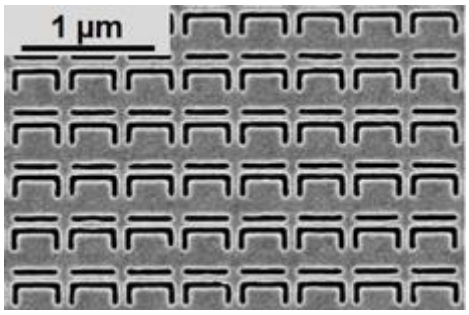
Metamaterials beat nature 10,000,000-fold

ORC researchers have created an artificial material with seven orders of magnitude larger nonlinear optical activity than found in natural materials. Their work, now published in Nature Communications, catapults nonlinear optical activity from a hardly detectable phenomenon to a major optical effect, with new potential for practical applications such as optical signal processing.



Eric Plum, Advanced Research Fellow, explained: "The article illustrates how nanoscale confinement of light in metamaterials offers extremely strong effects unfolding in nanoscale volumes of nonlinear medium. Our work shows how nonlinear plasmonics can become a solution for real applications. We've combined our recent breakthroughs of hundred-fold nanostructuring-enhanced nonlinearity of metal films and exceptionally large linear optical activity in metamaterials to achieve this leap in technology."

Materials with a twisted structure, such as sugar solution and quartz, have the ability to rotate the plane of polarization of light, that is, optical activity. In the 1960s it was observed that such polarization rotation depends on the intensity of light, however, the effect of nonlinear optical activity in natural materials is very weak.

Metamaterials are artificial media with unusual functionalities resulting from structuring on a length-scale shorter than the wavelength of light. Seen as a key technology of the future, metamaterials research has grown rapidly in the past decade. Southampton's Centre for Nanostructured Photonic Metamaterials, directed by Nikolay Zheludev, is at the heart of this development. Metamaterial nanostructures developed here have demonstrated unique functionalities relevant to all-optical data processing, super-resolution imaging and dynamic control over material properties, for example for optical switches, tunable filters and in principle even chameleon and camouflage surfaces.

To read the full article visit http://dx.doi.org/10.1038/ncomms1805

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