# 3D Metasurface Optical Cloak

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Optical invisibility is a highly sought-after technology for its ability to revolutionize the field of consumer optoelectronics and display as well as military operations. In recent years, cloaking devices were finally realized, but they mainly operated at microwave and infrared frequencies[1-4]. In addition, they were mostly limited to two-dimensional, and were bulky and much thicker than the cloaked region, making them impractical for real applications. Here we demonstrate a novel optical 3D carpet cloak using ultra-thin metasurface elements. Our metasurface cloak consists of subwavelength plasmonic nanoantennas which provide a distinct phase shift to the reflected electromagnetic waves. At each local point on the interface of the cloaked region, the phase of the light scattered by the interface is the same as that reflected from a flat mirror. Therefore in the far-field, the object is undetectable from its reflected light, as shown in the experimental results in Fig. 1 for 740 nm visible wavelength of light.

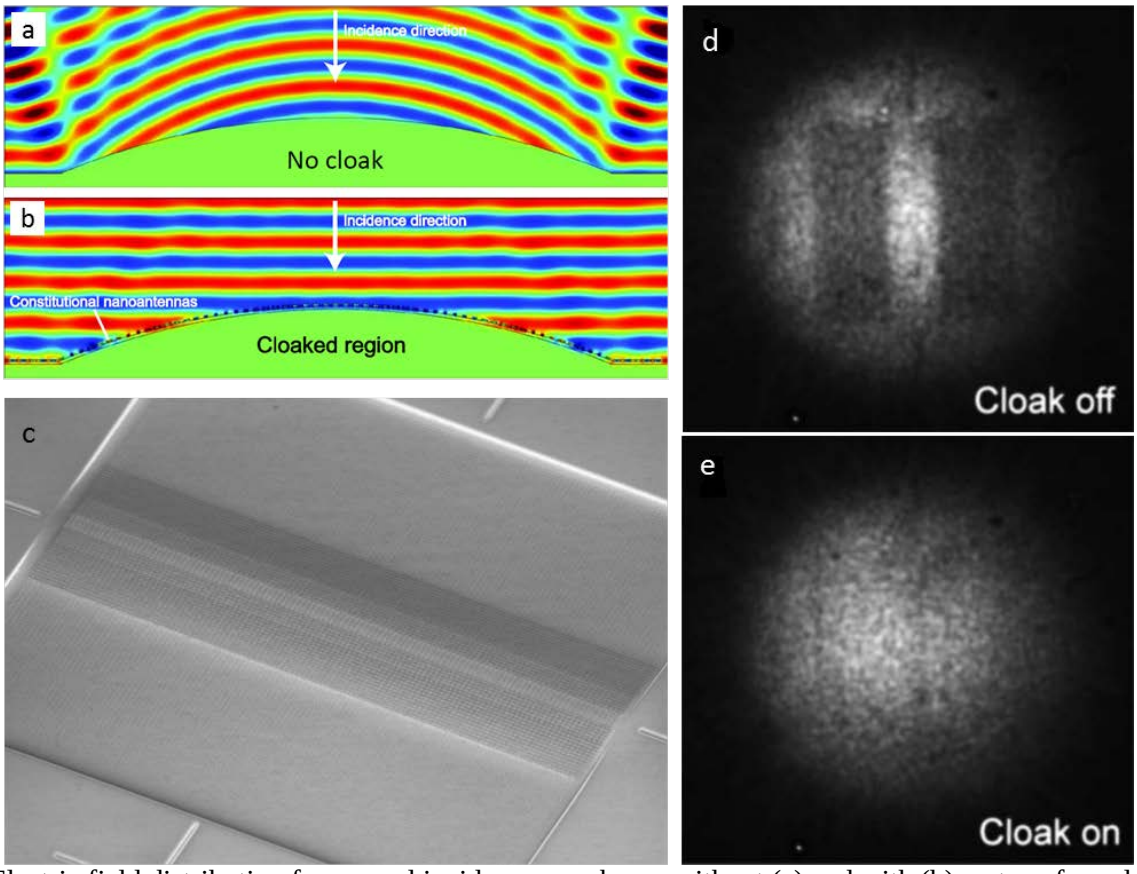


**Fig. 1** Electric field distribution for normal incidence on a bump without (a) and with (b) metasurface elements. (c) SEM image of the fabricated bump and metasurface. Optical reflective image when cloak is off (d) and on (e).

## References

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