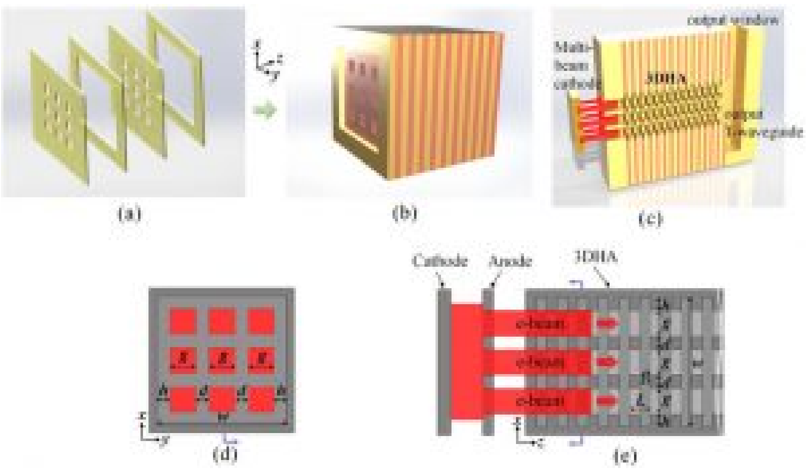
# [Coherent Terahertz Radiation from Multiple Electron Beams Excitation within a Plasmonic Crystal-like structure]




*Coherent terahertz radiation from multiple electron beams excitation within a plasmonic crystal-like structure (a three-dimensional holes array) which is composed of multiple stacked layers with 3 × 3 subwavelength holes array has been proposed in this paper. It has been found that in the structure the electromagnetic fields in each hole can be coupled with one another to construct a composite mode with strong field intensity. Therefore, the multiple electron beams injection can excite and efficiently interact with such mode. Meanwhile, the coupling among the electron beams is taken place during the interaction so that a very strong coherent terahertz radiation with high electron conversion efficiency can be generated. Furthermore, due to the coupling, the starting current density of this mechanism is much lower than that of traditional electron beam-driven terahertz sources. This multi-beam radiation system may provide a favorable way to combine photonics structure with electronics excitation to generate middle, high power terahertz radiation.*

**Source:** http://www.nature.com/articles/srep41116

**Related paper:** Yaxin Zhang et al.,Coherent Terahertz Radiation from Multiple Electron Beams Excitation within a Plasmonic Crystal-like structure, *Scientific Reports* **7**, Article number: 41116 (2017).

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# Congratulations on publishing "Fabrication methods of plasmonic and magnetoplasmonic crystals: a review".

**Congratulations on publishing "Fabrication methods of plasmonic and magnetoplasmonic crystals: a review" in The European Physical Journal Plus.**

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

Abstract. In recent years, plasmonic crystals have embraced a wide range of applications from medical to optoelectronic ones due to their outstanding and extraordinary properties such as enhanced optical transmission, large field enhancements, collimation of light through a subwavelength apertures and tunable multimode plasmonic resonances. For achieving optimized metallic nanostructures, a great effort is made to propose versatile fabrication methods that support interesting geometries and materials. In this paper,
we have made a comprehensive review of fabrication methods of plasmonic crystal and one of its main subgroups entitled “magnetoplasmonic crystals”. The fabrication methods are divided into two main groups of bottom-up and top-down approaches and their weak and strong points, besides their applications are discussed.

