

Spanish scientists bring us closer to making the dream of invisibility true

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With metamaterials, an object can be made invisible to a magnetic field. On the left, the magnetic field of a magnet interacts with an object, which is drawn to the magnet. On the right, if the object is covered with a metamaterial (in yellow), the magnetic field remains unaltered; it is exactly as if the object did not exist, it would not even be drawn to the magnet.

A group of researchers from the Department of Physics at UAB (Universitat Autònoma de Barcelona, Spain) have designed a device, called a dc metamaterial, which makes objects invisible under certain light - very low frequency electromagnetic waves - by making the inside of the magnetic field zero but not altering the exterior field. The device, which up to date has only been studied in theoretical works, thus acts as an invisibility cloak, making the object completely undetectable to these waves.

The research is based on an initial idea of the British Ben Wood and John Pendry - the latter considered the father of [metamaterials](#) - and is a step forward in the race to create devices which could make objects

invisible at visible light frequencies.

"The theoretical work provides the details for constructing a real dc metamaterial and represents another step towards invisibility," says Àlvar Sánchez, director of the research. He goes on to state that "now comes a very important stage: building a prototype in the laboratory and applying this device to improving [magnetic field](#) detection technology".

Making objects invisible always has been a dream of humanity, as can be seen in different works of literature, from "The Invisible Man" by H. G. Wells to Harry Potter's invisibility cloak. Technically, any object could be made invisible if it were covered with something which could make the light surround it, instead of absorbing or reflecting it. Thus it would be impossible to see the object since the light would only pass around it and if one were to look directly at the object, one would only see what is behind it. The object would become imperceptible.

Until recently scientists believed this type of "[invisibility cloak](#)" would be impossible to create, given that the trajectory of light in a specific environment is determined by the medium electric and [magnetic properties](#), with values that scientists thought could not be modified and therefore made invisibility impossible. However, more recent scientific discoveries have revealed that these values can be modified with the help of artificial materials containing unusual physical properties: metamaterials. These materials have unique electric and magnetic properties which, at least theoretically, could affect light in a way that they would make light pass around an object and thus make it invisible.

Invisibility in visible light, the rainbow-colour spectrum we can see with our own eyes, has not yet been achieved with experiments. Nonetheless, scientists are working with other types of light such as microwaves -with experimental results in 2006 which signalled the first step towards invisibility-, low frequency electromagnetic fields (such as radio or

television waves), or even with constant magnetic fields such as magnets or the Earth's magnetic field.

The metamaterial designed by the research group at UAB consists in an irregular network of superconductors, which give materials specific magnetic properties that can create "invisible" areas in the magnetic field and in very low frequency electromagnetic fields. The discovery can be applied to medical purposes, such as magnetoencephalographic or magnetocardiographic techniques (used to measure the magnetic fields created by the brain or the heart), which in order to function properly need to shield out all other existing magnetic fields. They also can be used in other areas in which magnetic field detection is important such as in sensors, or to prevent the magnetic detection of ships or submarines.

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