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NASA STUDYING WAYS TO MAKE 'TRACTOR BEAMS' A REALITY

Introduction

- Tractor beams - the ability to trap and move objects using laser light.
- A team of NASA scientists has won funding to study the concept for remotely capturing planetary or atmospheric particles and delivering them to a robotic rover or orbiting spacecraft for analysis.

The NASA Office of the Chief Technologist (OCT) has awarded Principal Investigator Paul Stysley and team members Demetrios Poullos and Barry Coyle at NASA's Goddard Space Flight Center in Greenbelt, Md., \$100,000.

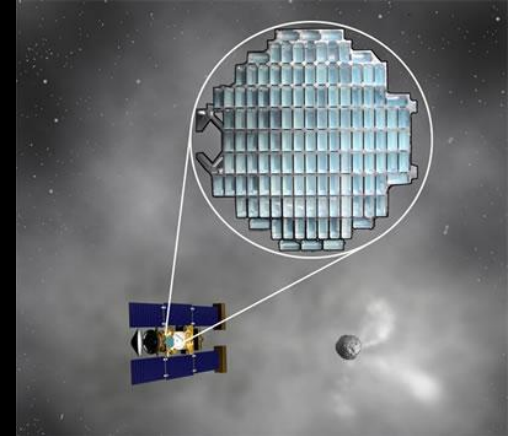


The thought

- It is not impossible with current techniques that they identified three different approaches for transporting small things using the power of light. (particles, as well as single molecules, viruses, ribonucleic acid, and fully functioning cells)
- The original thought was to use tractor beams for cleaning up orbital debris.
 - But it cannot pull something that huge.
 - Sample collection

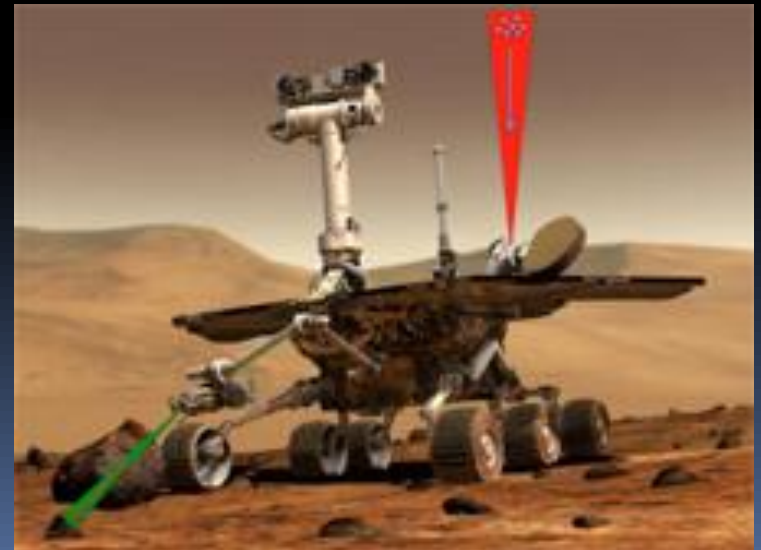
Current Techniques

- **Stardust** -a space probe launched in 1999, the Agency used aerogel to gather samples as it flew through the coma of comet Wild 2. It returned the samples in 2006.
- **Curiosity** -NASA's next rover to Mars, Curiosity, will drill and scoop samples from the Martian surface and then carry out detailed analyses of the materials with one of the rover's many onboard instruments, including the Goddard-built Sample Analysis at Mars instrument suite.




Replace Current Methods

- These techniques have proven to be largely successful, but they are limited by high costs and limited range and sample rate.
- Benefits of optical –trapping system : they could continuously and remotely capture particles over a longer period of time, which would enhance science goals and reduce mission risk.





Team to Study Three Approaches

- The optical vortex or "optical tweezers" method
 - The optical solenoid beams
 - The use of a Bessel beam
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The optical vortex or "optical tweezers" method

- The method used two counter-propagating beams of light. The resulting ring-like geometry confines particles to the dark core of the overlapping beams. By alternately strengthening or weakening the intensity of one of the light beams -- in effect heating the air around the trapped particle -- the particle would be moved along the ring's center.
- This technique requires the presence of an atmosphere.

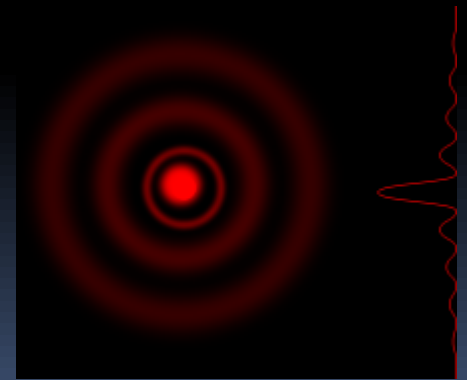


The optical solenoid beams

- Those whose intensity peaks spiral around the axis of propagation. The particulate matter is pulled back along the entire beam of light.
- Unlike the optical vortex method, this technique relies only on electromagnetic effects and could operate in a space vacuum.


The use of a Bessel beam

- Bessel beam, which, when projected onto a wall, features rings of light surround the central dot. It looks like the ripples surrounding a pebble dropped into a pool of water. According to theory, the laser beam could induce electric and magnetic fields in the path of an object, which could then pull the object backward.





Future

- Coyle said. "Once we select a technique, we will be in position to then formulate a possible system"
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Thanks for listening