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# Invisibility Umbrella Would Let Future Harry Potters See the Light

by Adrian Cho on 3 February 2009, 12:00 AM | [Permanent Link](#) | [0 Comments](#)

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Two years ago, physicists blurred the distinction between science and fiction by producing a shell-like "invisibility cloak" that made both itself and an object inside it undetectable—albeit when viewed with microwaves of a specific frequency. Now, a team from Hong Kong has gone one better with a theoretical scheme for an "invisibility umbrella" that can make both itself and an object placed *beside* it disappear. The previous cloak ferried incoming light around the enclosed object, rendering it blind to the outside world. In contrast, the umbrella leaves the hidden thing out in the open, so it can "see" its surroundings.

It's still a far cry from the magic garment that enables Harry Potter to sneak around Hogwarts Castle unseen and spy on others, but the concept draws rave reviews from other researchers. "It's an absolutely brilliant idea," says physicist Ulf Leonhardt of the University of St. Andrews in the U.K., one of the pioneers of cloaking theory.

In devising the scheme, Yun Lai, Che Ting Chan, and colleagues at the Hong Kong University of Science and Technology in Kowloon melded two earlier approaches. In 2005, Andrea Alù and Nader Engheta, electrical engineers at the University of Pennsylvania, predicted that researchers could make an object nearly invisible by coating it with a tailored layer of "metamaterial"—an assemblage of metallic rods and C-shaped rings that interacts with electromagnetic radiation in novel ways—counteracting the thing's tendency to scatter light.

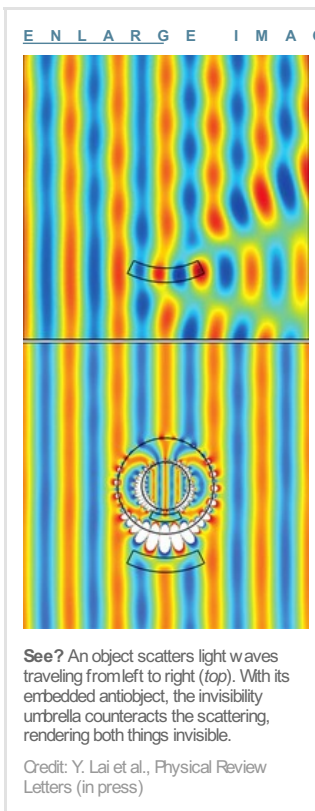
In contrast, in May 2006, Leonhardt and, independently, John Pendry of Imperial College London imagined stretching space so that the paths of light rays bend around an object. They then calculated how they might mimic that impossible stretching by sculpting the properties of a shell of metamaterial. Building on Pendry's implementation of such "transformation optics," experimenters David Schurig and David Smith of Duke University in Durham, North Carolina, produced a microwave cloak just 5 months later ([Science](#), 20 October 2006, p. 403).

Chan and colleagues struck a middle ground. In theory and simulations, they first used transformation optics to perfectly cancel the scattering from a cylindrical post of ordinary material by coating it in metamaterial. The researchers then realized that they could make an object near the now-invisible post disappear, too.

The trick, they report in a paper to be published in *Physical Review Letters*, is to embed a matching "antioject"—the metamaterial equivalent of a voodoo doll—in the outer layer of the post. The scattering from the embedded antioject exactly cancels the scattering from the object, Chan says, "so it looks as if there is nothing there." Because the hidden object remains outside the post or umbrella, it can detect light from its surroundings.

The scheme does have limitations, Pendry notes. The umbrella works for only a single frequency, has to be specifically tailored to the object to be hidden, and won't completely hide something that absorbs light. Still, Pendry says, "that's carping on my part—it's really a neat idea."

Making an invisibility umbrella even for microwaves may be challenging. It requires "left-handed" metamaterials that bend light in an especially strange way and are difficult to make. Still, Leonhardt says, "it's clear that someone will do this in the future." Given current progress, don't be surprised if some wizard of an experimenter does it sooner rather than later.



See? An object scatters light waves traveling from left to right (top). With its embedded antioject, the invisibility umbrella counteracts the scattering, rendering both things invisible.

Credit: Y. Lai et al., *Physical Review Letters* (in press)

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