

Russian Scientists Demonstrate Perfect Light Absorption by Single Nanoparticle

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In the future, this discovery will be helpful in the development of new technologies for wireless transfer of energy and data. The research was carried out by scientists from ITMO University and Moscow Institute of Physics and Technology (MIPT). The paper was published in Laser & Photonics Reviews.

As we know from high school physics, light can interact with matter in a variety of ways: it can refract, dissipate, or be absorbed by it. Usually, all three processes occur simultaneously.

In most cases, that is not an issue. But there are scientific fields where materials need to absorb all of the light. For instance, every photon that is refracted off the surface of a solar cell is lost energy that won't be retained, thus lowering the solar generator's efficiency rate.

Perfect absorption

That is why scientists all over the world are working on solving the issue of complete absorption, trying to minimize the number of wasted photons, or, ideally, bringing it to zero. Earlier on, researchers succeeded in demonstrating this phenomenon on large bodies of matter.

Fundamental research

This [research](#) is fundamental in the full sense of the word. As the researchers explain, it won't immediately result in the creation of new solar cells or other devices. But its success should become a foundation for further research in the field of energy transfer.



“This equation contains answers to all of the questions we have regarding the properties of the particle and the beam,” explains Alexey Proskurin, a PhD student at ITMO University. “One feature of this equation is that it contains non-zero solutions only for certain values of the particle’s parameters. In our case, that means that the effect of perfect absorption manifests only with specific combinations of the particle’s size and material at a specific distance to the surface and wavelength. These combinations correspond to a certain shape of the incident beam. Having solved the Fredholm equation, we found all the parameters of the particle and the incident field. And after we conducted the numerical experiments, we were able to confirm the discovered effect of perfect absorption.”



“Absorption of electromagnetic energy is at the heart of many modern devices. Reducing the size of the absorbers will make the devices themselves much smaller. We hope that the results of this research will be useful in the creation of compact microwave and optical antennas, as well as efficient wireless energy transfer devices,” concludes Andrey Bogdanov.

The reason is that Maxwell’s equations, which describe the behavior of electromagnetic fields – including their absorption – are scalable. In other words, once scientists have found the ideal proportions of properties of light and particles needed for perfect absorption at the nanoscale, the same proportions will be functional at the microscale or in objects the size of a phone or laptop battery.

Read the [original article](#) on ITMO University.