Study suggests simple way to make near-perfect lenses

A new study from the University of Edinburgh and Pennsylvania State University suggests a smart solution to one of the biggest challenges facing the optics and electromagnetics sector – how to produce near-perfect lenses cheaply.

Researchers have devised a strikingly simple method of producing materials which bend light the 'wrong' way – a significant development as lenses with minimal distortion can be made from flat slabs of these negatively-refracting materials. In technological fields where lenses are key components, such as telecommunications, microwave engineering and optical engineering, negatively-refracting materials which can be cheaply produced are expected to have a revolutionary impact.

Although scientists have sought to minimize lens distortion for centuries, it is only within the past five years that the production of near-perfect lenses has become a realistic possibility. Progress has been made possible with the recent creation of negatively-refracting materials which enable rays of light, passing from one material to another, to bend in the opposite direction to that described in conventional physics textbooks.

However, these negatively-refracting materials are difficult and costly to produce, as they involve complex assemblies of intricately-shaped conducting components embossed on non-conducting platforms. A study by Dr Tom Mackay, of the University of Edinburgh, and Professor Akhlesh Lakhtakia, of Pennsylvania State University, suggests a much simpler method of construction.

The new study, reported in Microwave and Optical Technology Letters, shows that rather than creating complex and costly microelectronic devices, negatively-refracting materials can instead be produced by simply blending two granular substances together. Neither of the two granular substances can refract negatively by itself. However, the study predicts that a homogeneous mixture of these two substances can refract negatively, provided the relative properties and proportions of the substances are chosen appropriately.

Dr Tom Mackay, of the University of Edinburgh's School of Mathematics, said: "Through its simplicity, this method represents an exciting breakthrough for inexpensive exploitation of negative refraction technologies. The prospects for near-perfect lenses, and beyond, brings dreams a step closer to reality."

Reference: 'Negative phase velocity in isotropic dielectric-magnetic mediums via homogenization' by T.G. Mackay and A. Lakhtakia, accepted for publication in Microwave and Optical Technology Letters, and available at http://www.arxiv.org/abs/physics/0505005

Source: University of Edinburgh