



## SPIE Student Seminar Series

**Dr. Justus Ndukaife**  
(Vanderbilt University)

# Opto-Thermo-Electrohydrodynamic Tweezers: A New Paradigm for Nano-Optical Trapping and Analysis of Single Molecules

**Abstract:** One-half of the 2018 Nobel Prize in Physics was awarded for Optical Tweezers and their application in biological systems. Optical tweezers have emerged as a powerful tool for the non-invasive trapping and manipulation of colloidal particles and biological cells. However, the stable trapping of nanometer-scale biological objects has been met with challenges due to the diffraction limit of light. Attempts to increase the laser power to generate enough optical trapping potential for trapping small biological objects, unfortunately, results in photo-toxicity and thermal stress, which damages the integrity of biological specimens. In this talk, I will

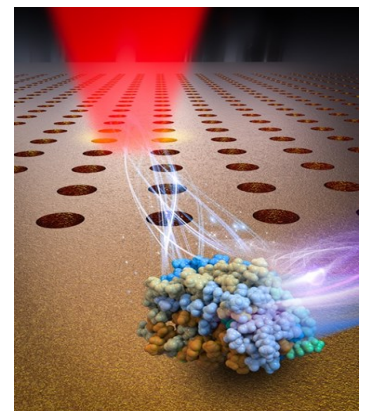
**Tuesday, February 23, 2021**

**2:00 pm ~ 3:00 pm (EST)**

**ZOOM ID: 942 0623 5038**

**Passcode: 407576**

introduce a new kind of optically controlled nanotweezers termed Opto-Thermo-Electrohydrodynamic Tweezers (OTET) that enables the stable trapping and manipulation of sub-10 nm biomolecules that are several microns away from the high-intensity laser focus, where they experience negligible photothermal heating and light intensity. The OTET platform employs a finite array of plasmonic nanoholes illuminated with light in conjunction with an applied electric field that can rapidly trap biomolecules at femtomolar concentrations. This novel optical nanotweezer is expected to open new horizons in life science and medicine by offering an unprecedented level of control of nano-sized biological objects.



**Bio:** Justus Ndukaife is an assistant professor of Electrical Engineering at Vanderbilt University. He received a Ph.D. in Electrical Engineering from Purdue University in 2017. His research is focused on nanophotonics including plasmonics and resonant dielectric cavities for applications in life science, quantum science and nano-assembly. Ndukaife received the International Rising Stars of Light award (2020). His global iCANX talk on Optical Nanotweezers research attracted more than 260,000 viewers world-wide. His other honors include the Year 2017 Prize in Physics by the Dimitris N. Chorafas Foundation, the Purdue College of Engineering Outstanding Research Award, NSBE Golden Torch Award, etc.

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