Nonlinear Plasmonic Sensing with Nanographene

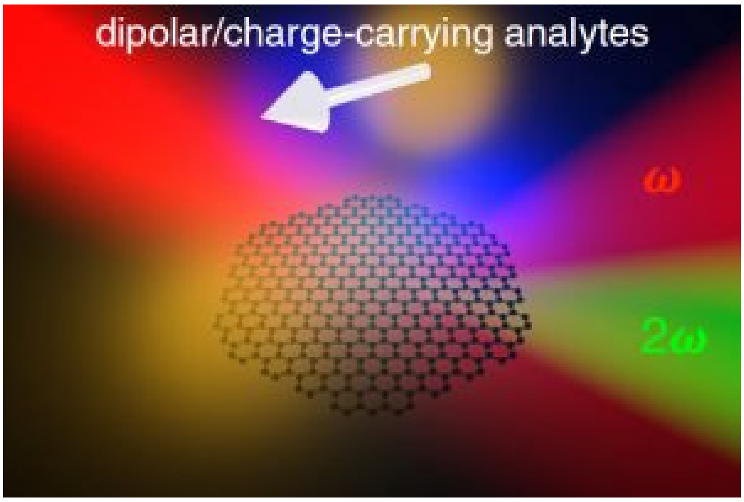


Illustration of an armchair-edged graphene nanohexagon (GNH) interacting with a charge- or dipole-carrying analyte (the white arrow indicates a permanent dipole moment). The molecule induces asymmetry in the nanohexagon conduction electron distribution, which can be detected by measuring either changes in the optical absorption spectrum or the onset of a second-harmonic signal.

Plasmons provide excellent sensitivity to detect analyte molecules through their strong interaction with the dielectric environment. Plasmonic sensors based on noble metals are, however, limited by the spectral broadening of these excitations. Yu and his colleagues identify a new mechanism that reveals the presence of individual molecules through the radical changes that they produce in the plasmons of graphene nanoislands. An elementary charge or a weak permanent dipole carried by the molecule are shown to be sufficient to trigger observable modifications in the linear absorption spectra and the nonlinear response of the nanoislands. In particular, a strong second-harmonic signal, forbidden by symmetry in the unexposed graphene nanostructure, emerges due to a redistribution of conduction electrons produced by interaction with the molecule. These results pave the way toward ultrasensitive nonlinear detection of dipolar molecules and molecular radicals that is made possible by the extraordinary optoelectronic properties of graphene.

Source: http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.117.123904

[Femtosecond plasmon interferometer]

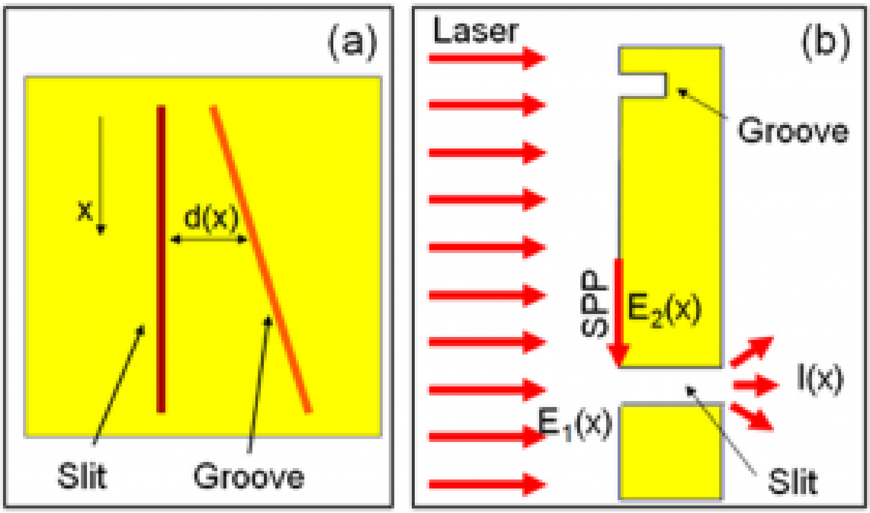


Fig. 1. Schematic of the tilted slit-groove interferometer: (a)top view,(b)excitation scheme.

