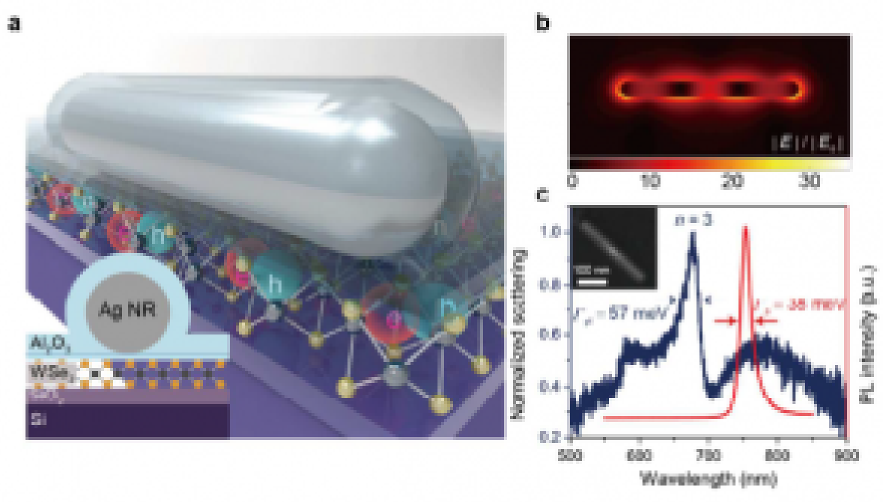
Manipulating coherent plasmon-exciton interaction in single silver nanorod on monolayer WSe2



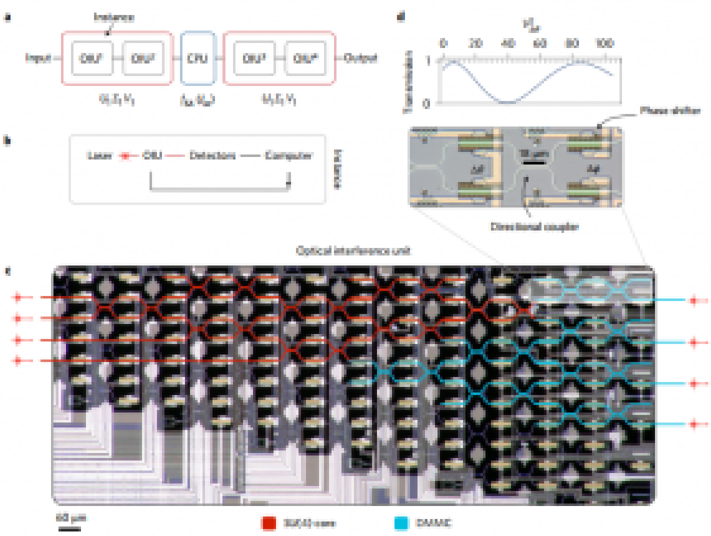
Strong coupling between plasmons and excitons in nanocavities can result in the
formation of hybrid plexcitonic states. Understanding the dispersion relation of plexcitons is important both for fundamental quantum science and for applications including optoelectronics and nonlinear optics devices. The conventional approach, based on statistics over different nanocavities suffers from large inhomogeneities from the samples, owing to the non-uniformity of nanocavities and the lack of control over the locations and orientations of the excitons. Here they report the first measurement of the dispersion relationship of plexcitons in an individual nanocavity. Using a single silver nanorod as a Fabry-Pérot nanocavity, they realize strong coupling of plasmon in single nanocavity with excitons in a single atomic layer of tungsten diselenide. The plexciton dispersion is measured by in-situ redshifting the plasmon energy via successive deposition of a dielectric

layer. Room temperature formation of plexcitons with Rabi splittings as large as 49.5 meV is observed. Realization of strong plasmon-exciton coupling by
in-situ tuning of the plasmon provides a novel route for manipulation of excitons in
semiconductors.

Source:http://pubs.acs.org/doi/abs/10.1021/acs.nanolett.7b01176

Related paper: Di Zheng et al.,Manipulating coherent plasmon-exciton interaction in single silver nanorod on monolayer WSe_2,*Nano Lett.*, 17 (6), pp 3809–3814,(2017).