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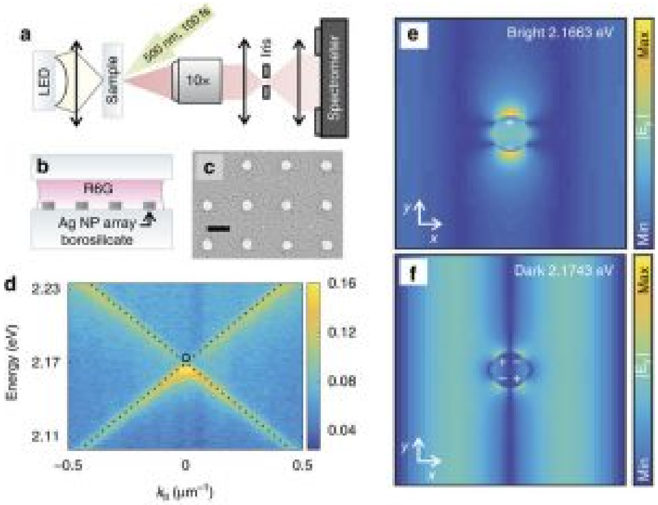
http://www.readcube.com/articles/10.1140/epjp/i2017-11294-2?author_access_token=5ukIRDEPUcYD1VXfS0obL4sPkCdkOxEKPl2JoxdvwqHBCtd8mfbxpiaGtAn6OMeXxDxcO83Yy3Q6wIeLNPNdYDyYtbYNEnDwWOIGmMgDKs4cA3reTza5u_dBCevP3A1FrEN8TdFQTmrx-YAQMQuY_g%3D%3D

http://link.springer.com/article/10.1140%2Fepjp%2Fi2017-11294-2

# [Lasing in dark and bright modes of a finite-sized plasmonic lattice]()




Lasing at the nanometre scale promises strong light-matter interactions and ultrafast operation. Plasmonic resonances supported by metallic nanoparticles have extremely small mode volumes and high field enhancements, making them an ideal platform for studying nanoscale lasing. At visible frequencies, however, the applicability of plasmon resonances is limited due to strong ohmic and radiative losses. Intriguingly, plasmonic nanoparticle arrays support non-radiative dark modes that offer longer life-times but are inaccessible to far-field radiation. Here,,they show lasing both in dark and bright modes of an array of silver nanoparticles combined with optically pumped dye molecules. Linewidths of 0.2 nm at visible wavelengths and room temperature are observed. Access to the dark modes is provided by a coherent out-coupling mechanism based on the finite size of the array. The results open a route to utilize all modes of plasmonic lattices, also the high-Q ones, for studies of strong light-matter interactions, condensation and photon fluids.

**Source:** http://www.nature.com/articles/ncomms13687

**Related paper:** T. K. Hakala et al.,Lasing in dark and bright modes of a finite-sized plasmonic lattice, *Nature Communications*, 13687 (2017).

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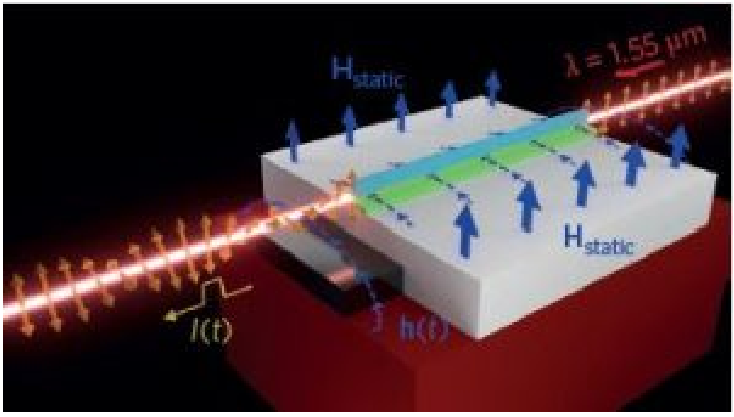
# Nanoscale rotator




The rotation of the polarization of light by magneto-optical materials is well exploited by macroscale devices such as optical isolators, however, demonstrations in nano-optics or plasmonics are lacking due to issues such as dissipation and phasematching. Now, Curtis Firby and colleagues from Canada have proposed an integrated magnetoplasmonic Faraday rotator. They predict 99.4% polarization conversion over an 830-µm-long device using low-loss modes that can propagate over a distance of 1 mm. The proposed structure, designed for 1,550 nm wavelength operation, is a 450-nm-wide ridge waveguide with multilayers stacked vertically within. A 25-nm-thick silver layer is surrounded by two 20-nm-thick SiO2 layers. A highindex 'hat' for the ridge is formed by a 725-nm-thick layer of TiO2 while the bottom high-index ridge region is a

320-nm-thick Bi:YIG rib on top of a 260-nm-thick Bi:YIG platform. The team designed the waveguide structure such that transverse electric and transverse magnetic modes are phase matched and low-loss but with sufficient mode overlap in the Bi:YIG medium to cause the polarization rotation. The design could lead to miniature integrated circuitry that is capable of modulating polarization at speeds as fast as 10 GHz.

