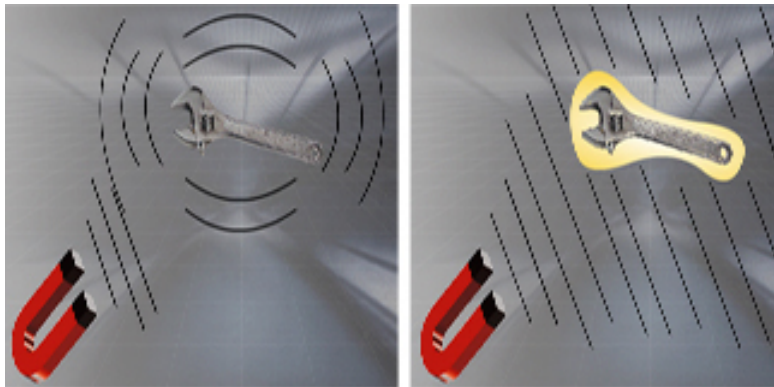


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Discovery at UAB brings us nearer to making the dream of invisibility true



A group of researchers from the Department of Physics at UAB have designed a device which makes objects invisible under certain light - very low frequency electromagnetic waves - by making the interior magnetic field zero but not altering the exterior field. The device, which up to date has only been studied in theoretical works, 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 it would make it 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.

The group in charge of this research was formed by Carles Navau, Du-Xing Chen (ICREA professor) and Núria del Valle, and was directed by Àlvar Sánchez. The research was funded by the NANOSELECT Consolider project and published in the journal Applied Physics Letters.

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