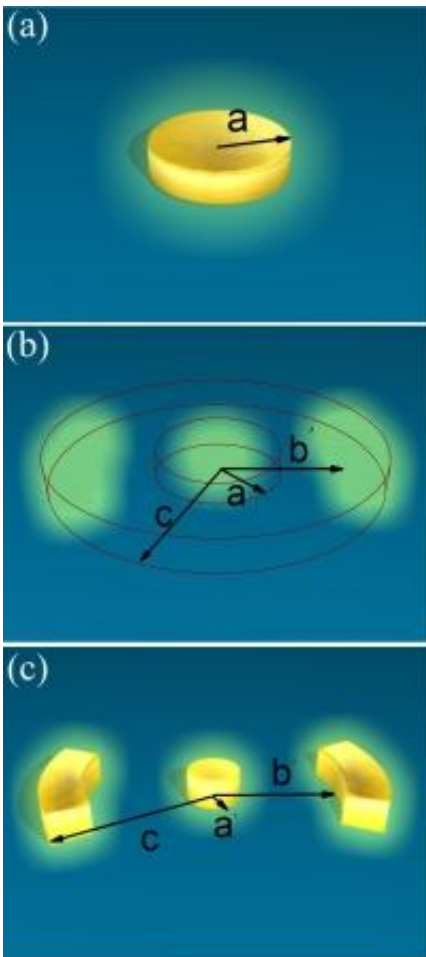


Engineering 'ghost' objects: A breakthrough in scattering illusion

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(a) The original metallic object. (b) The metallic object covered by the designed ghost device, metamorphosing scattering feature of the original object. (c) A shrunk metallic object at the original centre with two wing dielectric objects, whose signature is identical to (b). Credit: National University of Singapore

A team at the NUS Department of Electrical & Computer Engineering led by Dr Qiu Cheng-Wei has come out with an optical device to "engineer" ghosts. When someone claims he has seen a ghost, the phenomenon may be caused by an optical illusion happening through a wild stroke of nature. But the actual engineering of such a phenomenon is the holy grail of researchers in the field of optical illusions, electromagnetic, and radar detection—not only because of the thrill and excitement of being able to create a "ghost" but because of the implications it will have in science and applications.

Their research has opened up a completely new avenue for cognitive deception through light-matter behaviour control. This would have wide applications in defence and security. Their findings will also pave the way for the design of new optical and microwave devices such as those for detection and communication. The team will further develop this technique to make larger microwave devices to achieve radar "ghosts" and aircraft camouflage suitable for defence purpose.

Dr Qiu's paper, entitled "Creation of Ghost Illusions Using Metamaterials in Wave Dynamics" will be published in *Advanced Functional Materials* in March 2013.

Their paper reported for the first time, the realisation of creating "ghosts" through optic [scattering](#) and metamaterials which are artificial materials designed with properties (which do not exist naturally) built-in. Their device is capable of creating more than one virtual "ghost" image from the actual object. The geometric shape, position and equivalent material properties of these "ghost" images can be pre-designed and controlled—and are also able to appear in distributed places away from the location of the real object.

Doing a David Copperfield

The scientific community has always been enthralled in the creation of an illusion which can potentially transform an actual perception into a pre-controlled perception. So far, scientists experimenting with metamaterials in "ghosting" do not have much success in changing the perception of the real object, and define where the "ghost" should appear. They can only create one "ghost", in the same location (as where the real object is).

But Dr Qiu's device can create multiple "ghosts". It can also make the real object or person "disappear". The researchers can also determine how the "ghosts" look, taking on a different shape or size from the actual object.

Added Dr Qiu, "As our work solves several major issues associated with "ghost" illusion, we believe it will pave way for future applications of advanced optical illusion, camouflage, and cloaking—in an interestingly new sense. Our work has enormous potential to enhance our ability to mould, harness, and perceive wave at will. I believe it can stimulate new thoughts of realising something extraordinary that is counter-intuitive."

Provided by National University of Singapore

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