PURDUE
UNIVERSITY

School of Electrical and Computer Engineering

Inter-office Memorandum

Scheduling of Examinations:

Student's Name:	Di Wang
Degree:	Doctor of Philosophy
Type:	Preliminary Exam
Major Professor:	ALEXANDRA BOLTASSEVA
Advisor 1:	VLADIMIR M. SHALAEV
Advisor 2:	ALEXANDER V. KILDISHEV
Advisor 3:	ZHIHONG CHEN
Examination Date:	12-19-2017
Examination Time:	10:00 AM
Building & Room:	BRK 2001

Thesis Title: Novel Graphene Optoelectronic Sensors

Abstract: Optoelectronic sensors – tools used to gather and decode information carried by light – comprise an essential part of modern advanced technologies. As extensions to human sense organs, they work as information collectors for human beings to perceive the environment in a safer manner, over a broader scope, and at a higher precision. The universal use of light in a vast diversity of researches spanning from cosmology to molecular science generates a demand for optoelectronic sensors of tremendous variety.

Since it was first successfully exfoliated from bulk graphite in 2004, graphene – a monolayer of carbon atoms arranged in honeycomb lattice – has attracted enormous attention from researchers with highly diversified research interests. Originating from its two-dimensional nature, graphene exhibits extraordinary electrical and optical properties, such as zero effective charge carrier mass, zero bandgap and linear band dispersion close to the Dirac point. Moreover, its ultimate thinness facilitates modification of charge carrier concentration, which enables dynamic tunability with this material. These unique properties render graphene as a material resembling both conductor and semiconductor. As a result, exotic optical response is present in graphene.

In the scope of this work, I explore graphene as a material for advanced optoelectronic sensor functionalities/performance, including graphene plasmonic resonator and photodetector. With coworkers, I have revealed enhanced plasmonic resonance in double layer graphene nanoribbons relative to single layer graphene nanoribbons, and have demonstrated a broadband sensitive graphene photodetector augmented by gold fractal metasurface. Currently, I am working on a device which exploits the photothermoelectric (PTE) effect in graphene to further enhance the sensitivity of graphene photodetector, and have obtained some intermediate result of using

plasmonic structure as efficient optical heaters for graphene PTE detector.

Committee Members: If you are unable to attend this examination, please contact Mr. Wang.