



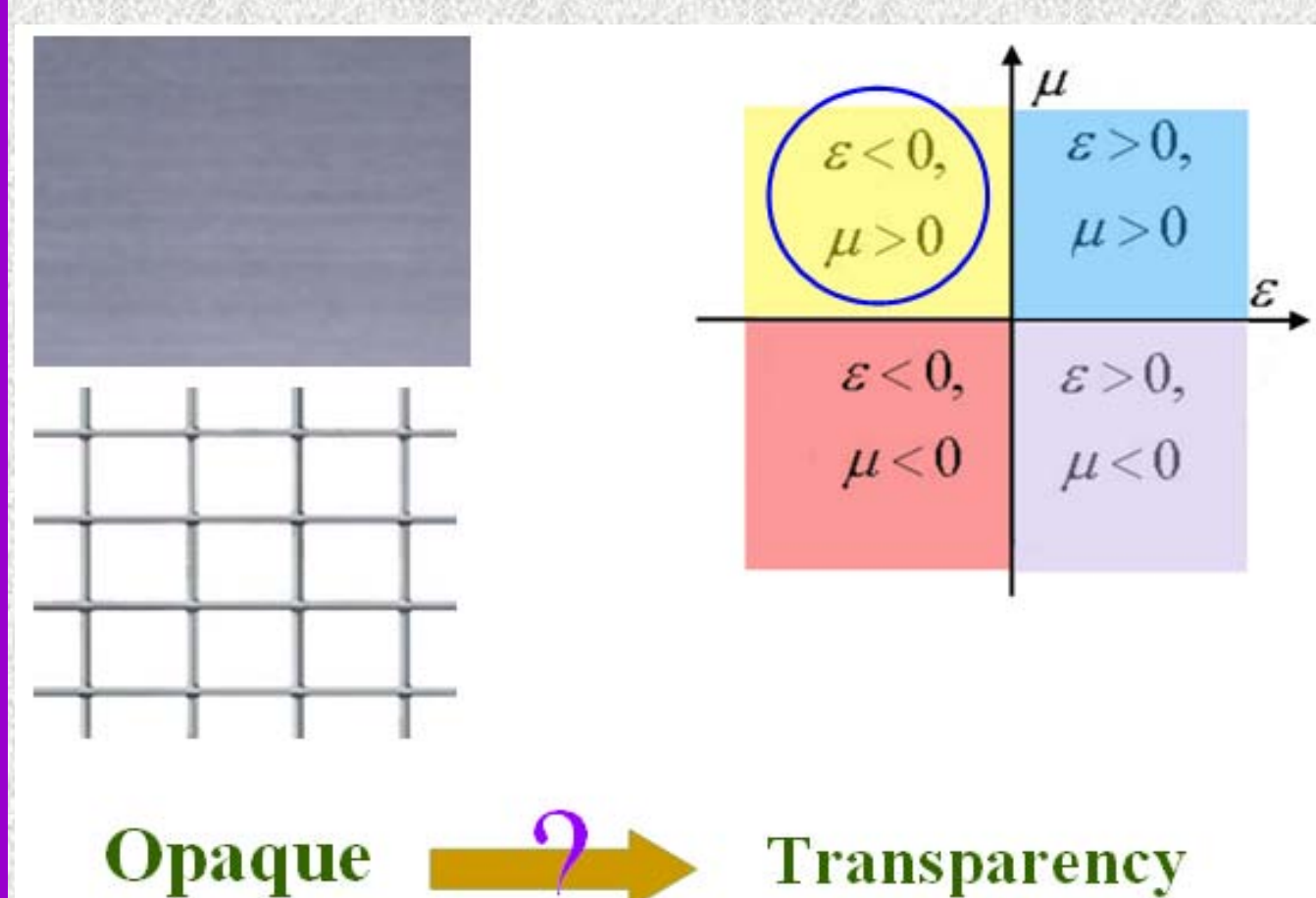
Making a solid metallic film perfectly transparent

