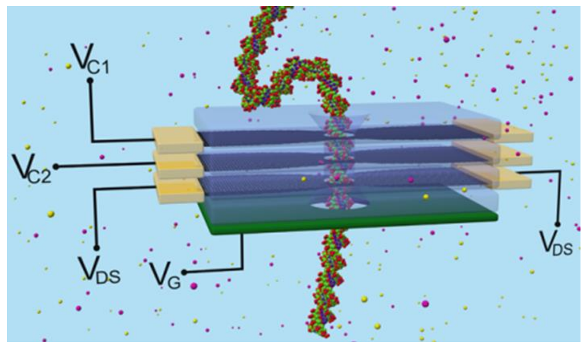
NANOHOUR

Wednesday, April 17, 2013 at 3:00 pm
Beckman Institute - Room 3269

Graphene Quantum Point Contact Transistor for DNA Sensing

Anuj Girdhar, Physics
Graduate Student with Professor Jean-Pierre Leburton

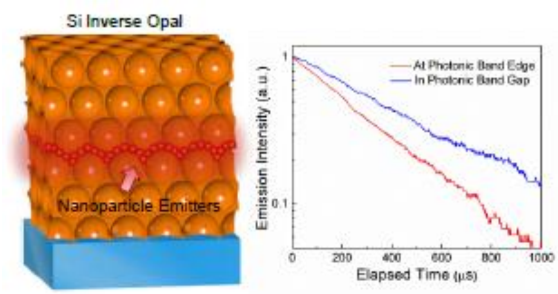
The single-atom thickness of monolayer graphene makes it an ideal candidate for DNA sequencing as it can scan molecules passing through a nanopore at high resolution. Additionally, unlike most insulating membranes, graphene is electrically active, and this property can be exploited to control and electronically sense biomolecules. We show that the shape of the edge as well as the shape, position, and size of the nanopore can strongly affect the electronic conductance through a lateral constriction in a graphene nanoribbon as well as its sensitivity to external charges. In this context the geometry of the graphene membrane can be tuned to detect the rotational and positional conformation of a DNA strand inside the nanopore. We show that a quantum point contact (QPC) geometry is suitable for the electrically-active graphene layer and propose a viable design for a graphene-based DNA sequencing device.



Light-Matter Interaction in 3D Photonic Crystals with Engineered Defects

Hailong Ning, Materials Science and Engineering
Graduate Student with Professor Paul Braun

Light-matter interactions are more pronounced in 3D photon crystals (PhCs) compared to 1D and 2D cases, because photons can be completely confined and manipulated in those structures. In order to fully utilize their properties, defects such as light emitters, cavities and waveguides must be incorporated to the 3D networks. The goal of my thesis research is to study the interaction between light and engineered defects inside 3D PhCs for new applications. The influence of 3D silicon PhC environment on the spontaneous emission (SE) of rare-earth nanoparticle emitters was investigated by placing the emitting defects at specific locations inside 3D architectures. The photonic responses in both frequency and time domains were measured and compared to the theory. This enabled us to understand the key requirements to control SE in 3D dielectric PhCs, and also provided guidance for developing a hybrid surface emitting laser system that consisted of 3D silicon PhC reflectors and III-V gain medium built by transfer printing. In comparison to DBR and other types of reflectors, 3D PhCs can potentially lower the lasing threshold. Advanced transferring printing with micro-structured stamps also allowed patterning the gain medium in advance to suppress in-plane waveguide modes of the resonant cavity, which can potentially further reduce the lasing threshold.



Coffee and cookies will be served
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