Voilà! Cloak of Invisibility Unveiled

Just 5 months after predicting it should be possible, a team of physicists has produced a cloaking device that renders an object invisible—at least when viewed in microwaves of a particular wavelength.

The cloak is hardly perfect: Instead of an all-concealing sphere, it’s a ring that works only for microwaves zipping along in a plane. The microwaves must also be polarized perpendicular to the plane. And even then, the cloak reflects some of the waves and casts a slight shadow. Nevertheless, “it’s a very good achievement,” says Ulf Leonhardt, a theorist at the University of St. Andrews in the United Kingdom. “It’s surprising that it’s as simple as it is and that it works so well.”

The cloak embodies the theory laid out by theorist John Pendry of Imperial College London and experimenters David Schurig and David Smith, who work in the electrical and computer engineering department at Duke University in Durham, North Carolina. In May, the team showed that, in principle, it’s possible to ferry electromagnetic waves such as light around an object by surrounding it with a “metamaterial”: an assemblage of tiny rods and C-shaped rings (Science, 26 May, p. 1120). The waves would then pass as if the object weren’t there, rendering it invisible.

The electromagnetic waves cause the electrons in the rings and rods to slosh, and the sloshing, in turn, affects the speed at which the waves travel through the material. If the speed varies in the right way within the cloak, the waves will curve around the object. The theory predicts only how the speed of the waves must vary; it leaves it to experimenters to design the material.

When Schurig, Smith, and colleagues worked out the details, they found that their two-dimensional device required only C-shaped copper rings nestled side by side. The team also simplified the parameters specified by the theory. The changes made the metamaterial easier to build but also left the cloak slightly reflective, as the team reports online this week in Science (www.sciencemag.org/cgi/content/abstract/1133628). “The goal of this paper was to demonstrate that we more or less have the mechanism and that we can design the materials to the parameters,” Schurig says.

Even the simplified cloak is a significant advance, says Costas Soukoulis, a theorist at Iowa State University in Ames and the U.S. Department of Energy’s Ames Laboratory. “This is very, very important that experiments have produced what theorists had predicted,” Soukoulis says. Microwave cloaks might be useful for eluding radar, he says.

It may take years for researchers to make a cloak for visible light. Still, most believe such a thing should be possible now that a cloak for microwaves has been built. After all, not seeing is believing.