[Deep learning with coherent nanophotonic circuits]()

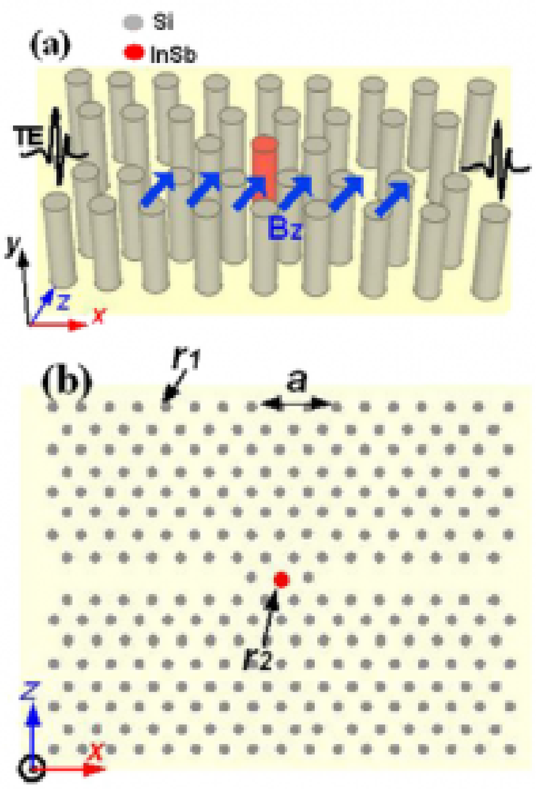


Artificial neural networks are computational network models inspired by signal processing in the brain. These models have dramatically improved performance for many machine-learning tasks, including speech and image recognition. However, today’s computing hardware is inefficient at implementing neural networks, in large part because much of it was designed for von Neumann computing schemes. Significant effort has been made towards developing electronic architectures tuned to implement artificial neural networks that exhibit improved computational speed and accuracy. Here, they propose a new architecture for a fully optical neural network that, in principle, could offer an enhancement in computational speed and power efficiency over state-of-the-art electronics for conventional inference tasks. They experimentally demonstrate the essential part of the concept using a programmable nanophotonic processor featuring a cascaded array of 56 programmable Mach–Zehnder interferometers in a silicon photonic integrated circuit and show its utility for vowel recognition.

Source:https://www.nature.com/nphoton/journal/v11/n7/abs/nphoton.2017.93.html

Related paper: Yichen Shen et al.,Deep learning with coherent nanophotonic circuits,Nature Photonics 11, 441–446 (2017)

[Vertically magnetic-controlled THz modulator based on 2-Dmagnetized plasma photonic crystal]()

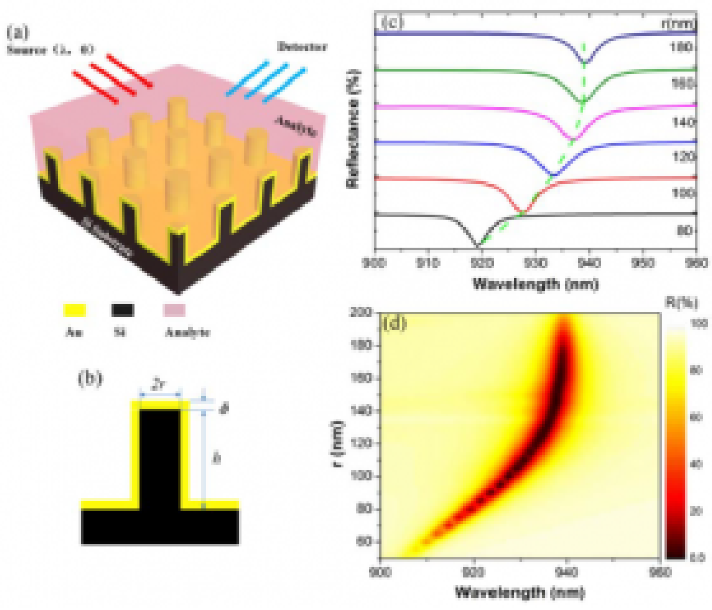


A novel magnetized plasma modulator for THz range is proposed. The structure is based on 2-D photoniccrystal (PC) constructed by triangular lattice of Si rods in air with line defects and an InSb rod as apoint defect. Based on the magneto-optic effect, the resonant frequency can be tuned by the externalmagnetic field and the radius of point defect. The transfer and disappearance of the PC-based mode canbe realized by utilizing a waveguide and a plasma cavity. The simulation results show that PC-based modedisappearance modulator has the potential for THz wireless broadband communication system with agood performance of high contrast ratio (<33.61 dB), low insertion loss (<0.36 dB) and high modulationrate (~4 GHz).