Zhengyong Song, Feilong Mao, Qiong He, Zhenghua An,
and Lei Zhou

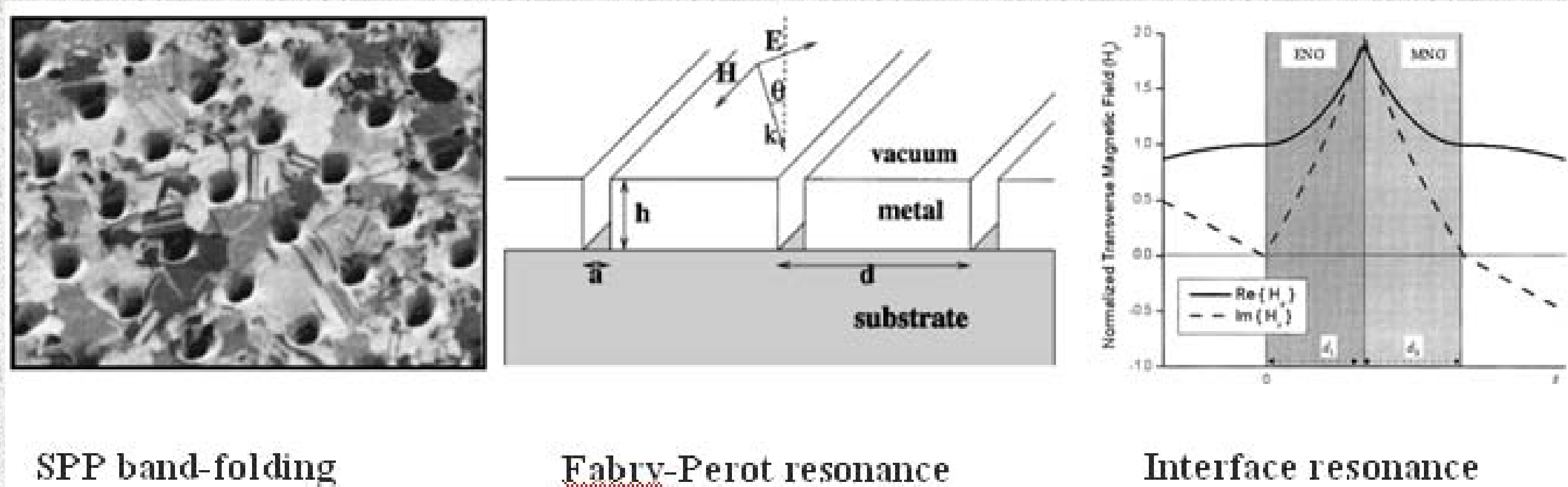
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Background



Previous mechanisms



Sensitive to period
Low transmission

Strongly depend on thickness
No subwavelength

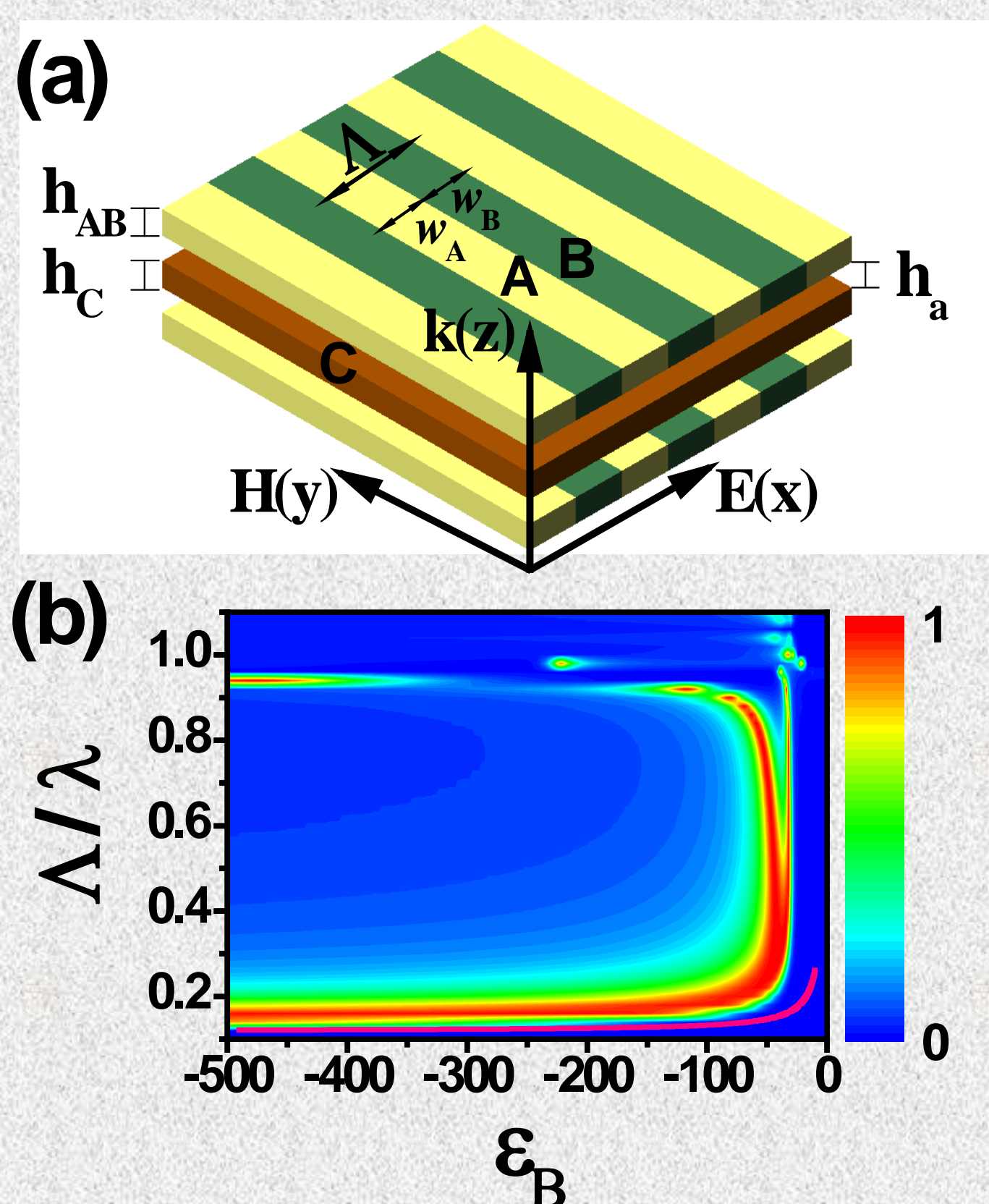
Not easily realized in
visible or IR region

