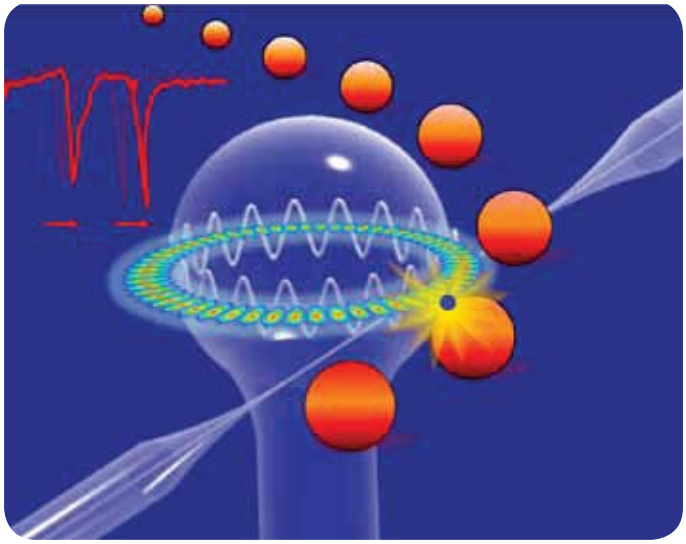
Biophysics //

Nanoparticle-based Protein Detection / Optoplasmonic Superlenses

Researchers at **Pennsylvania State University (USA)**, **Boston University (USA)**, **Wyss Institute for Bioinspired Engineering, Harvard, Cambridge (USA)**, and **Max Planck Institute for the Science of Light (Germany)** demonstrate a **biosensing approach** which, for the first time, combines the high **sensitivity of whispering gallery modes (WGMs) with a metallic nanoparticle-based assay**.

They provide a computational model based on generalized Mie theory to explain the higher sensitivity of protein detection. They quantitatively analyze the binding of a model protein (i.e., Bovine Serum Albumin) to **gold nanoparticle**s from high-Q WGM resonance frequency shifts, and fit the results to an adsorption isotherm, which agrees with the theoretical predictions of a two-component adsorption model.

Miguel A. Santiago-Cordoba, Svetlana V. Boriskina, Frank Vollmer, and Melik C. Demirel: Nanoparticle-based protein detection by optical shift of a resonant microcavity, In: *Applied Physics Letters*, Vol. 99(2011), Issue 7, August 15, 2011, Article 073701 [3 pages], DOI:10.1063/1.3599706: http://dx.doi.org/10.1063/1.3599706



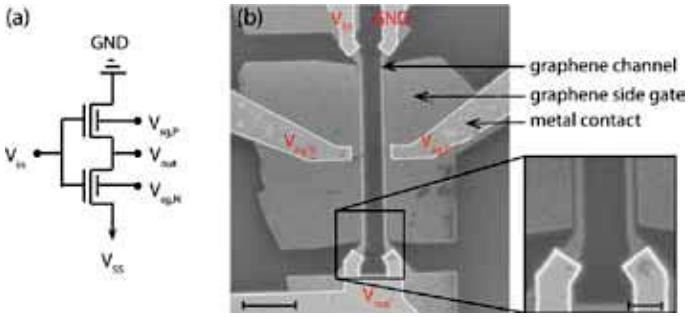
Another related paper recently published in *PNAS* shows the advantages of the resonant hybrid optoplasmonic elements as fluorescence sensors and quantum-optical networks components.

Svetlana Boriskina and Björn Reinhard (**Department of Chemistry and the Photonics Center, Boston University, USA**) introduce herein **optoplasmonic superlenses** that combine the capability of optical microcavities to insulate molecule-photon systems from decohering environmental effects with the superior light nanoconcentration properties of nanoantennas. The proposed structures provide significant enhancement of the emitter radiative rate

and efficient long-range transfer of emitted photons followed by subsequent refocusing into nanoscale volumes accessible to near- and far-field detection. Optoplasmonic superlenses are versatile building blocks for optoplasmonic nanocircuits and can be used to construct "dark" single-molecule sensors, resonant amplifiers, nanoconcentrators, frequency multiplexers, demultiplexers, energy converters, and dynamical switches. © PNAS

S.V. Boriskina and B.M. Reinhard: Spectrally and Spatially Configurable Superlenses for Optoplasmonic Nanocircuits, In: *PNAS*, Vol. 108, No. 8, February 22, 2011, Pages 3147-3151, DOI:10.1073/pnas.1016181108:
http://dx.doi.org/10.1073/pnas.1016181108
Department of Chemistry and the Photonics Center, Boston University, USA:
http://www.bu.edu/chemistry/

Complementary-Type Graphene Inverters Operating at Room Temperature



Purdue researchers are making progress in creating digital transistors using a material called graphene, potentially sidestepping an obstacle thought to dramatically limit the material's use in computers and consumer electronics. This composite image shows the circuit schematics of a new type of graphene inverter, a critical building block of digital transistors, left, and scanning electron microscope images of the fabricated device. (Image © Hong-Yan Chen, Purdue University Birck Nanotechnology Center)

The Purdue researchers are the first to create graphene inverters that work at room temperature and have a gain larger than one, a basic requirement for digital electronics that enables transistors to amplify signals and control its switching from 0 to 1.

Findings were detailed in a paper, "Complementary-Type Graphene Inverters Operating at Room-Temperature," presented in June during the 2011 Device Research Conference in Santa Barbara, Calif.

Hong-Yan Chen, Joerg Appenzeller: Complementary-Type Graphene Inverters Operating at Room Temperature:
http://www.purdue.edu/newsroom/research/2011/110906AppenzellerGraphene.html