Near-Field Observations of Plasmonic Interference on Gold Films Perforated with Aperiodic Subwavelength Hole Arrays

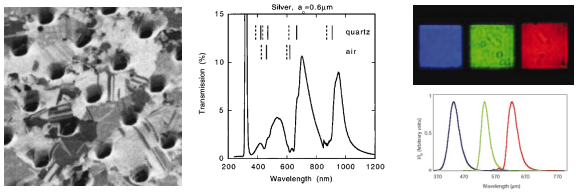
Biqin Dong[1], Xiaolong Zu[1], Jing Xue[2], Ran Liu[2], Wei Zeng[3], Xiaohan Liu[1], Jian Zi[1]

[1] Department of Physics and Key Laboratory of Micro and Nano Photonic Structures (Ministry of Education), Fudan University, Shanghai 200433, China. [2] Department of Microelectronics, Fudan University, Shanghai 200433, China. [3] National Microanalysis Center, Fudan University, Shanghai 200433, China

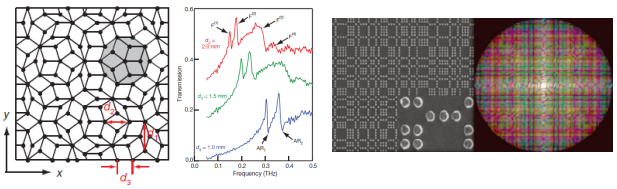
Extraordinary optical transmission

Extraordinary optical transmission (EOT) through a metal film perforated with periodic subwavelength hole arrays have opened up a new prospect for nanoscale manipulations of light[1,2]. Recently, EOT has also been found in aperiodic subwavelength hole arrays with both local rotation symmetry and long-range order, displaying richer resonances than in periodic subwavelength hole arrays[3-5].

Periodic subwavelength hole arrays



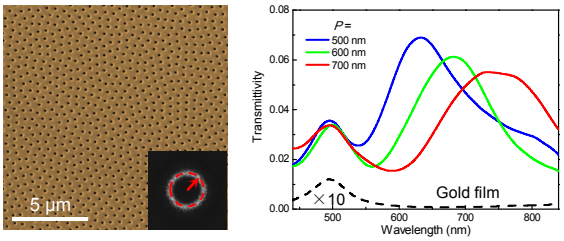
Aperiodic subwavelength hole arrays



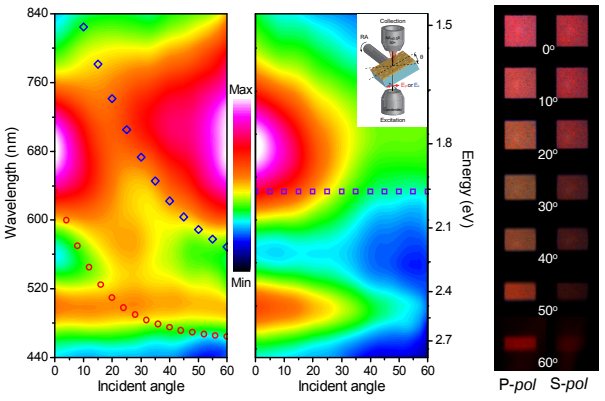
References

[1] T. W. Ebbesen *et al. Nature* **391**, 667, (1998).
[2] W. L. Barnes, *et al. Nature* **424**, 824, (2003).
[3] F. Przybilla *et al. Appl. Phys. Lett.* **89**, 121115, (2006).
[4] T. Matsui *et al. Nature* **446**, 517, (2007).
[5] A. Gopinath *et al. Nano Letters* **8**, 2423, (2008).

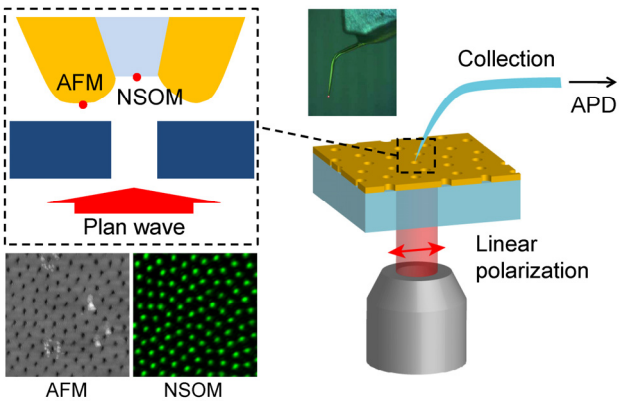
Extraordinary optical transmission enhanced by the short-range order

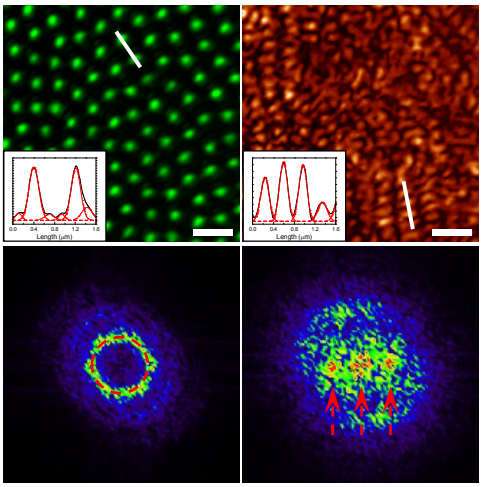


Angle-resolution transmission micro-spectroscopy



Near-field scanning optical microscopy and observations of plasmonic interference





Conclusions

- Near-field observations indicated that the 500-nm transmission peak is produced by the direct transmission of light through the holes. On the other hand, for the broad transmission peak at higher wavelengths, clear interference patterns of surface plasmons were observed, implying that the peak is due to the excitations of surface plasmons.
- Our results suggest that metallic films perforatred with subwavelength holes of the amorphous lattice could be useful for broadband plasmonic devices such as the enhancement of light extraction.