plasmon excitations of the Ag nanoparticles and the interband transitions of the Au nanoparticles.

Although the nanoparticle superlattices obtained in these experiments were only a few micrometres in size, these proof-of-concept experiments demonstrate the power of DNA for precision nanostructure assembly and the potential of self-assembled metamaterials to rival — or even surpass — lithographically generated structures. One can imagine expanding the size and complexity of these nanoparticle-based metamaterials using DNA scaffolds or DNA origami architectures[7], or even building an active metamaterial that evolves in response to a polymerase enzyme. Perhaps even more exciting is the idea that, as DNA nanotechnology matures, these assembly tools will become readily available to scientists and engineers interested in rapidly building metamaterial prototypes and exploring new electromagnetic phenomena enabled by self-assembled structures. ❐

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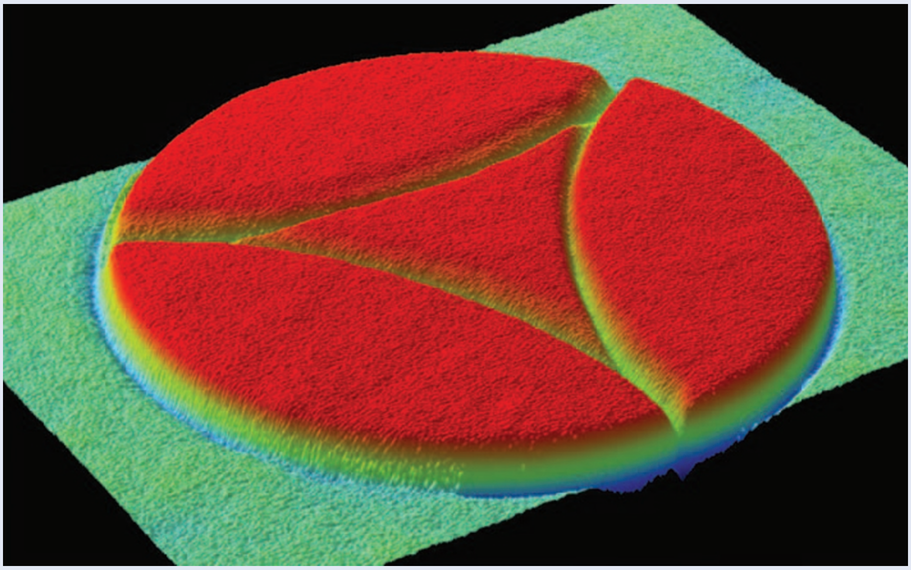
OPTICAL PHYSICS

Shaping the topology of light

Light beams rotate as they propagate through space. A light beam has spin angular momentum if all its polarization vectors rotate, whereas it possesses orbital angular momentum (OAM) if its phase structure rotates. A beam with OAM has an optical vortex along its axis. OAM can be many times greater than spin angular momentum, allowing it to be used in many applications, including imaging, optical tweezing, and, more recently, optical communications. To extend the applicability of OAM, researchers have recently been seeking to realize small-scale optical vortex generators; they have been focusing their efforts on directly downsizing existing centimetre-scale generators.



ETIENNE BRASSELET *ET AL.*

Now, Etienne Brasselet from France and co-workers in Australia have demonstrated the use of a discrete set of continuous deformations of a circular nanoslit to generate and control optical vortices on a microscopic scale (*Phys. Rev. Lett.* **111,** 193901; 2013).

A subwavelength structure can be used to generate optical anisotropy, even when the individual components making up the structure are optically isotropic. Thus, a straight metallic nanoslit can act as an optical retarder, whereas a circular metallic nanoslit may produce OAM via the spin–orbit interaction of light. However, circular or convex polygonal slits give access to a total phase circulation of only 2π.

To control the phase circulation by any multiple of 2π, and hence realize a versatile strategy for shaping the topology of light fields on a small scale, Brasselet and colleagues introduced judicious continuous deformations to the circular nanoslit. They achieved this by milling a cusped, closed-path metallic nanoslit on a thin gold film (see figure). They showed that circular metallic nanoslits with intruding cusps having radii of 5 μm and 10 μm and having different orders of circular arcs allowed various kinds of structured light fields to be generated in a controlled manner. The concept exploits the interplay between the spin angular momentum and the OAM of light. Brasselet and co-workers experimentally demonstrated topological shaping of visible light.

The team says that the method offers a purely geometrical approach to tailored-made topological shaping of light on a small spatial scale, and proposes it as a potential way to realize 'singular nanophotonics' — the controlled generation of optical singularities at the nanoscale. Potential applications include nanomanipulation of OAM, singular plasmonic elements for sorting and routing quantum optical information, and chiral optical sensing.

"The current limitation is the relatively low efficiency of the demonstrated topological shaping of light. This efficiency is expected to be enhanced by refining the design of the nanoslit. Future work will aim at extending the demonstrated concept to different nanostructures besides nanoslits, and exploring nonplanar geometries with the goal of achieving three-dimensional control of complex light on the nanoscale. Also, proof-of-principle demonstrations of applications in nanomanipulation and sensing are planned," Brasselet explained to *Nature Photonics.*

RACHEL WON