New Optical Tweezers for Rapid Control of Nanoscale Objects

VANDERBILT UNIVERSITY
CTTC Center for Technology Transfer & Commercialization

Summary

Vanderbilt researchers have developed a novel technology for trapping and dynamically manipulating nanoscale objects. Control over miniature objects like proteins can aid in applications such as biological sensing, single molecule analysis, and size-based sorting of nanoscale objects.

Addressed Need

Optical tweezers have emerged as a powerful tool for the non-invasive trapping and manipulation of colloidal articles and biological cells; however, existing devices use high intensity laser power to trap nanoscale objects, which can cause photo-toxicity and thermal stress to trapped biological specimens. In addition to possibly damaging specimens, current optical tweezers also lack the ability to dynamically manipulate and control nanoscale objects at femtomolar concentrations and in timely manners. The present technology was designed to overcome each of these challenges.

Unique Features

The Vanderbilt nanotweezer, or opto-thermo-electrohydrodynamic tweezers (OTET), traps and sorts nanoscale objects at locations away from the high intensity laser, meaning that trapped specimens experience negligible photothermal heating and light intensity. In addition, OTET can achieve trapping in less than 2 minutes. This non-invasive, rapid approach is expected to open new opportunities in nanoscience and life science by offering an unprecedented level of control of tiny nano-sized objects, including photo-sensitive biological molecules.

Technology Development Status

A prototype of the device has been fabricated and experimentally tested.

Intellectual Property Status

A patent application has been filed.

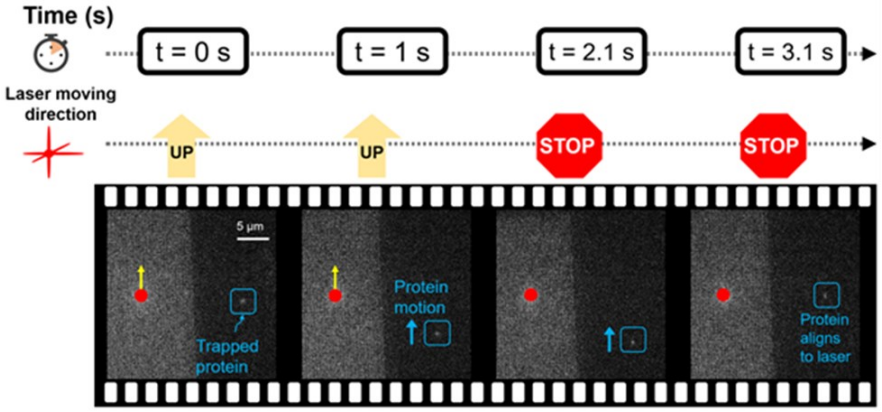

Figure 1: Frame-by-frame images showing a demonstration of dynamic manipulation of a single BSA protein molecule. Red dots show the laser spot position, and the single molecule (tiny bright dot) is highlighted inside a blue rectangular. Yellow arrows show the direction of laser motion, and the blue arrow indicates the molecule motion.

CTTC CONTACT:
Philip Swaney, PhD
(615) 322-1067
philip.swaney@vanderbilt.edu

INVENTORS:
Justus Ndukaife, PhD
Department of Electrical Engineering
Ndukaife Lab

VU REFERENCE: VU 20158

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