Department of Physics and Astronomy Colloquium

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Date: March 8, 2017
Time: 3:40 p.m. (**Refreshments** in ***Rm. 103*** @ **3:30 p.m.**)
Place: Rm. 103, Thirkield Hall, Howard University
Host: Dr. Pratibha Dev

Asymmetric Metasurfaces for Terahertz Modulators and Ultrasensitive Biosensors

Abstract: Metamaterials are artificial structures with engineered electromagnetic properties derived from the arrangement of metallic unit cells ("meta-atoms"). When breaking the symmetry of these unit cells, researchers have shown the activation of additional operating frequencies or modes with increased Q factors and higher sensing capabilities. Here, we present the exploitation of these attributes in asymmetric metasurfaces for 1) graphene-based terahertz modulators and 2) ultrasensitive wide-range flexible biosensors.

Graphene-based metastructures have several advantages over traditional metallic structures including high carrier mobility, material flexibility, and resonance frequency tunability. A diverse set of graphene metamaterials structures such as split-ring resonators (SRRs) have been theoretically proposed with amplitude modulation up to 80% and frequency tunability up to 400 GHz. The aim of this work is to realize the high amplitude modulation and broad frequency modulation by fabricating novel hybrid graphene devices with asymmetric SRR metasurfaces to generate multiple Fano resonances. Our devices have 7 additional modes covering a range of 250 GHz and increased tunability from the gated graphene layer. Additionally, terahertz metamaterials have the capability to sense biological agents down to pg/L concentrations. Furthermore, asymmetric metasurfaces have shown Q factors up to 300. Here, using a flexible polymide susbtrate, we demonstrate a wide range biosensor featuring asymmetric metasurfaces and the effect of the substrate on the sensitivity of these devices.