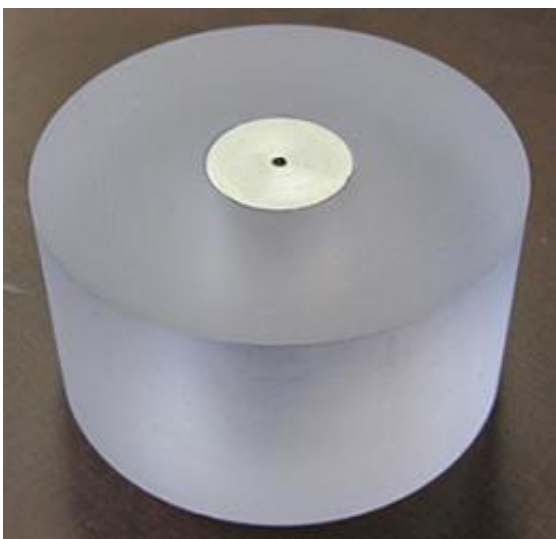


Electromagnetic cloaking possible with ordinary plastic, study finds

October 2 2012, by Tea Kalska



A metal object can be made invisible with the help of ordinary plastic, Pekka Alitalo and Constantinos Valagiannopoulos, researchers from the School of Electrical Engineering, have shown in their study.

The object, however, does not become invisible to the human eye – only to electromagnetic radiation at [microwave frequencies](#). In practical terms, this means that [electromagnetic waves](#) travelling, for example, between two antennas, do not detect an object located in their path, allowing the waves to travel the distance between them despite the obstacle, without any disruption to communications.

Previously, a similar effect has only been achieved using complex devices or expensive [metamaterials](#) with a right electromagnetic response. In contrast, the method developed by Pekka Alitalo and Constantinos Valagiannopoulos is simple and affordable.

Plastic decreases electromagnetic scattering

Pekka Alitalo explains that objects are visible because they [scatter light](#) which is electromagnetic radiation. A metal object will not, however, scatter electromagnetic radiation at microwave frequencies to the same extent when covered with a [dielectric material](#) – an [insulator](#) that does not conduct electricity. One such dielectric material is ordinary plastic used by Alitalo and Valagiannopoulos.

"Because of space limitations, often something has to be placed in front of an antenna, such as a support structure or another antenna, and the radiation transmitted by the [antenna](#) cannot then travel through the object. We were especially interested in cloaking metal objects as metal is a material that causes strong scattering and as such, greatly interferes with communications", Alitalo explains.

Preventing scattering altogether has not yet proved possible, but the plastic cover reduced scattering caused by a metal cylinder by approximately 70 per cent.

"If we want to build an 'invisibility device', it can be considered a success if over half of the scattering disappears."

Laws of physics do not prevent invisibility

So scattering from objects can be reduced at microwave frequencies, putting the objects 'out of the sight' of the waves. According to Alitalo,

there is no law of physics preventing the reduction of scattering at the frequency of visible light. This would render the object invisible to the human eye.

Science has already achieved this but the object made invisible was so miniscule it was hard to detect by the human eye in any case. Alitalo explains that at the spectrum of light visible to humans, the wavelength is around a few hundred nanometres, meaning that the diameter of the object being cloaked should be even smaller than this.

There is a limit to the size of an object that can be rendered invisible even to [electromagnetic radiation](#) at microwave frequencies.

"In our study, the wavelength was ten centimetres and the diameter of the tested metal cylinder was two centimetres. When the size of the object being cloaked increases while the frequency remains the same, the method stops working at some point. If for instance a tank is covered with plastic, it does not help because the object is just too big at this specific frequency."

More information: "Demonstration of electromagnetic cloaking of conducting object by dielectric material cover" by Pekka Alitalo and Constantinos Valagiannopoulos was published on 16 August 2012 in the publication *Electronics Letters*, Vol. 48, No. 17.

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