Our Motivations

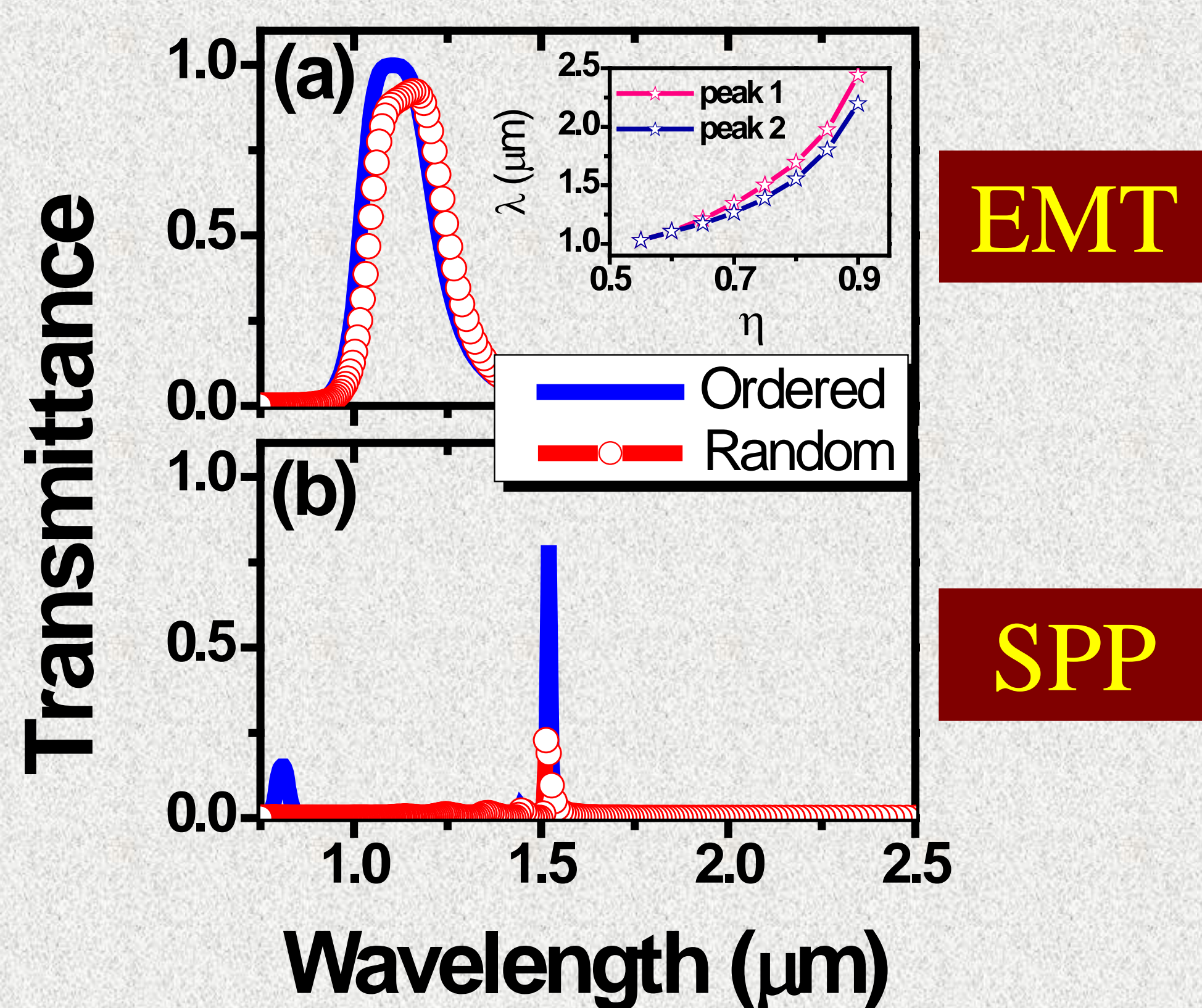
- ① Structureless metal film
- ② High transmission
- ③ Insensitive to disorder
- ④ Ultra-wide band
- ⑤ Simple principle

