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ABSTRACTS

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diffraction coupled plasmonic resonances with the spectral line full-width-half-maximum as low as 5 nm and quality factors Q reaching 300, at important fibre-optic telecom wavelengths around 1.5 µm. Using these resonances, we demonstrate a hybrid graphene-plasmonic modulator with the modulation depth of 20% in reflection operated by gating of a single layer graphene, the largest measured so far.

Optical Tamm state at the cholesteric liquid crystal/metal interface

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Optical Tamm state (OTS) is an optical analogue of Tamm state which is electronic density localization at the boundary of periodic atomic potential. The OTS appears as electromagnetic field localization at the interface of photonic crystal and metal [1]. Experimentally the OTS appears as a narrow dip in reflectance spectrum in the photonic band gap spectral range. Cholesteric liquid crystals (CLCs) are self-organized photonic crystals formed by rod-like molecules arranged in a periodical helical structure [2]. The CLCs have a stop-band for light with the one direction of circular polarization (the same as the CLC twist). Therefore, the appearance of OTSs is expected in CLC/metal structures [3, 4]. In this work the properties of the OTS at the CLC/gold interface are studied using 4×4 Berreman matrix method.

The optical parameters [5] and structure of studied CLC/gold model are shown in Fig. 1a. The plane-parallel anisotropic dielectric layer was introduced between the CLC and the metal layers. The optical axis of the anisotropic layer was laid along the planes of its interfaces with the CLC and gold layers.

The calculated reflectance spectra of the structure are shown depending on thickness of anisotropic layer (Fig. 1b) and angle of incidence (Fig. 1c). The dependence of the OTS resonance depths and spectral positions on the thickness of the anisotropic layer and the wavelength of the incident light is periodic. The OTS is shown to be excited if phase of the wave transmitted through the anisotropic layer changes by $\pi/2$ and the anisotropic layer acts as a quater-wave plate. The maximum value of the resonance dip is achieved at the wavelength of 780 nm when the thickness of the anisotropic layer is 2030 nm. Fig. 1c demonstrates that the OTS excitation occurs over a large range of angles of incidence. It also shows that photonic band gap center and the OTS dispersion curve shifts to shorter wavelengths with incident angle increase.

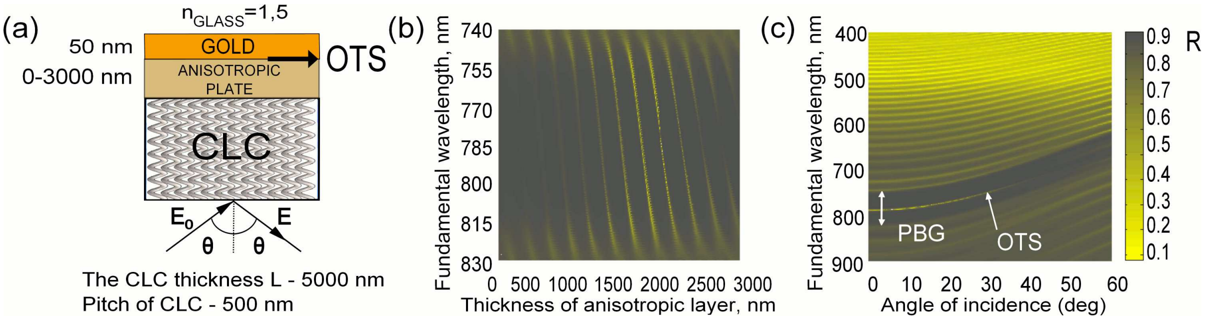

Fig. 1: a — The sketch of the studied CLC structure. E_0 and E are the incident and reflected waves, respectively, θ is angle of incidence. b — Reflectance spectrum of the modeled structure depending on the thickness of the anisotropic layer; c — Reflectance spectrum versus angle of incidence and wavelength of the radiation.

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Manipulating electromagnetic wave with meta-surfaces

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Metamaterials are artificially engineered materials whose optical properties arise primarily from their micro-structure ("meta-atom") and its macroscopic order. Metasurface, as a new emerging field of metamaterials, have aroused considerable interest due to their capability of arbitrary manipulation of the phase and amplitude profile at the interface.

In this talk, we briefly summarize our recent efforts in employing meta-surfaces to control electromagnetic waves, including realizing high-efficiency photonic spin-hall effect [1] and surface-plasmon couplers [2], and controlling phases with graphene-based meta-surfaces [3].

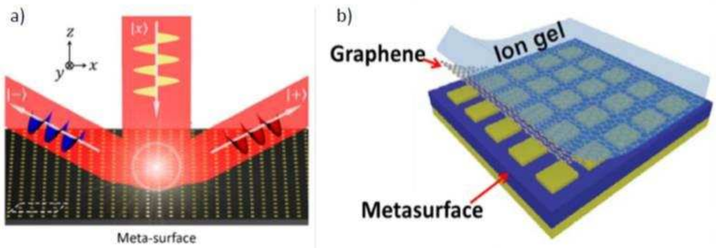

Fig. 1: a) Schematics of the 100%-efficiency photonic spin-hall effect realized at our reflective meta-surface, b) full-range phase modulator based on graphene metasurfaces.

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Characterization and application of resonant properties of out-diffused silver nanoislands

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Plasmonic nanoparticles used as nanoantennas [1] are nowadays undergoing deep investigations as structures, which are able to enhance the local electromagnetic field thus, leading to an increased