

Scientists create cloak of invisibility

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By RANDOLPH E. SCHMID, AP Science Writer

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Scientists are boldly going where only fiction has gone before — to develop a Cloak of Invisibility. It isn't quite ready to hide a Romulan space ship from Capt. James T. Kirk or to disguise Harry Potter, but it is a significant start and could show the way to more sophisticated designs.

In this first successful experiment, researchers from the United States and England were able to cloak a copper cylinder.

It's like a mirage, where heat causes the bending of light rays and cloaks the road ahead behind an image of the sky.

"We have built an artificial mirage that can hide something from would-be observers in any direction," said cloak designer David Schurig, a research associate in Duke University's electrical and computer engineering department.

For their first attempt, the researchers designed a cloak that prevents microwaves from detecting objects. Like light and radar waves, microwaves usually bounce off objects, making them visible to instruments and creating a shadow that can be detected.

Cloaking used special materials to deflect radar or light or other waves around an object, like water flowing around a smooth rock in a stream. It differs from stealth technology, which does not make an aircraft invisible but reduces the cross-section available to radar, making it hard to track.

The new work points the way for an improved version that could hide people and objects from visible light.

Conceptually, the chance of adapting the concept to visible light is good, Schurig said in a telephone interview. But, he added, "From an engineering point of view it is very challenging."

The cloaking of a cylinder from microwaves comes just five months after Schurig and colleagues published their theory that it should be possible. Their work is reported in a paper in Friday's issue of the journal *Science*.

"We did this work very quickly ... and that led to a cloak that is not optimal," said co-author David R. Smith, also of Duke. "We know how to make a much better one."

The first working cloak was in only two dimensions and did cast a small shadow, Smith said. The next step is to go for three dimensions and to eliminate any shadow.

Viewers can see things because objects scatter the light that strikes them, reflecting some of it back to the eye.

"The cloak reduces both an object's reflection and its shadow, either of which would enable its detection," Smith said.

The cloak is made of metamaterials, which are mixtures of metal and circuit board materials such as ceramic, Teflon or fiber composite.

In an ideal situation, the cloak and the item it is hiding would be invisible. An observer would see whatever is beyond them, with no evidence the cloaked item exists.

"Since we do not have a perfect cloak at this point, there is some reflection and some shadow, meaning that the background would still be visible just darkened somewhat. ... We now just need to improve the performance of cloaking structures."

In a very speculative application, he added, "one could imagine 'cloaking' acoustic waves, so as to shield a region from vibration or seismic activity."

Natalia M. Litchinitser, a researcher at the University of Michigan department of electrical engineering and computer science who was not part of the research team, said the ideas raised by the work "represent a first step toward the development of functional materials for a wide spectrum of civil and military applications."

Joining Schurig and Smith in the project were researchers at Imperial College in London and SensorMetrix, a materials and technology company in San Diego.

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