Reference:

ACS Photon. http://doi.org/bvg4 (2016)

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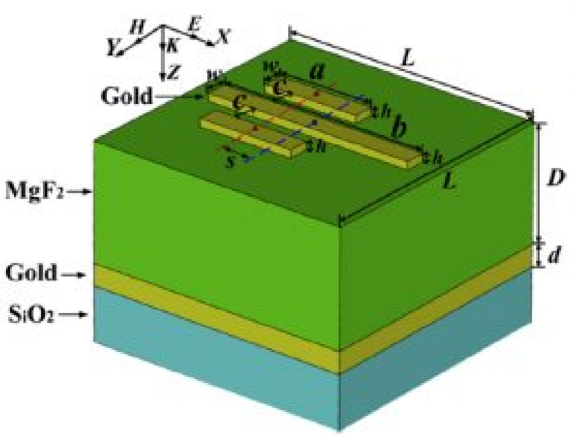
# Dual-band infrared perfect absorber for plasmonic sensor based on the electromagnetically induced reflection-like effect




Proposed structure of Liu and his colleagues

Liu and his colleagues present a scheme for realizing a narrow-dual-band perfect absorber based on the plasmonic analogy of the electromagnetically induced reflection (EIR)-like effect. In their scheme, two short gold bars are excited strongly by incident plane wave serving as the bright mode. The middle gold bar is excited by two short gold bars. Due to the strong hybridization between the two short gold bars and the middle gold bar, two absorption peaks occur. The corresponding absorption rates are both over 99%. The quality factors of the two absorption peaks are 41.76 (198.47 THz) and 71.42 (207.79 THz), respectively, and the narrow-distance of the two absorption peaks is 9.32 THz. Therefore, they are narrow enough for the absorber to be a filter and a dual-band plasmonic sensor.

Source: http://www.sciencedirect.com/science/article/pii/S0030401816302267

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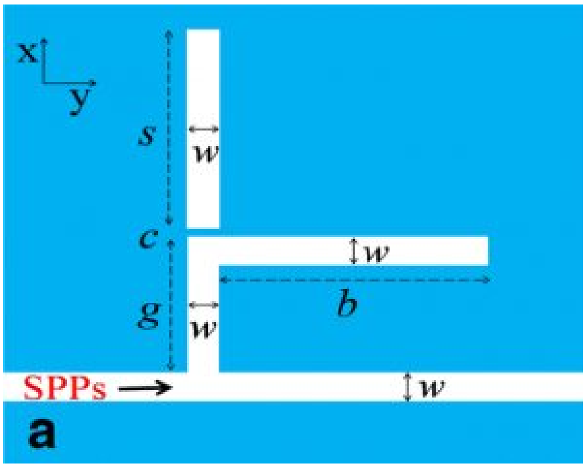
# [Plasmon-Induced Transparency in a Surface Plasmon Polariton Waveguide with a Right-Angled Slot and Rectangle Cavity]




Schematic diagram and geometric parameters of the nanoscale plasmonic resonator system.

The phenomenon of plasmon-induced transparency (PIT) is realized a in surface plasmon polariton waveguide at near-infrared frequencies. The right-angled slot and rectangle cavity placed inside one of the metallic claddings are respectively utilized to obtain bright and dark modes in a typical bright-dark mode waveguide. A PIT transmission spectrum of the waveguide is generated due to the destructive interference between the bright and dark modes, and the induced transparency peak can be manipulated by adjusting the size of the bright and dark resonators and the coupling distance between them. Subsequently, spectral splitting based on the PIT structure is studied numerically and analytically. Simulation

results indicate that double electromagnetically induced transparency (EIT)-like peaks emerge in the broadband transmission spectrum by adding another rectangle cavity, and the corresponding physical mechanism is presented. Yu and his colleagues' novel plasmonic structure and the findings pave the way for new design and engineering of highly integrated optical circuit such as nanoscale optical switching, nanosensor, and wavelength-selecting nanostructure.

Source:http://link.springer.com/article/10.1007/s11468-015-0153-6