



IEEE SF Bay Area MEMS & Sensors Chapter

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Lab-on-Chip Technologies Beyond the Diffraction Limit: Ebola Detection and Cancer Diagnostics



Speaker: [Professor Ahmet Ali Yanik](#), UC Santa Cruz

Date/Time: Wednesday, Jan. 28, 2015, 7:45pm

Location: Texas Instruments Building E Conference Center, 2900 Semiconductor Dr., Santa Clara, CA 95052 ([Directions](#))

Food: Pizza and beverages will be available at 7:15 pm for a donation at the door.

Sponsor: Sponsorship opportunities are available. Interested parties please email SFBA-MEMS-OFFICERS@listserv.ieee.org

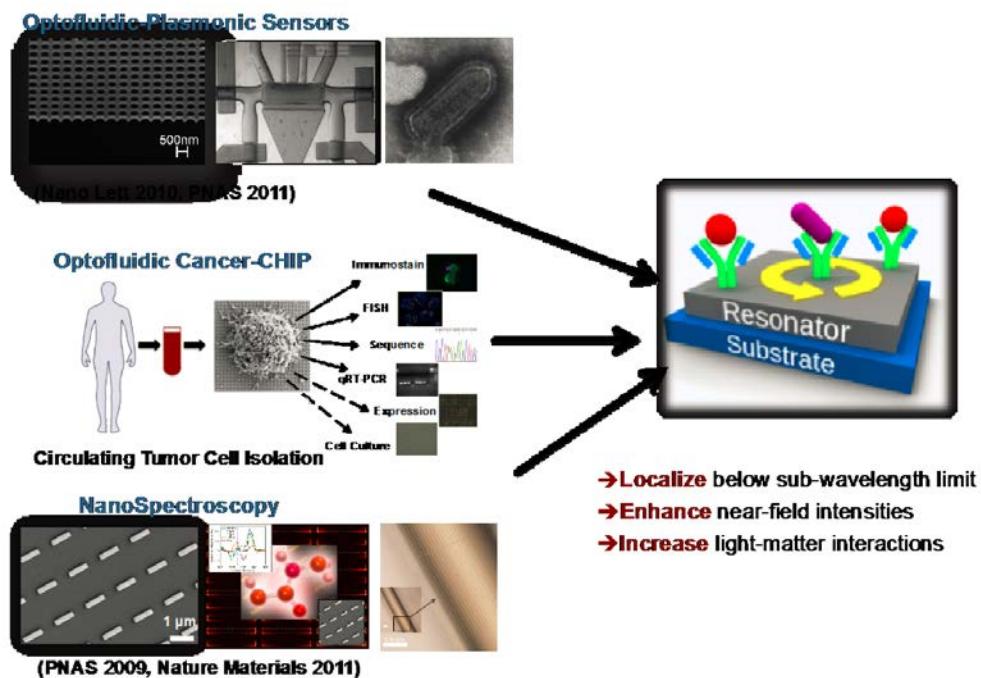
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Abstract: Nanophotonics is opening a myriad of unprecedented opportunities for biomedical applications by localizing light beyond the diffraction limit and dramatically boosting the light-matter interactions at nanoscale dimensions. In this talk, I will introduce a number of transformative technologies based on nanoscale control of light and fluidics on a chip. I will show how to overcome some of the fundamental limitations of the state of art techniques used in vitro diagnostics, which makes up a \$10B global market.

First, an ultrasensitive detection technology with detection limits surpassing the gold standard surface plasmon resonance (SPR) sensors will be introduced. Practical applications of this technology allowing million fold enhanced multiplexing capabilities with minute sample volumes will be shown. Using a bottom-up approach, I will merge nanofluidic and nanophotonic technologies at sub-wavelength dimensions to break the diffusion barrier. For point-of-care applications, a novel sensing scheme enabling label-free detection of biomarker proteins “with the naked eye” will be introduced. Real world applications of these optofluidic-plasmonic sensors for rapid and reliable detection of whole viruses from biological media will be demonstrated. I will extend this nanofluidic approach to a micro-nano cross flow scheme for isolation of rare circulating tumor cells (CTCs) for cancer diagnostics and prognosis. Potential implications of this technique for the analysis of single tumor cells and their metastatic potential will be discussed.

For conformational analysis of proteins at few molecule levels and in vivo real time cancer biopsy applications, I will introduce an ultrasensitive infrared (IR) nanospectroscopy technique allowing 100,000 fold signal enhancements in vibrational signatures of proteins. Using collective excitation of these plasmonic nanoantenna arrays, unprecedented near field enhancements and record low zeptomole detection limits will be demonstrated. I will discuss potential applications of this technology for pharmaceutical applications such as small drug molecule-protein interactions. This nanospectroscopic technique will be integrated onto optical fiber surfaces to achieve real-time cancer biopsy in the human body. Finally, I will introduce a novel absorption spectroscopy technique based on asymmetric

Fano resonances in meta-materials for complete and simultaneous analysis of protein-protein interactions and their folding states.



Biography: Ahmet Ali Yanik is an Assist. Prof. of Electrical Engineering at University of California, Santa Cruz (UCSC). His current research focuses on isolation and single cell analysis of Circulating Tumor Cells (CTCs) from human blood using optofluidic-nanoplasmonic platforms. His research interests include nanoplasmonic and metamaterial devices for ultrasensitive infrared spectroscopy of biomolecules/chemicals as well as high-throughput, cost effective, BioNEMS technologies for life sciences, point-of-care diagnostics and global health. His expertise is in high-end nanolithography and bio-patterning as well as theory and engineering of nanophotonic devices. He received his Ph.D. degree in applied theoretical physics from Purdue University, under the supervision of Prof. Supriyo Datta. During his PhD, he studied spin dependent electron transport in low dimensional molecular/nano-electronic devices and introduced one of the most advanced quantum transport models (spin-NEGF) that exists today. Before joining to UCSC, he was a senior research associate at BioMEMS Resource Center at Harvard Medical School and Surgery Department in Massachusetts General Hospital. He was also instrumental in the establishment of The Laboratory of Integrated Nanophotonics and Biosensing Systems at The Boston University Photonics Center. He has published more than 80 peer reviewed journal articles and conference proceedings. His scientific contributions have been featured in numerous magazines and by scientific organizations, including National Academy of Science, National Science Foundation, Institute of Physics, Nature Materials, Physics World, US News, IBM Think Project and Biophotonics International.