# Perfect image without metamaterials... and a reprieve for silicon chips (w/ Video)

September 29 2009

(PhysOrg.com) -- Since 2000, John Pendry's work on metamaterials has been at the van guard of efforts to create a perfect image - images with perfect resolution that can stem from light being moved in odd directions to create, among other tricks of the light, the illusion of invisibility.

One exciting development was Pendry's theoretically perfect work on negative refraction, which offered the possibility of lenses that could create images with resolution not possible with conventional lenses. But this proved problematic in practice as the negatively refracting materials so far produced did not live up to their potential - absorbing a certain amount of the light and spoiling the resolution of the perfect image.

In a new research paper published today, Tuesday, 29 September, in

New Journal of Physics called 'Perfect imaging without negative refraction', Ulf Leonhardt, Chair of Theoretical Physics at the University of St. Andrew's, has shown that there is another way to create the perfect image.

Inspired by James Clerk Maxwell's findings, first expounded in the 1850s, Leonhardt is reintroducing the idea of a 'fish-eye' lens; a lens that can work in any direction but had not, until now, been modeled to fully account for the wave-like properties of light.

Professor Leonhardt said, "It is the waviness of light that limits the resolution of lenses. Apparently, nobody had tried to calculate the imaging of light waves in Maxwell's fish-eye. The new research proves that the fish-eye has unlimited resolution in principle, and, as it does not need negative refraction, it may also work in practice.

"The theory was inspired by ideas for invisibility where light is bent around objects to make them disappear from view. Here the ideas behind invisibility are applied for perfect imaging."

While the work is only theoretical at present, it will be exciting news to silicon chip manufacturers as the resolution limit of lenses limits the microchip technology needed for making ever faster computers.

While this development will not overcome the problems posed by the physical limits of smaller and smaller chip circuitry, it will give chipmakers freedom to photograph ever smaller, and more compact, structures of billions of tiny transistors on silicon chips to meet the insatiable appetite for faster and smaller computers.

More information: Journal paper: http://stacks.iop.org/NJP/11/093040.

Source: Institute of Physics (news : web)