**Metamaterial opens up
new paths!**

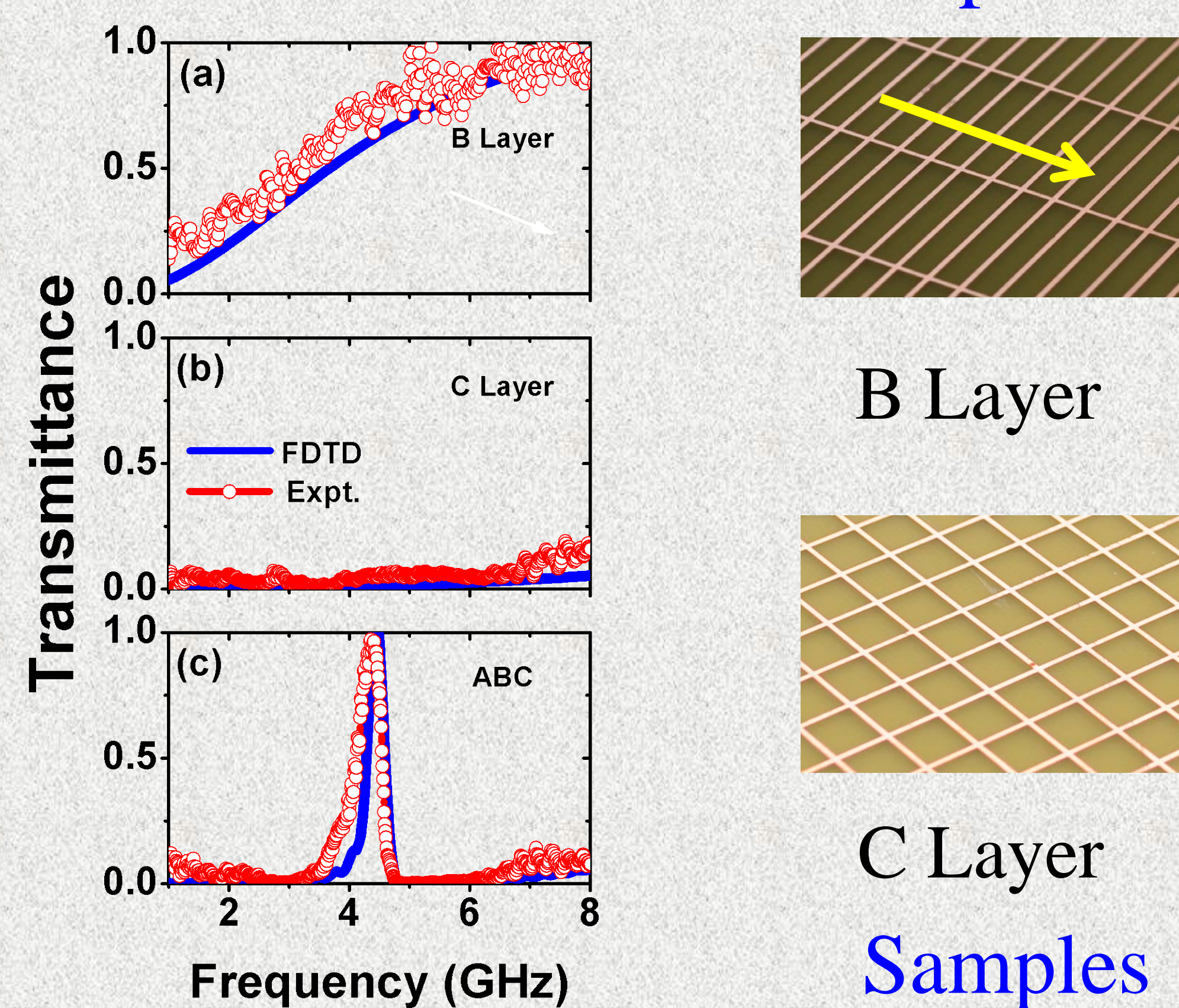
Theoretical Model



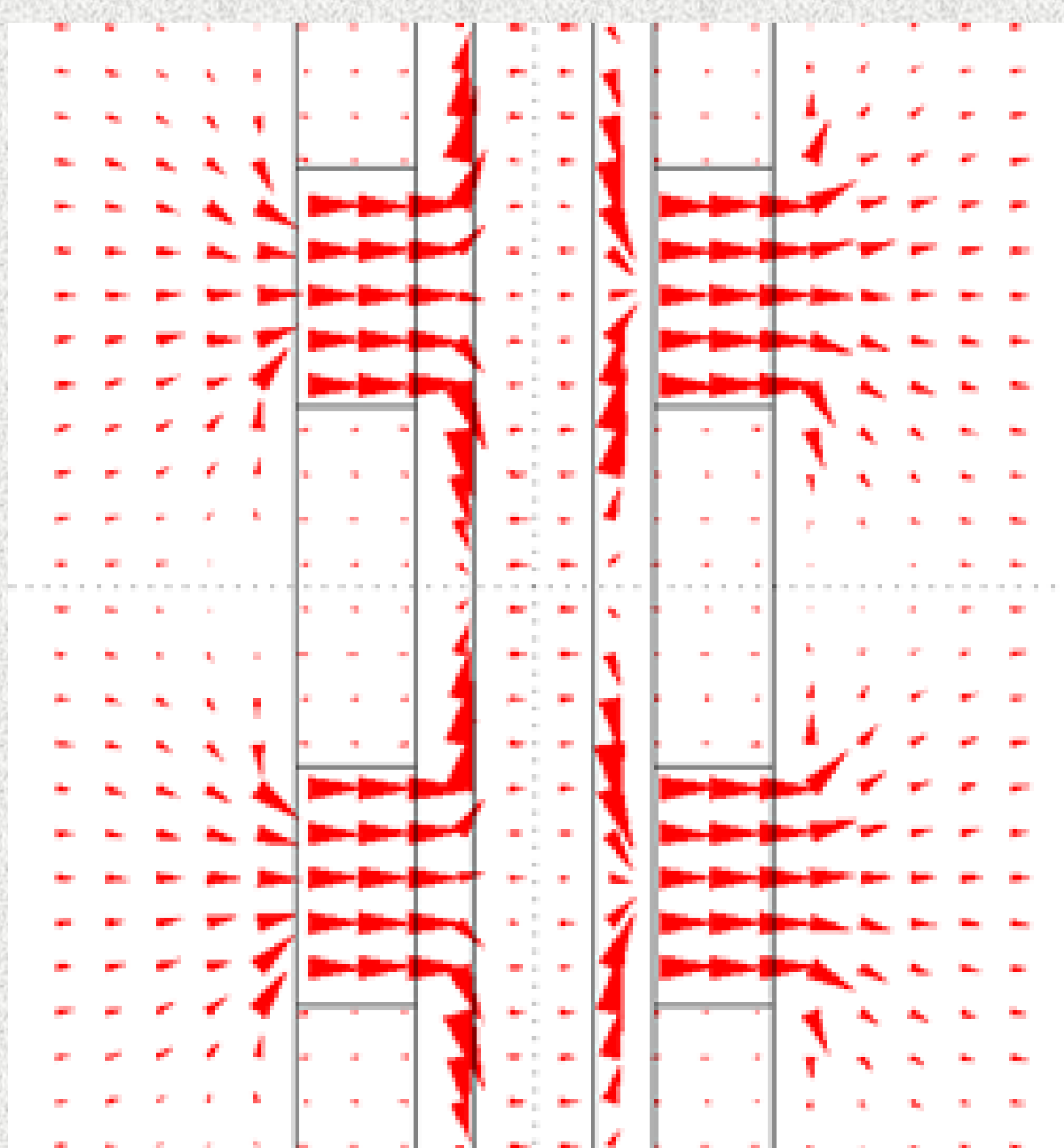
Realization in Near-IR



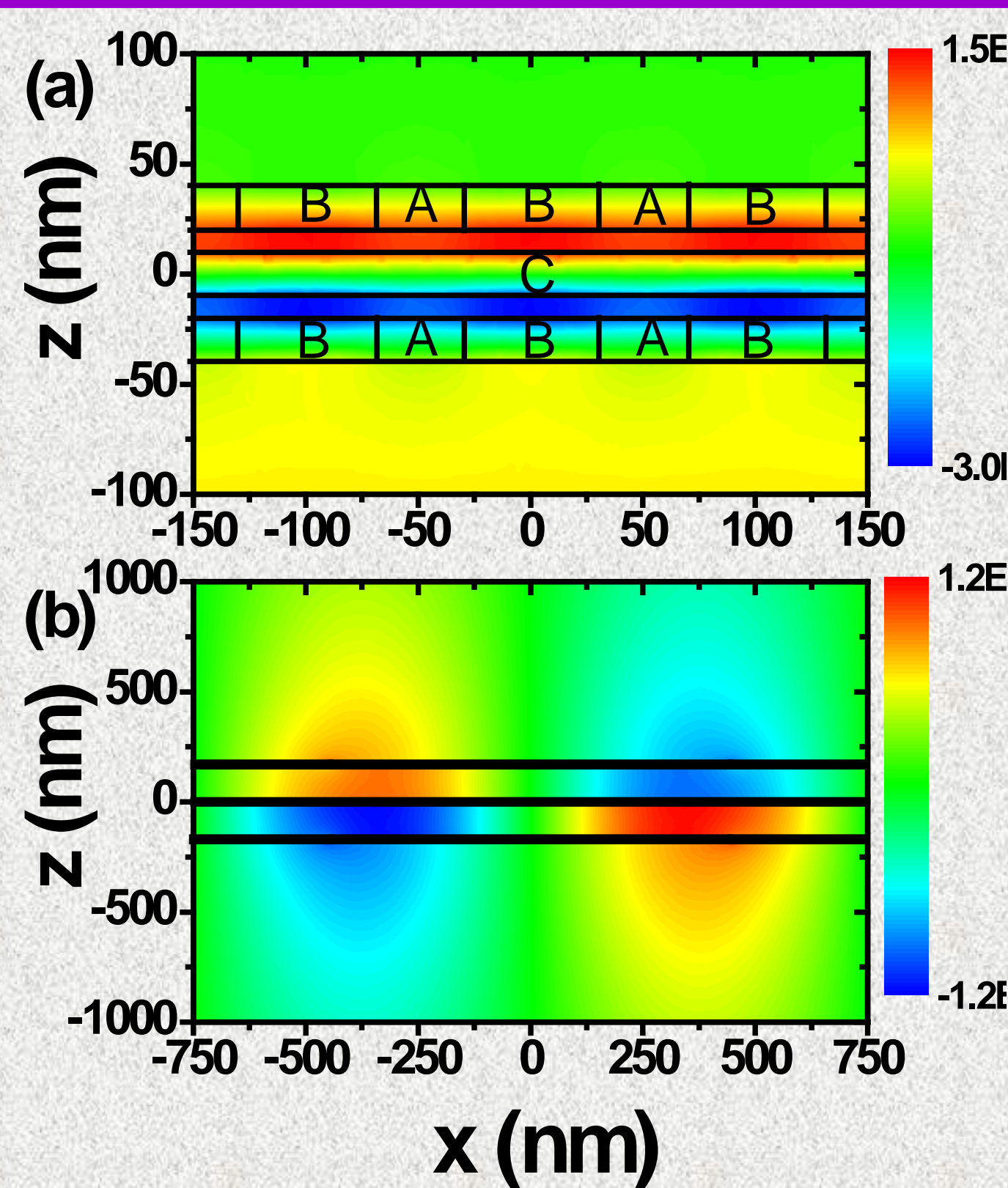
