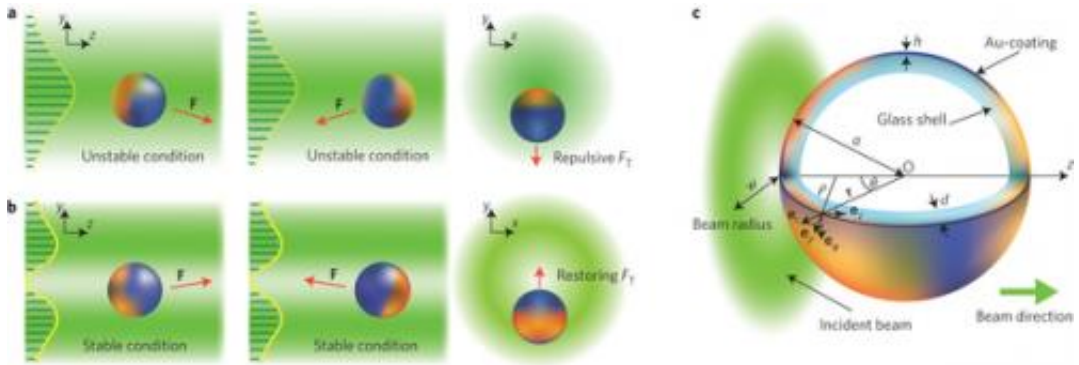
Researchers build reversible tractor beam that moves objects 100 times farther than other efforts

October 20 2014, by Bob Yirka



Concept of photophoretic light–particle interaction in gases. Credit: *Nature Photonics* (2014) doi:10.1038/nphoton.2014.242

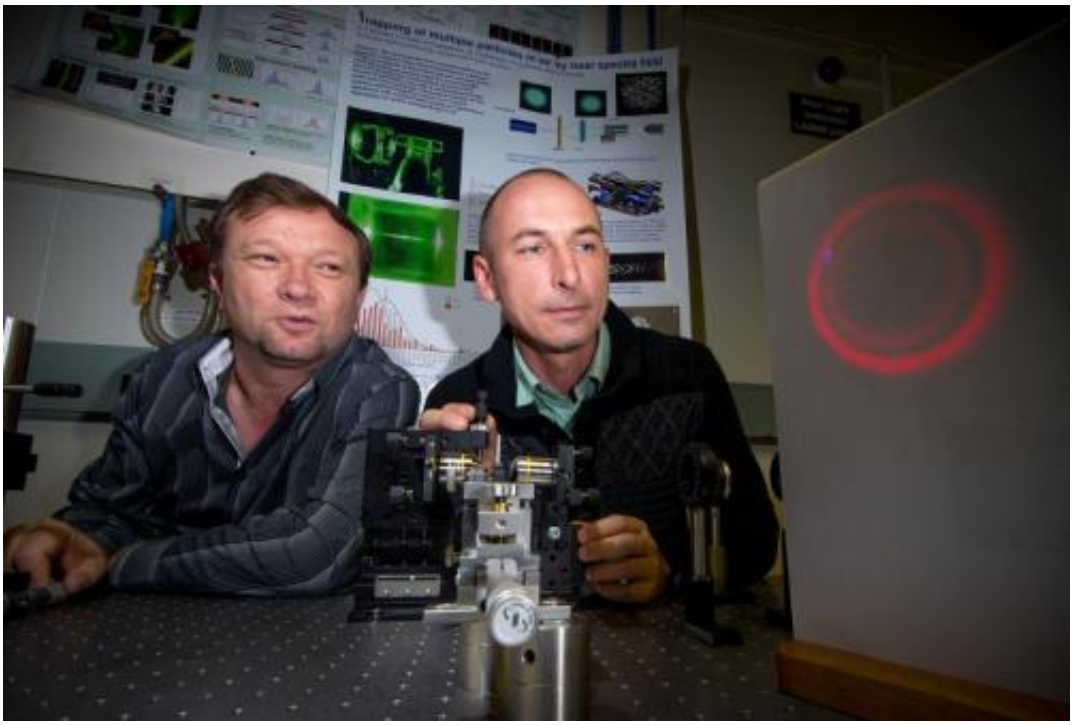
(Phys.org) —A team of researchers working in Australia has built a tractor beam that bests the distance of other efforts a hundred fold—and it can both push and pull objects. In their paper published in the journal *Nature Photonics*, the team describes their tractor beam project, how it works and what purpose it might serve.

A tractor beam is of course a beam emitted by a source that is used to hold and/or move another object. The idea was popularized by the Star Trek series and other science fiction works, and was used typically by one starship to trap and move another starship. In real life, physicists

have made some inroads into developing a tractor beam (mostly based on the movement of photons to propel particles) but thus far, the objects trapped and moved have been extremely small and the distance moved even smaller. In this new effort the researchers used a different technique to move an object that was bigger and to move it much farther—a hundred times as far.

The new tractor beam is based on heat—a laser that shines a doughnut-shaped beam (it has a cold center) was fired at a gold covered tiny (0.2mm diameter) glass bead that was small enough to just fit inside the beam, where it was cold. The heat from the surrounding beam caused the surface of the bead to heat—creating hotspots. When the hotspots came into contact with air particles, those particles were repelled, which in turn caused an opposing force against the glass bead, pushing it (up to a distance of 20cm). The researchers found they could change the movement of the beads by adjusting the polarization of the laser, causing changes in the hotspots on the beads. That meant the beads could be pushed forward, stopped, pulled back, or held in place.

The team suggests their tractor beam could be useful in real world applications because of its versatility and because it requires just a single beam. They believe it might be used for removing pollutants from the air, or for pulling undesirable particles from samples of materials. They also note that it could very easily be made much larger, noting they were prevented from doing so by the small size of their lab.



Dr. Vladlen Shvedov (L) and Dr. Cyril Hnatovsky adjust the hollow laser beam in their lab at the Australian National University. Credit: Stuart Hay, ANU

More information: Economic tools for evaluating liabilities in environmental justice struggles, *Nature Photonics* (2014) DOI: 10.1038/nphoton.2014.242

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Press release: phys.org/wire-news/175254446/p … er-tractor-beam.html