Yale Institute for Nanoscience and Quantum Engineering

Friday- February 28, 2014

12:00 to 1:00 p.m.

Becton Seminar Room

Light lunch will be served at 11:45 a.m.

Zaki Leghtas

Department of Applied Physics, Yale University

"Preparing Schrodinger Cat States By Parametric Pumping"

Maintaining a quantum superposition state of light in a cavity has important applications for quantum error correction. We demonstrate an experimental protocol based on parametric pumping and Josephson circuits, which prepares a Schrodinger cat state in a cavity. This is achieved by engineering a dissipative environment, which exchanges only pairs of photons with our cavity mode. The dissipative nature of this preparation would lead to the observation of a dynamical Zeno effect, where the competition between a coherent drive and the dissipation reveals non trivial dynamics.

Minsuk Kwak

Department of Biomedical Engineering, Yale University

"Nanowire Array Chips For Molecular Typing Of Rare Trafficking Leukocytes With Application To Neurodegenerative Pathology"

Cerebrospinal fluid (CSF) is one of the major routes through which trafficking leukocytes migrate into the CNS. Therefore, the number of leukocytes and their phenotypic compositions in CSF may represent important sources to investigate immune-to-brain interaction, or diagnose and monitor neurodegenerative diseases. Due to the paucity of trafficking leucocytes in CSF, a technology capable of efficient isolation, enumeration, and molecular typing of these cells in the clinical settings has not been achieved. In this study, we report on a biofunctionalized silicon nanowire array chip for highly efficient capture and multiplexed phenotyping of rare trafficking leukocytes in small quantities of clinical CSF specimens collected from neurodegenerative disease patients. The antibody-coated 3D nanostructured materials exhibited vastly improved rare cell capture efficiency due to high-affinity binding and enhanced cell-substrate interactions. Moreover, our platform creates multiple cell capture interfaces, each of which can selectively isolate specific leukocyte phenotype. Comparison with the traditional immunophenotyping using flow cytometry demonstrated that our novel silicon nanowire-based rare cell analysis platform can perform rapid detection and simultaneous molecular characterization of heterogeneous immune cells. Multiplexed molecular typing of rare leukocytes in CSF samples collected from Alzheimer's disease patients revealed the elevation of white blood cell counts and significant alterations in the distribution of major leukocyte phenotypes. Our technology represents a practical tool potentially for diagnosing and monitoring the pathogenesis of neurodegenerative diseases by allowing an effective hematological analysis of CSF from patients.

HOST: Paul Fleury