



UNIVERSITY OF CENTRAL FLORIDA

NANOSCIENCE TECHNOLOGY CENTER
ADVANCED MATERIALS PROCESSING & ANALYSIS CENTER
ASM MATERIALS ADVANTAGE, STUDENT CHAPTER

GRADUATE RESEARCH SEMINAR SERIES

Friday
February 13, 2015

12:00 PM — 1:00 PM

Research Pavilion
NSTC
Conference Room 475

*Pizza and drinks
will be provided*

Two-Dimensional Fermionic Hong-Ou-Mandel Interference with Massless Dirac Fermions

Mahtab Khan (12:00 PM - 12:30 PM)
Dr. Michael Leuenberger's Group

Abstract: We propose a two-dimensional Hong-Ou-Mandel (HOM) type interference experiment for massless Dirac fermions in graphene and 3D topological insulators. Since massless Dirac fermions exhibit linear dispersion, similar to photons in vacuum, they can be used to obtain the HOM interference



intensity pattern as a function of the delay time between two massless Dirac fermions. We show that while the Coulomb interaction leads to a significant change in the angle dependence of the tunneling of two identical massless Dirac fermions incident from opposite sides of a potential barrier, it does not affect the HOM interference pattern. We apply our formalism to develop a massless Dirac fermion beam splitter (BS) for controlling the transmission and reflection coefficients. We calculate the resulting time-resolved correlation function for two identical massless Dirac fermions scattering off the BS.

An Effort Towards Improving The Biocatalytic Activity of Nano Cerium Oxide

Ankur Gupta (12:30 PM—1:00 PM)
Dr. Sudipta Seal's Group

Abstract: Human body is a complex system and several harmful/reactive species are generated as byproduct of aerobic respiration. Generation of free radical such as reactive oxygen species (ROS) induce oxidative stress which damage the living cells. In healthy human body, the disproportionation of superoxide radicals (SOD) is catalyzed by Superoxide dismutase enzyme whereas H₂O₂ is scavenged by catalase. Cerium oxide nanoparticles (CNPs) are known to mimic SOD and catalase enzyme. Therefore, CNPs are the most studied rare earth oxide material having applications in industry to therapeutics. These unique activity of CNPs owing to low reduction potential of Ce⁺³/Ce⁺⁴ couple and/or oxygen vacancies present on the surface. However, no concrete evidence is available to understand the mechanism behind the redox activity of CNPs. This understanding will create scope and foundation to improve the formulation of CNPs and optimize dose in biology applications. In this attempt,



Lanthanum (La), Samarium (Sm) and Erbium (Er) doped CNPs were prepared in controlled atmosphere of dextran polymer at room temperature to alter surface chemistry at nanoscale. Doped CNPs were characterized using X-ray diffraction, HRTEM, XPS, UV-vis, and FT-IR spectroscopy. XPS results exhibit the increase in Ce⁺³ ions and oxygen vacancies in doped CNPs. Superoxide dismutase and catalase activities of doped CNPs were analyzed using WST-1 and Amplex Red assays. Cell compatibility was measured using MTT assay. In this study we unfolded the correlation of cerium oxide catalytic activity in respect to its surface chemistry.