Abstract of Presentation

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Presentation Title(Should be no more than 20 words):

Chiral planar materials for polarization control

Abstract :

Chiral materials possess no reflection symmetry and interact differently with leftand right-hand circularly-polarized light. This gives rise to optical activity, e.g., to the rotation of polarization when light traverses a chiral medium. The concept chirality can be extended to two-dimensional (2D) space to describe planar structures that cannot be brought into congruence with their mirror images by in-plane rotations or translations.

In cooperation Prof Makoto Gonokami (Applied Physics Department of the University of Tokyo) we developed quasi-2D planar metal and dielectric nanostructures that are chiral and have a period of sub-wavelength of visible light. The structures, which do not diffract light, give rise to giant specific rotation in direct transmission and at normal incidence. The polarization rotation angle reverses sign with the handedness of the structure. The obtained results are supported by numerical calculations based on solving the electromagnetic problem in the structure as well as by fundamental symmetry arguments.

In two-dimensional array of chiral metal nanoparticles, the polarization effect is enhanced by a strong coupling of photons with surface plasmons, while in all-dielectric materials low-loss waveguide mode results in a dramatic enhancement of the optical activity. One may anticipate that the giant polarization rotation in all-dielectric chiral structure will open new opportunities in polarization control for light emitters, polarization selective photo-sensors and polarization switching devices. This is because these structures allow us to reduce optical losses, which are impose severe restrictions on photonic applications.

The developed approach is very attractive also for polarization control in THZ spectral range where subwavelength planar structures can be printed using conventional jet-printing technique with sub-millimetre resolution.