Melentiev and his colleagues have realized a plasmonic interferometer formed by a nanoslit and a nanogroove in a single-crystal gold film. The possibility of measuring laser pulses of ultimately short durations, corresponding to two periods of a light wave (6 fs pulse duration), has been demonstrated using this interferometer.

Source: http://www.sciencedirect.com/science/article/pii/S0030401816306496

Related paper:

Melentiev et al.,Femtosecond plasmon interferometer, Optics Communications, Volume 382, 2017, Pages 509-513.

A smartphone based surface plasmon resonance imaging

(SPRi) platform for on-site biodetection

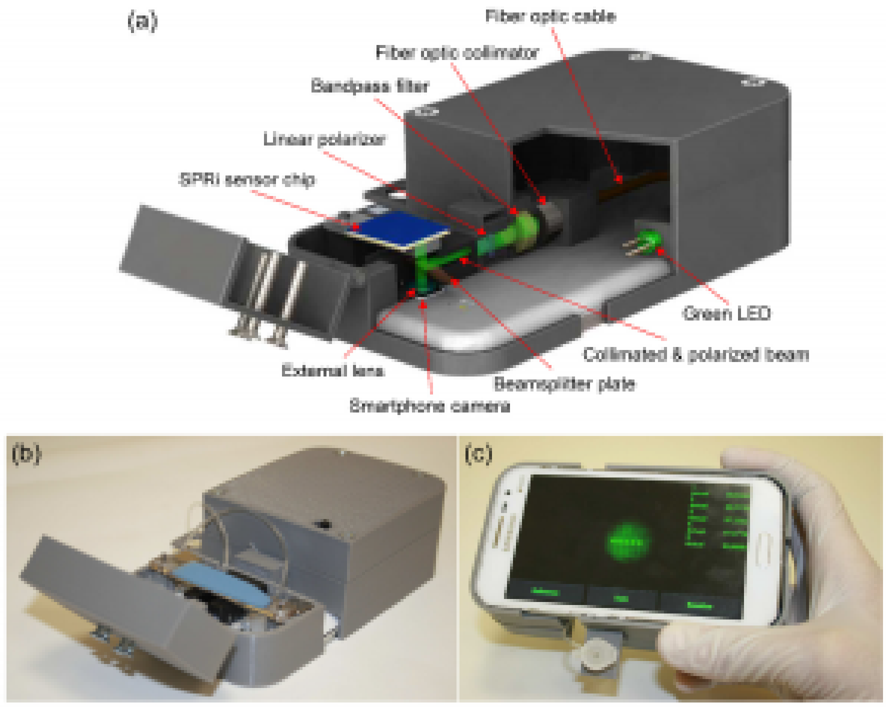


Fig.1. Surface plasmon resonance imaging platform integrated with a smartphone. (a) Schematic illustration and (b) photograph of the imaging apparatus. (c) Customdeveloped smartphone application for real-time and on-site monitoring of multiple sensing spots.

Guner and his colleagues demonstrate a surface plasmon resonance imaging platform integrated with a smartphone to be used in the field with high-throughput bio-detection. Inexpensive and disposable SPR substrates are produced by metal coating of commercial Blu-ray discs. A compact imaging apparatus is fabricated using a 3D printer which allows taking SPR measurements from more than 20.000 individual pixels.

Real-time bulk refractive index change measurements yield noise equivalent refractive index changes as low as4.12 × 10−5RIU which is comparable with the detection performance of commercial instruments. As a demonstration of a biological assay, they have shown capture of mouse IgG antibodies by immobilized layer of rabbit anti-mouse (RAM) IgG antibody with nanomolar level limit of detection. Their approach in miniaturization of SPR biosensing in a cost-effective manner could enable realization of portable SPR measurement systems and kits for point-of-care applications.

