

Invisibility cloak closer with flexible 'metamaterial'

By Jason Palmer Science and technology reporter, BBC News

Scientists in the UK have demonstrated a flexible film that represents a big step toward the "invisibility cloak" made famous by Harry Potter. The film contains tiny structures that together form a "metamaterial", which can, among other tricks, manipulate light to render objects invisible. Flexible metamaterials have been made before, but only work for light of a colour far beyond that which we see. Physicists have hailed the approach a "huge step forward". Metamaterials work by interrupting and channelling the flow of light at a fundamental level; in a sense they can be seen as bouncing light waves around in a prescribed fashion to achieve a particular result. However, the laws of optics have it that light waves can only be manipulated in this way by structures that are about as large as the 'waves' length. Until now, the most striking demonstrations of invisibility have occurred for light waves with a much longer wavelength - a far redder colour - than we can see. This is because it is simply easier to construct metamaterials with relatively large structures. Even flexible metamaterial films have been shown off for this high-wavelength range. For the far shorter waves that we can see, a metamaterial requires structures so tiny - nanostructures - that they push the boundaries of manufacturing. "The first step is imagining first of all that this could be done. All the typical results have been reached in flat and rigid surfaces because this is the legacy of the procedures used to create nanostructures." It clearly isn't an invisibility cloak yet - but it's the right step toward that" SO instead of building the typical stacks of the "fishnet" structures on hard, brittle silicon, Dr Di Falco used a thin polymer film. "Typically what you do is stack several layers of fishnet structures and this all together will give you a metamaterial". What I've done here is fabricate a single layer - I lift it off so that at the end I am left with a self-standing membrane - and show that it has the properties required to create a 3D flexible metamaterial." It clearly isn't an invisibility cloak yet - but it's the right step toward that". He added that the next step would be to characterise the way that the material's optical properties change as it is bent and folded. If the properties were sensitive to the movement, delicate manipulations of the films may make them useful for next-generation lenses in, for example, handheld cameras. If instead they were impervious to bending and motion, the films might be useful for instance in contact lenses. "Harry Potter has to wait still - that's the huge goal," he said." So far he's had to live in a house and now he can live in something like a tent; it's not the cloak that adjusts to his shape, but it's a bit more flexible. Now we have to take the next step forward."

metamaterials - are artificial materials engineered to provide properties which "may not be readily available in nature"

fundamental- any factor that could be considered important to the understanding of a particular business

rigid - incapable of or resistant to bending