

Announcing the Final Examination of Daniel Franklin for the degree of Doctor of Philosophy in Physics

Date: March 27, 2018

Time: 1:00 p.m.

Room: CREOL 103

Dissertation title: Dynamically Tunable Plasmonic Structural Color

Abstract:

Functional surfaces which can control light across the electromagnetic spectrum are highly desirable. With the aid of advanced modeling and fabrication techniques, researchers have demonstrated surfaces with near arbitrary tailoring of reflected/transmitted amplitude, phase and polarization - the applications for which are diverse as light itself. These systems often comprise of structured metals and dielectrics that, when combined, manifest resonances dependent on structural dimensions. This attribute provides a convenient and direct path to arbitrarily engineer the surface's optical characteristics across many electromagnetic regimes. But while many of these plasmonic systems struggle to compete with the efficiency of pre-existing technologies, the ability to tune plasmonic structures post-fabrication is a distinct advantage which may lead to novel devices.

In this work, I will summarize fundamental and applied aspects of tunable plasmonic systems as applied to the visible and infrared regimes. I will demonstrate how liquid crystal may be used to dynamically and reversibly tune the plasmonic resonances of metallic surfaces on a millisecond time scale. For the visible, this results in dynamic color-changing surfaces capable of covering the entire RGB color space and which is compatible with active addressing schemes. I will then show the application of these concepts to infrared absorbers through the use of liquid crystal and phase change materials. The later of these devices can find use in infrared data/image encoding, thermal management and camouflage. Together, these works explore the limits of tunable plasmonic systems and the novel devices they might lead to.

Outline of Studies:

Major: Physics

Educational Career:

B. S. Missouri University of Science and Technology, 2011

Committee in Charge:

Dr. Debashis Chanda (Chair)

Dr. Robert Peale

Dr. Michael Leuenberger

Dr. Shin-Tson Wu (External Committee Member)

Approved for distribution by Dr. Debashis Chanda, Committee Chair, on March 18, 2018.

The public is welcome to attend.