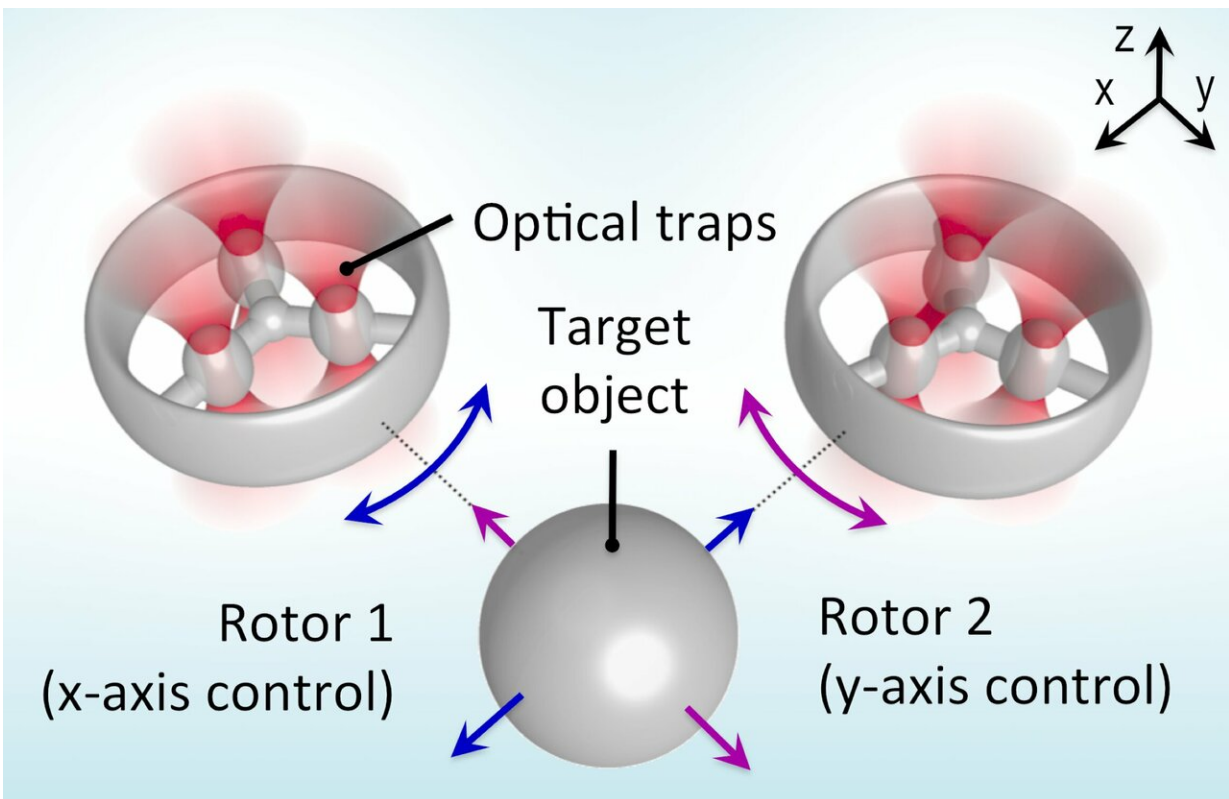


Research paves the way for next generation of optical tweezers

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A diagram showing 2 optically trapped rotors and how their motion can be used to control a free-floating cell (grey sphere). Credit: Dave Phillips

Scientists have developed a pioneering new technique that could pave the way for the next generation of optical tweezers.

A team of researchers from the Universities of Glasgow, Bristol and Exeter, have created a new method of moving [microscopic objects](#) around using micro-robotics.

Currently, optical tweezers—which are used to study proteins, biological molecular motors, DNA and the inner life of cells—use light to hold objects as small as a single nanoparticle in one place.

They use the unusual optical forces created by tightly focused [laser beams](#) to trap and manipulate particles, essentially acting as 'microscopic hands' for scientists.

The first optical tweezers were developed in the 1970s by Dr. Arthur Ashkin. Since then, a series of breakthroughs have allowed scientists to manipulate complex objects such as viruses and cells. Dr. Ashkin, now in his 90s, was recently awarded the Nobel Prize in Physics in 2018 for his pioneering work.

However, this existing [technique](#) has limitations—the high intensities of light required by optical tweezers can damage live biological specimens, and also restrict the types of objects that can be held.

Now, the research team have developed a [new technique](#) that enables optical trapping without focussing any laser light onto the trapped particles.

To do this they have developed optically trapped micro-rotors, which are placed in the liquid surrounding the particle, and used to manipulate its movement using fluid flow.

As the micro-rotors are rotated, they create a wave in the liquid that exerts a force on the particle—much in the same way that a jet of water in a Jacuzzi can push away anything that floats past.

By controlling the directions of each micro-rotor, scientists can either move the particle to a specific location or hold it in one spot—allowing particles to be sorted or imaged at high resolution.

Crucially, this new technique allows scientists to use flow to pinpoint one specific particle at a time, and not affect others in close proximity.

The research is published in the leading journal *Nature Communications*.

Dr. Phillips, part of the University of Exeter's Physics department, and senior author on the study said: "This research expands the applications of [optical tweezers](#) to trap [particles](#) of any material in a liquid environment, and without risk of photo-damage, and adds to the toolbox of techniques that allow us develop new nanotechnologies."

More information: Unė G. Būtaityė et al, Indirect optical trapping using light driven micro-rotors for reconfigurable hydrodynamic manipulation, *Nature Communications* (2019). [DOI: 10.1038/s41467-019-08968-7](#)

Provided by University of Exeter

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