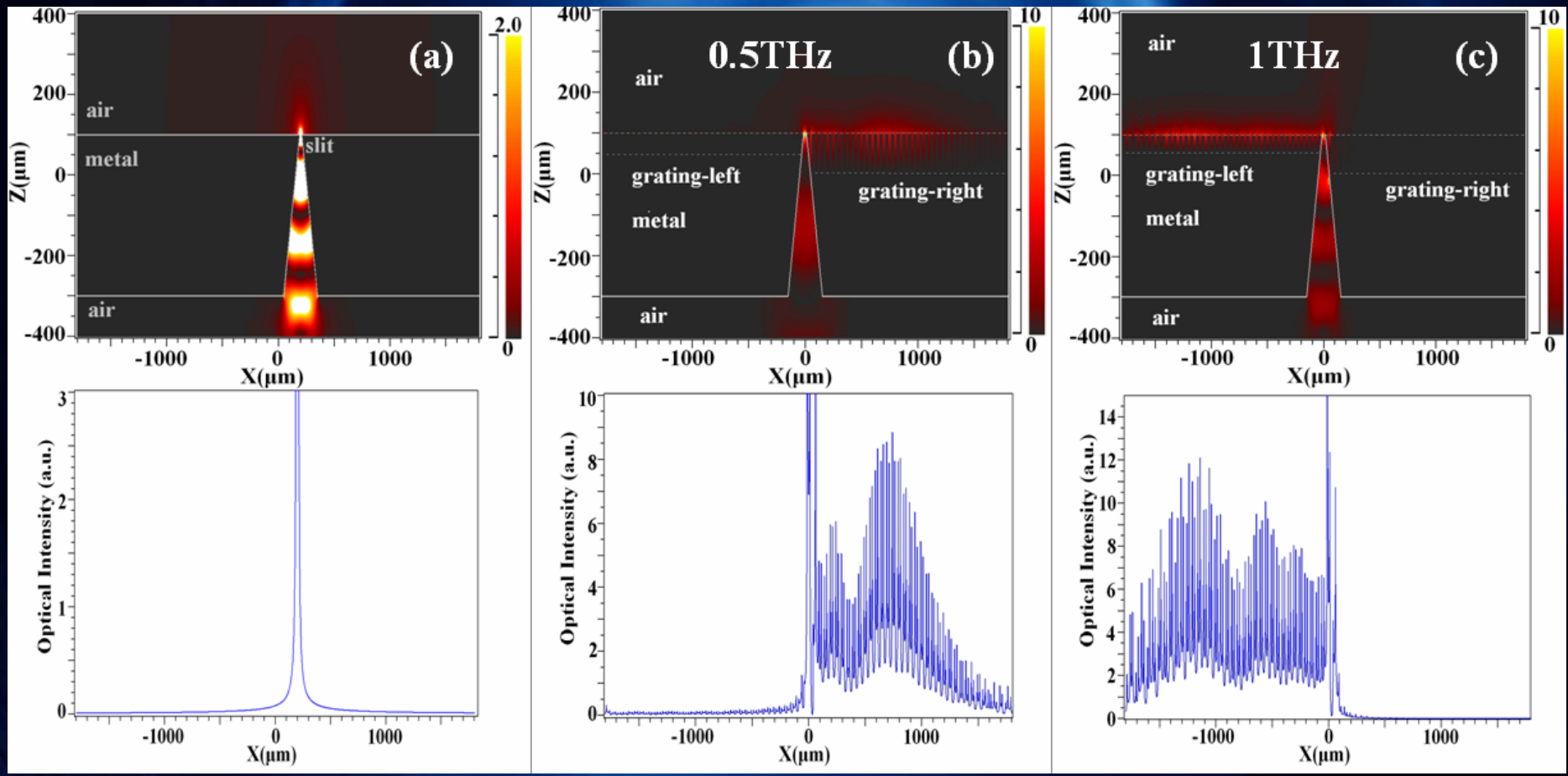


• Mark I. Stockman.“ Nanofocusing of Optical Energy in Tapered PlasmonicWaveguides,” Phys. Rev. Lett.**93**, 137404 (2004).

• P. Ginzburg, D. Arbel, and M. Orenstein. “Gap plasmon polariton structure for very efficient microscale-tonanoscale interfacing,” Opti. Lett. **31**, 3288 (2006)

Bidirectional Subwavelength Slit Coupler for THz Surface Plasmons

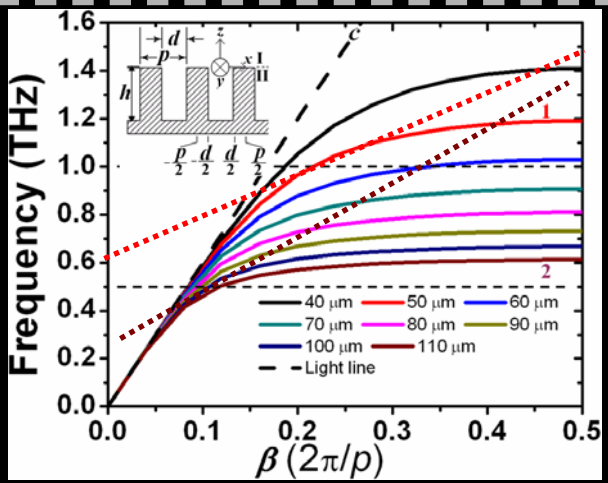
Splitter Part:



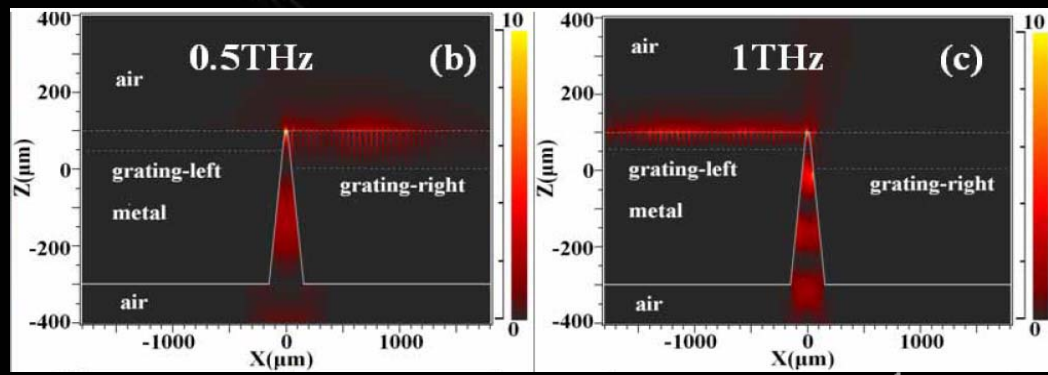
Design of Bidirectional Subwavelength Slit Coupler for THz Surface Plasmons

Part 1 Introduction
Part 2 Design of the Plasmonic Surface Wave Coupler
Part 3 Unidirectional and Bidirectional Subwavelength Slit Coupler for THz Surface Plasmons

Summary



Design



FDTD results

Thank you