Source:http://www.sciencedirect.com/science/article/pii/S1569441016301250

Related paper: Wen Zhou et al.,Vertically magnetic-controlled THz modulator based on 2-D magnetized plasma photonic crystal,Photonics and Nanostructures – Fundamentals and Applications,Volume 23, February 2017, Pages 28–35,(2017).

[Silicon-gold core-shell nanowire array for an optically and electrically characterized refractive index sensor based on plasmonic resonance and Schottky junction]()

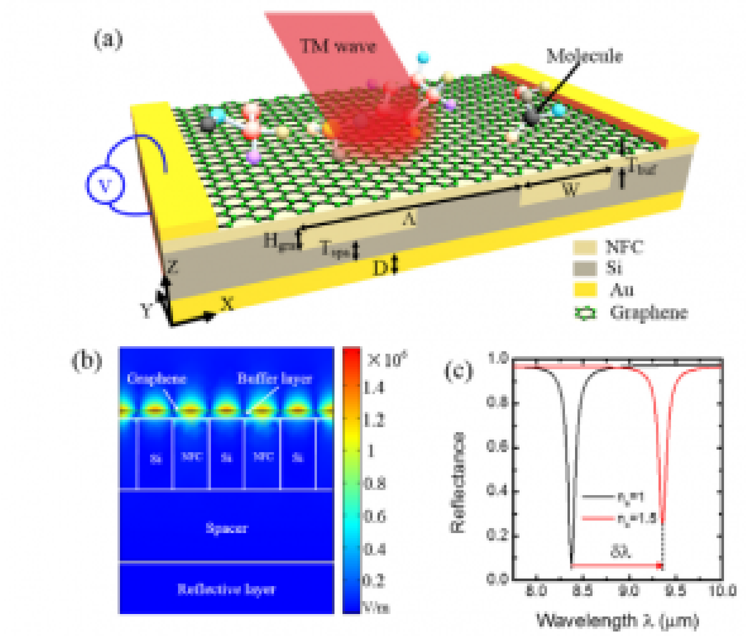


This work reports the plasmonically enhanced refractive index sensor consisting of silicon nanowire array (Si-NWA) coated by a conformal gold (Au) nanoshell. Compared to the pure Si or Au NWA system, the Si-Au core-shell setup leads to substantially enhanced optical in-coupling to excite strong surface plasmon resonance (SPR) for highly sensitive sensors. Results indicate that the SPR wavelength can be subtly tuned by manipulating the nanowire radius, and it shows a strong shift with very small variation of the refractive index of the analyte. Furthermore, they configure the system into the Schottky junction, which can separate the photogenerated hot electrons so that the electrical outputs under various incident wavelengths can be measured. The capabilities of optical and electrical measurements ensure a high flexibility of the sensing system. Through their optoelectronic evaluation, the optimally designed system shows a sensitivity up to 1008 nm per refractive index unit and a full width at half-maximum of 9.89 nm; moreover, the high sensing performance can be sustained in a relatively large range of the incident angle.

Source:https://www-osapublishing-org.ezp3.semantak.com/ol/viewmedia.cfm?URI=ol-42-7-1225&seq=0&origin=search

Related paper: Qin, L et al.,Silicon-gold core-shell nanowire array for an optically and electrically characterized refractive index sensor based on plasmonic resonance and Schottky junction,Optics Letters,Vol. 42, Issue 7, pp. 1225-1228,(2017).

[Cavity-enhanced continuous graphene plasmonic resonator for infrared sensing]()



They propose a cavity-enhanced resonator based on graphene surface plasmonics for infrared sensing. In such a resonator, a continuous and non-patterned monolayer graphene serves as the sensing medium by exciting surface plasmons on its surface, which can preserve the excellent electronic property of graphene and avoid the interaction between biomolecules and dielectric substrate. To improve its sensing performance, an optical cavity is employed to enhance the coupling of the incident light with the resonator. Simulation results demonstrate that the reflection spectra of the resonator can be modified to be narrower and deeper to improve the figure of merit (FOM) of the device significantly by adjusting the structure parameters of the cavity and the Fermi energy level.

The FOM can achieve a high value of up to 20.15 RIU^{-1}, which is about twice larger than that of the traditional structure without a cavity. Furthermore, the resonator can work in a wide angle range of the incident light. Such a plasmonic resonator with excellent features may provide a strategy to engineer graphene-based SPR sensor with high detection accuracy.

Source:http://www.sciencedirect.com/science/article/pii/S0030401816305028

Related paper: Wei Wei et al.,Cavity-enhanced continuous graphene plasmonic resonator for infrared sensing, Optics Communications ,Volume 395, Pages 147–153,(2017).