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Northeastern physicists develop 3D metamaterial nanolens that achieves super-resolution imaging

A research team from Northeastern University has developed a new nanolens that can beat the diffraction limit to achieve so-called super-resolution imaging, better than can be achieved by current technology. The nanolens is made from arrays of nanowires also called as metamaterials – manufactured materials not found in nature – and has superior imaging capabilities compared to current imaging technologies.

The research was conducted by a team led Srinivas Sridhar, Ph.D., distinguished professor and Director of the Electronic Materials Research Institute at Northeastern University, and is featured in the January 11 issue of the journal Applied Physics Letters.

Conventional lenses construct an image of an object only using ordinary waves, discarding information regarding the fine, tiny details of the object that are contained in "evanescent" waves. For this reason, conventional optical systems, such as microscopes, cannot accurately image very small, nano-sized objects.

Using a different approach, the research team organized and packaged nanowires to design a new type of lens. By precisely aligning and arranging millions of nanowires – each one measuring 20 nanometers in diameter – they were able to control how light passed through the lens. The lens is able to depict a clear, high-resolution image of nano-sized objects because it uses both the ordinary and evanescent waves to construct the image.

"This is the best superlens realized so far and is a significant development in the field of high resolution optical imaging," said Sridhar.

The researchers expect that the technology can be used to improve biomedical imaging and lithography techniques.

"We have the capability for the large-scale production of these nanolenses and hope to manufacture these devices in the near future," added Sridhar.

Others involved in this research project include Didier Casse, Wentao Lu, Latika Menon, Yongjiang Huang and Evin Gultepe, all from the Electronic Materials Research Institute. For more information visit http://sagar.physics.neu.edu.

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