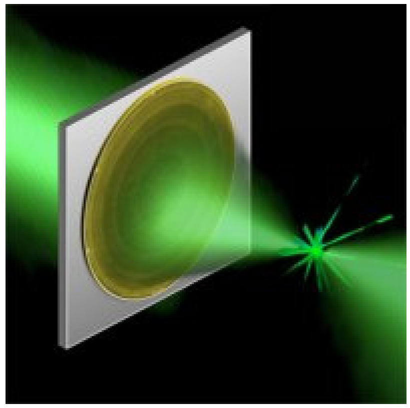
New distortion-free lens from gold and silicon for a distortion free perfect image



A new ultrathin, flat lens focuses light without imparting the optical distortions of conventional lenses.

A research Organization has developed a new 60-nanometer thick silicon lens, layered with legions of gold nanoantennas, can catch and refocus light without the distortion or other artifacts that come with having to use the thick, curved pieces of glass we're used to -- it's so accurate that it nearly challenges the laws of diffraction. The lens isn't trapped to bending one slice of the light spectrum, either. It can range from near-infrared to terahertz ranges, suiting it both to photography and to shuttling data.

This flat lens opens up a new type of technology, the researchers are presenting a new way of making lenses. Instead of creating phase delays as light propagates through the thickness of the material, you can create an instantaneous phase shift right at the surface of the lens. It's extremely exciting."

The researchers create the flat lens by plating a very thin wafer of silicon with a nanometer-thin layer of gold. Next, they strip away parts of the gold layer to leave behind an array of V-shaped structures, evenly spaced in rows across the surface. When the research group shines a laser onto the flat lens, these structures act as nanoantennas that capture the incoming light and hold onto it briefly before releasing it again. Those delays, which are precisely tuned across the surface of the lens, change the direction of the light in the same way that a thick glass lens would, with an important distinction.

The flat lens eliminates optical aberrations such as the "fish-eye" effect that results from conventional wide-angle lenses. Astigmatism and coma aberrations also do not occur with the flat lens, so the resulting image or signal is completely accurate and does not require any complex corrective techniques.

The array of nanoantennas, dubbed a "metasurface," can be tuned for specific wavelengths of light by simply changing the size, angle, and spacing of the antennas.

“In the future the researchers can potentially replace all the bulk components in the majority of optical systems with just flat surfaces, “It certainly captures the imagination.”

The concept of optical phase discontinuities is applied to the design and demonstration of aberration-free planar lenses and axicons, comprising a phased array of ultrathin subwavelength-spaced optical antennas. The lenses and axicons consist of V-shaped nanoantennas that introduce a radial distribution of phase discontinuities, thereby generating respectively spherical wavefronts and nondiffracting Bessel beams at telecom wavelengths. Simulations are also presented to show that our aberration-free designs are applicable to high-numerical aperture lenses such as flat microscope objectives.

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