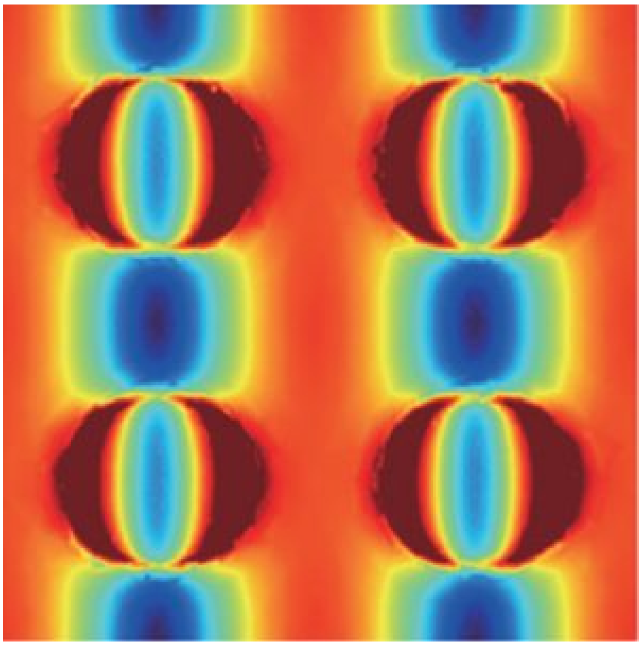
Source: http://www.sciencedirect.com/science/article/pii/S092540051631293X

Journal reference:

Hasan Guner et al., A smartphone based surface plasmon resonance imaging (SPRi) platform for on-site biodetection, Sensors and Actuators B: Chemical, Volume 239, 2017, Pages 571-577.

[Tunable Fano resonance and magneto-optical response in magnetoplasmonic structure fabricated by pure

ferromagnetic metals



The developments in nanophotonics demand more efficient and delicate control of light. It has recently been proposed to achieve this goal by combining plasmonics and magneto-optics in so-called magnetoplasmonic nanostructures. However, significant challenges still remain because of the difficulty in the design of spectrally tunable systems exhibiting novel plasmonic and magneto-optical responses simultaneously. Here Chen and his colleagues report a magnetoplasmonic structure which consists of a two-dimensional nickel nanodisk array on top of a cobalt film substrate. They demonstrate that a tunable Fano resonance can be generated in this system with properly designed geometric parameters. Furthermore, the magneto-optical Kerr responses in this system can be manipulated due to the concerted actions of free electrons in the resonance. Their results reveal the possibility of fabricating large-area magnetoplasmonic structures by a simple, mass-producible method, and tuning the plasmonic and magneto-optical responses simultaneously.

Source: http://journals.aps.org/prb/abstract/10.1103/PhysRevB.

93.214411

[Congratulations on publishing “Neuroplasmonics: From Kretschmann configuration to plasmonic crystals”.]

Congratulations on publishing “Neuroplasmonics: From Kretschmann configuration to plasmonic crystals” in The European Physical Journal Plus.

This paper is written by Foozieh Sohrabi under the direct supervision of Dr Seyedeh Mehri Hamidi.

Abstract: Recently, a worldwide attempt for understanding the functions of brain and nervous system has been made. Hence, various aspects of neuroscience have been investigated through different techniques. Among these techniques, neuroplasmonics as a newborn branch of this science tries to seize the realm of *in vitro* and *in vivo* neural imaging, recording and healing. Neuroplasmonics offers advantages comprising rapidity, high sensitivity, biological compatibility, label-free and real-time detection by benefiting from the sensing and thermal characteristics of surface plasmon resonances (SPRs). This paper reviews four main branches of neuroplasmonics comprising prism coupler configurations, the combination of SPR and fluorescence microscopy and methods based on nanorods and plasmonic crystals. For each division, the advantages, disadvantages and the provided facilities will be discussed in detail.

Reference: Sohrabi, F. & Hamidi, S. Eur. Phys. J. Plus (2016) 131: 221. doi:10.1140/epjp/i2016-16221-5

The legal and public full-text view can be reached via:

http://rdcu.be/nrAY