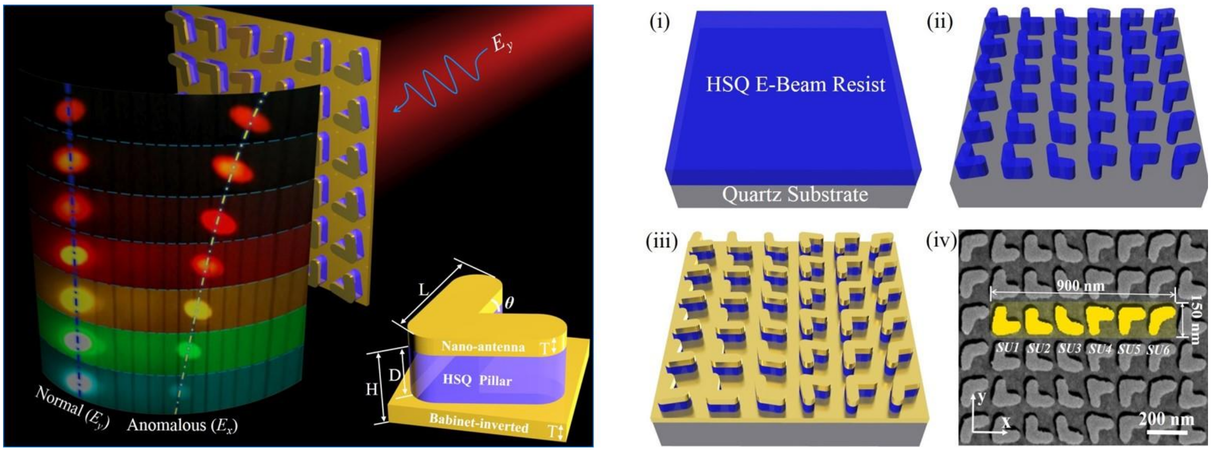
NUS researchers make a breakthrough in the plasmonic metasurface

Metasurface is a type of artificially structured two-dimensional (2D) materials for manipulating the propagation of electromagnetic waves, with the thickness far smaller than the operational wavelength. It may allow the realization of exotic and intriguing effects which can't be obtained by natural materials or 3D metamaterials. This concept is however still in its infancy due to either low manipulation efficiency or extreme complexity in sample fabrication, especially in the visible light.

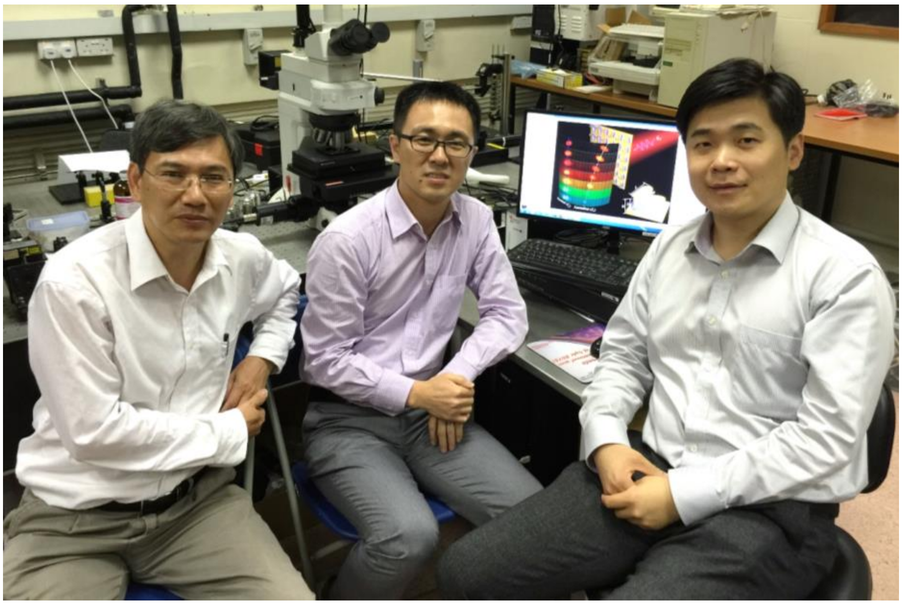
NUS Electrical & Computer Engineering (ECE) team led by Prof. Cheng-Wei Qiu develop a new metasurface configuration may fill the gap between laboratory proof-of-concept demonstrations and practical productions. Their finding was published in *Science Advances* [*Sci. Adv. 2, e1501168 (2016)*] entitled *"*Hybrid bilayer plasmonic metasurfaces efficiently manipulates visible light*"*, and selected as Research Highlights by *Nature Physics* [(*Nat. Phys. 12, 111, (2016*)] in February 2016, entitled "Metasurfaces: Double up".

They proposed and experimentally demonstrated a novel design of bilayer metasurface, which configured by marrying the 2D array V-shape nano-antennas with its babinet-inverted complementary counterpart, for manipulating transmitted visible light with very high efficiency, without sacrifice the ultra-thin property. It overturns a widely accepted perception and shows that coupled plasmonic metasurfaces could surprisingly beat silicon metasurfaces, even though the metal's ohmic loss is much higher than dielectrics. Moreover, the required sample fabrication is even simpler than the existing single metasurface designs.

Dr. Qiu said that one-step fabrication process of their bilayer metasurfaces releases the challenges in sample preparation, in conjunction with the significant improvement of efficiency, will facilitate and enable the viable commercialization and mass production of the metasurface concept, and further allow the miniaturization and integration of optical components and systems.



Two highly-coupled plasmonic metasurfaces behave much better than any individual ones



Dr Qin Fei (middle), Prof. Hong (left), Prof. Qiu (right)