

ANTONIO AMBROSIO 'Photon-Less Near-Field Imaging and Vortex Beams Generation with Dielectric Metasurfaces'

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April 25, 2018

Seminar, April 25, 2018, 12:30. ICFO's Seminar Room

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I will present the most recent results from two different research topics: 1) high-resolution optical nano-imaging via photon-less detection in scanning probe microscopy; 2) designing dielectric metasurfaces for structuring light.

Photon-less near-field imaging - Breaking the diffraction limit is the motivation behind Scanning Probe Microscopy (SPM) that includes Atomic Force Microscopy (AFM) and Near-field Scanning Optical Microscopy (SNOM). More recently, the possibility of optical nano-imaging without detecting any light has been also showed. The technique is based on the detection of the weak optical forces established between the sample surface and the microscope probe when both are illuminated. This scanning probe technique is called photo-induced force microscopy (PiFM) and has some advantages with respect to standard SNOM techniques, mainly the suppression of the light background in the detection, with possibly enhanced resolution and the broadband character: It can work with any light wavelength. I recently showed that PiFM can be used for optical nano-imaging of dielectric metasurfaces. I also showed that photon-less-detection optical nano-imaging, eventually combined with SNOM, can be used to image surface waves of 2D materials.

Vortex beams generation with dielectric metasurface - Metasurfaces provides us with the unique capability to fully control light with planar elements. Recently, there has been increasing interest in using dielectric materials, like TiO₂, in order to reduce losses and undesired polarization conversion, just to name some advantages over metallic

nano-structures. In 2017, we realized a dielectric metasurface q-plate that produces visible vortex light beams whose handedness depend by the polarization handedness of the illuminating light. We then generalized the concept by realizing a dielectric metasurface (J-plate) that converts arbitrary light spin states into arbitrary total angular momentum states.

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Hosted by Prof. Frank Koppens