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SEMINAR

Virus Counter: Rapid and Sensitive Diagnostics Based on Digital Detection of Individual Pathogens

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Abstract: The response of modern infectious disease diagnostics to the rapid spread of SARS-CoV-2 has exposed the challenges in viral disease diagnostics. PCR-based diagnostic systems for SARS-CoV-2 are in overwhelming demand resulting in a widespread lack of accessibility to testing similar to the 2009 flu pandemic and 2014 Ebola outbreak. Efforts to solve supply-line issues for PCR will not solve the disadvantages for the method including tedious sample preparation and time consumption. Lateral flow assays (LFAs) and enzyme-linked immunosorbent assays (ELISAs) are also potential solutions for viral diagnostics, however, their limited sensitivity at low viral titers hinders the early stage diagnostic capabilities of the techniques. Considering the shortcomings of the current point of care (POC) tools, diagnostic testing for 2019 novel coronavirus (SARS-CoV-2) is desperately in need of a development of a sensitive high-throughput POC platform. Single-particle interferometric reflectance imaging sensor (SP-IRIS) technique relies on different supply lines for testing, ensuring the response resilience. SP-IRIS offers optical visualization and characterization of individual nanoparticles without any labels. The already established viral enumeration system has shown the ability to detect viruses such as Ebola and Marburg viruses. Here, we discuss how this platform will be modified with a functionalized assay for SARS-CoV-2. Adapting this sensing technique for compatibility with microwell plates will allow for an automated detection biosensor for viral particles in a high-throughput platform.

Bio: Professor M. Selim Ünlü is a Distinguished Professor of Engineering at Boston University. His research interests are in nanophotonics and biophotonics focusing on development of biological detection and imaging techniques, particularly in high-throughput digital biosensors based on detection of individual nanoparticles and viruses. Dr. Ünlü was the recipient of the NSF CAREER and ONR Young Investigator Awards in 1996. He has been selected as a Photonics Society Distinguished Lecturer for 2005-2007 and Australian Research Council Nanotechnology Network (ARCNN) Distinguished Lecturer for 2007. He has been elevated to IEEE Fellow rank in 2007 for his “contributions to optoelectronic devices” and OSA Fellow rank in 2017 for his “for pioneering contributions in utilization of optical interference in enhanced photodetectors and biological sensing and imaging.” In 2008, he was awarded the Science Award by the Turkish Scientific Foundation. His past professional service includes serving as the Editor-in-Chief for IEEE Journal of Quantum Electronics.

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