Bending light with better precision

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Physicists from the University of California at San Diego (UCSD) have demonstrated a new technique to control the speed and direction of light using memory metamaterials whose properties can be repeatedly changed.

A metamaterial is a structure engineered from a variety of substances that, when put together, yield optical properties that do not exist in nature. In this experiment, the metamaterial in use is a hybrid device made of split ring resonators (SRRs) – gold rings with a chunk taken out of one side – over a thin layer of vanadium dioxide (VO2).

By applying a pulse of electricity to this SRR-VO2 hybrid, the physicists can create a temperature gradient along the device that selectively changes the way the material interacts with light – changing the light's speed and direction, for example, or how much light is reflected or absorbed at each point along the device. The material even "remembers" these changes after the voltage is removed.

In a paper published in the AIP's *Applied Physics Letters*, the UCSD team – in collaboration with researchers from Duke University in Durham, N.C., and the Electronics and Telecommunications Research Institute (ETRI) in South Korea – applied this gradient-producing principle to show that it's possible to modify the way that light interacts with a metamaterial on the order of a single wavelength for 1-terahertz-frequency radiation.

Being able to tune metamaterial devices at this level of precision –

repeatedly, as required, and after the metamaterial has been fabricated – opens the door to new techniques, including the ability to manufacture Gradient Index of Refraction (GRIN) devices, that can be used for a variety of imaging and communication technologies.

More information: "Reconfigurable Gradient Index Using VO2 Memory Metamaterials" is published in *Applied Physics Letters*.

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