Physics students devise concept for Star Wars-style deflector shields

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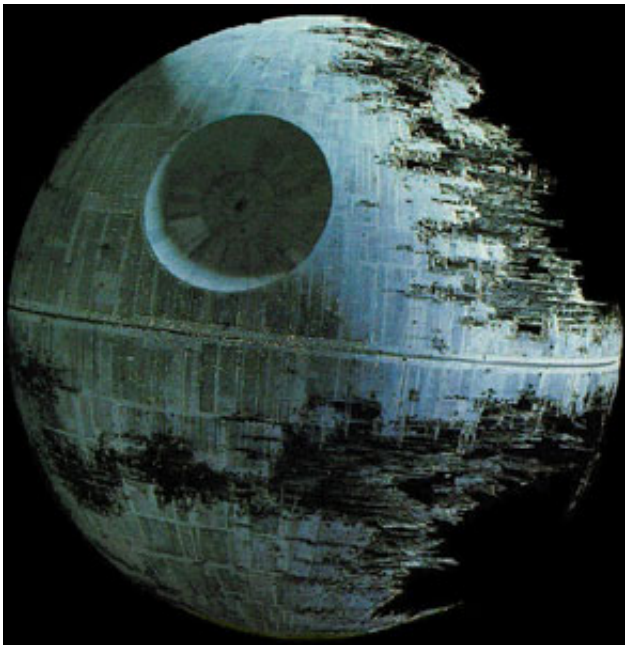

The Death Star, which protagonist Luke Skywalker successfully destroys in the Star Wars franchise while piloting an X-Wing fighter. Credit: Wikipedia;

If you have often imagined yourself piloting your X-Wing fighter on an attack run on the Death Star, you'll be reassured that University of Leicester students have demonstrated that your shields could take whatever the Imperial fleet can throw at you.

The only drawback is that you won't be able to see a thing outside of your starfighter.

In anticipation of Star Wars Day on 4 May, three fourth-year Physics students at the University have proven that shields, such as those seen protecting spaceships in the Star Wars film series, would not only be scientifically feasible, they have also shown that the science behind the principle is already used here on Earth.

They have published their findings in the Journal of Special Physics Topics, a peer-reviewed student journal run by the University's Department of Physics and Astronomy.

In the Star Wars movies, the latest of which began filming in April, spaceships are protected by a shield defence system that deflects enemy laser fire. In order to recreate this type of shield, the students assumed that a surrounding field of super-hot plasma would be used, held in place by a magnetic field around the ship.

The denser the plasma, the higher the frequency of electromagnetic wave (or laser radiation) will be deflected.

The principle can already be seen, not in a galaxy far, far away, but in the atmosphere around our own planet. It is seen in 'over-the-horizon' radio communications, used for decades in early warning RADAR systems and for long distance communications where satellite communications are not feasible.

Student Alexander Toohie said: "The Earth's atmosphere is made up of several distinct layers, one of which is the ionosphere. The ionosphere is a plasma, and extends from roughly 50km above the surface of the Earth to the edge of space.

"Just like the plasma described in our paper, it reflects certain frequencies of electromagnetic radiation, in this case radio frequencies. Radio communications and RADAR can be beamed upwards toward the

sky where it will be reflected back down toward the Earth. This method can be used to send communications over the horizon where radio transmissions would not normally be capable of reaching, much like using a mirror to look around a corner."

A strong magnetic field would be needed to create the required pressure to contain the plasma. The students calculated that the magnet strength required was definitely feasible, but would need a large power source that would restrict space in your ship.

Another major restriction would be that a shield designed to deflect light radiation would prevent any light reaching the pilot, leaving them effectively blind – unless, like Jedi pilot Luke Skywalker, they relied on the Force to guide them!

The students suggest that an Ultra-Violet camera would be a more readily available alternative, as UV radiation is beyond the frequency of light radiation.

While the technology might not be ready to protect your starfighter, there are more down-to-earth applications that we could see in the future.

Alexander explains: "Another possible application of this principle may be for trapping radiation inside a shell of plasma rather than excluding it. This may be useful for applications that require incredibly high temperature environments, such as experimental fusion reactors."

The students presented their findings in a paper for the *Journal of Physics Special Topics*, a peer-reviewed student journal run by the University's Department of Physics and Astronomy. The student-run journal is designed to give students practical experience of writing, editing, publishing and reviewing scientific papers.

Alexander said: "This module is very valuable to students who will be staying in academia after graduating as it gives a good insight into the publishing process for academic papers.

"But it is also valuable to students who do not intend to continue in research, as it allows us to investigate problems that we are interested in, and also gives us feedback from our peers on our writing style and the way in which we tackle problems."

Course tutor Dr Mervyn Roy, a lecturer in the University of Leicester's Department of Physics and Astronomy, said: "The aim of the module is for the students to learn about peer review and scientific publishing.

"The students are encouraged to be imaginative with their topics, and find ways to apply basic physics to the weird, the wonderful and the everyday."

More information: *Journal of Physics Special Topics*, J. McGuire, A. Toohie and A. Pohl, Department of Physics and Astronomy, University of Leicester. Leicester, LE1 7RH. Nov 20, 2013.

Provided by University of Leicester