Microwave Simulation & Experiment



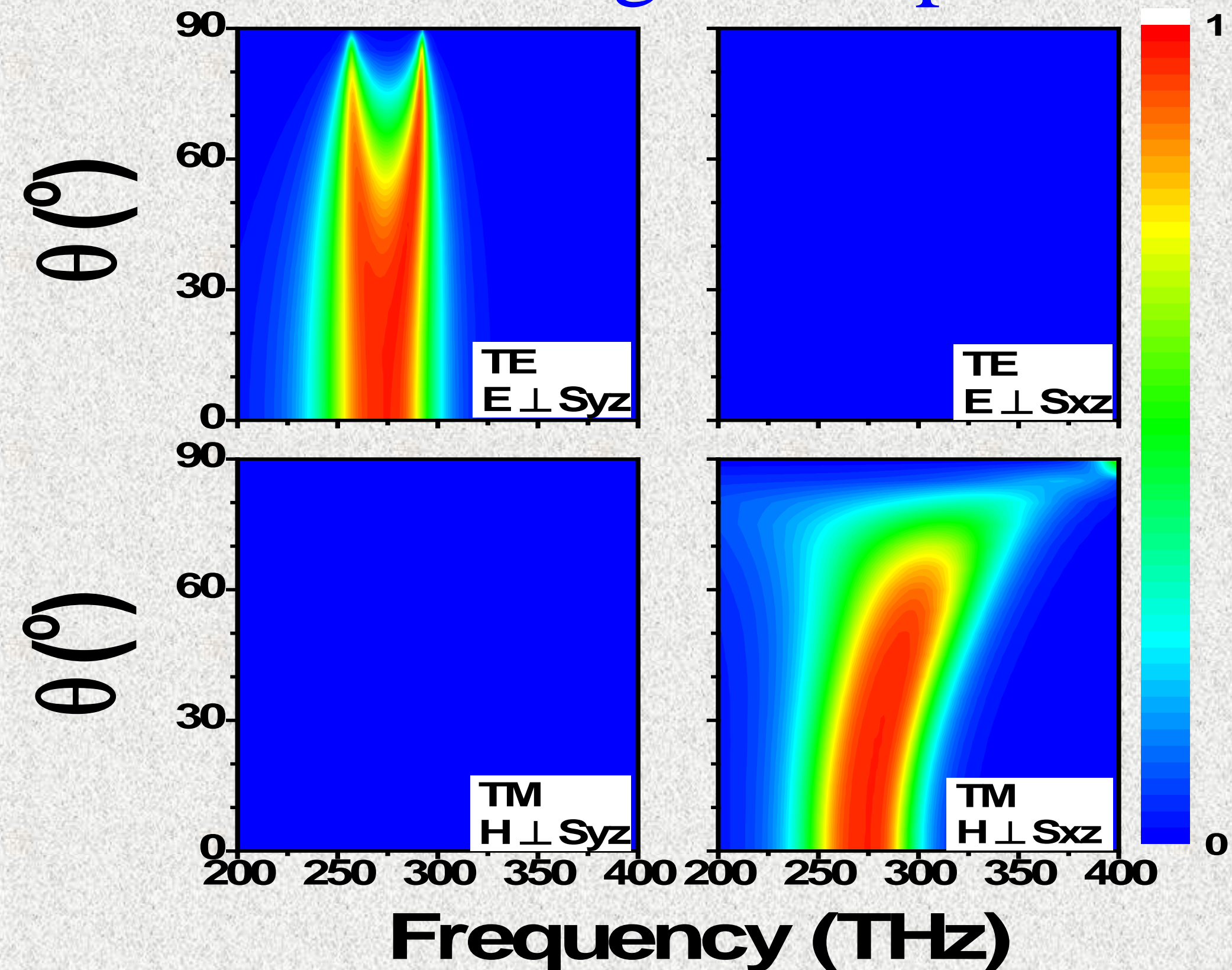
Energy flux



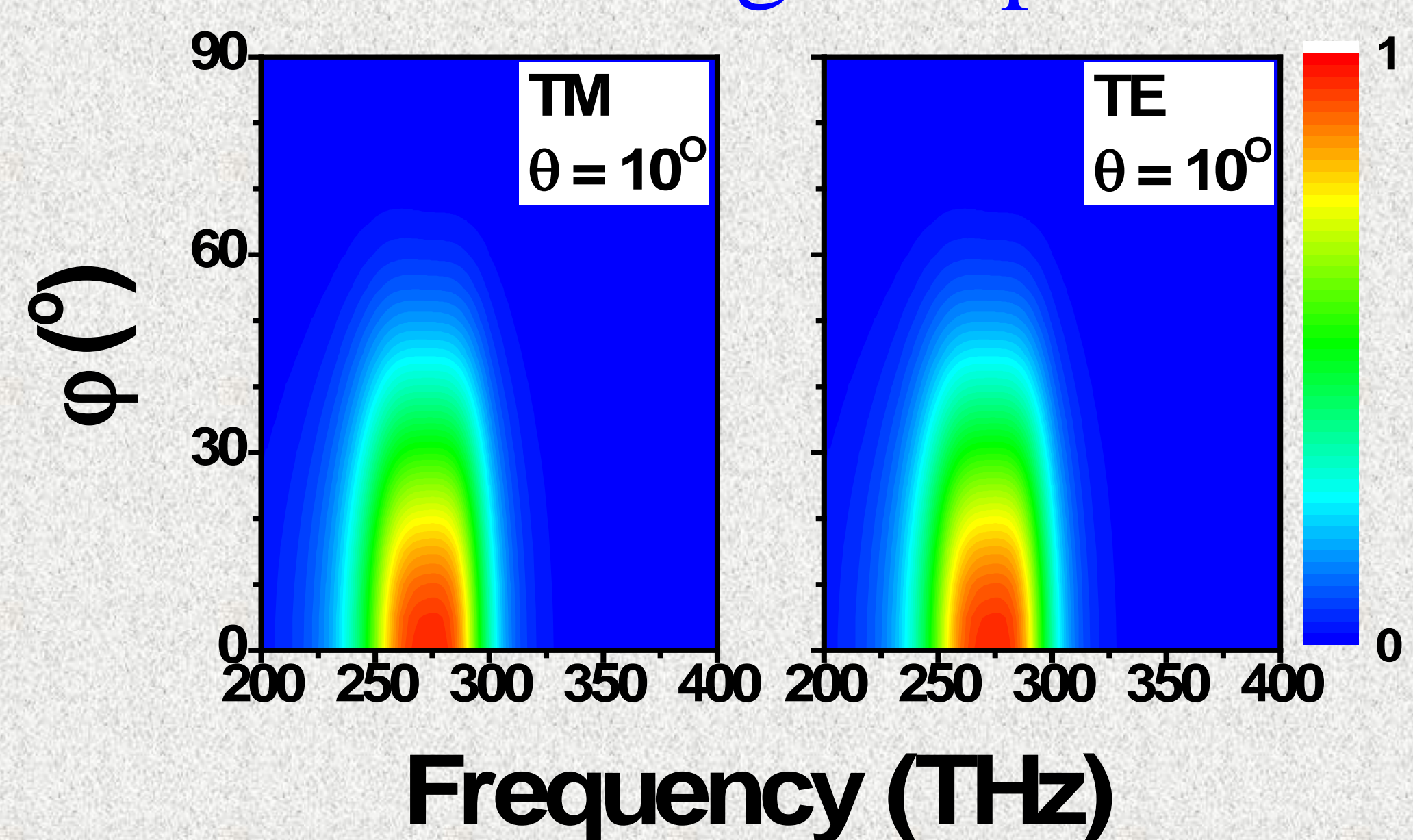
Field distribution



Incident angle independent



Azimuth angle dependent



Conclusions:

- [1] Make opaque metamaterial transparent by means of very simple structure
- [2] Independent of incident angle and disorder compared with other methods
- [3] Keep structural integrity
- [4] Good agreement between FDTD simulation and experimental results

References:

- (1) T. W. Ebbesen, *et al*, Nature (London) 391, 667 (1998).
- (2) J. A. Porto, *et al*, PRL 83, 2845 (1999).
- (3) Alu and Engheta, IEEE Trans. Ant. Propag. 51, 2558 (2003).
- (4) D. Bergman, Physics Reports 43, 377 (1978).
- (5) Lei Zhou, *et al*, PRL 94, 243905 (2005).