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Master in Photonics – “PHOTONICS BCN” ERASMUS+ “EUROPHOTONICS”

MASTER THESIS PROPOSAL

Dates: April - September 2020

Laboratory: Nonlinear Optics and Lasers

Institution: Physics Department, Universitat Politècnica de Catalunya

City, Country: Terrassa (Barcelona)

Title of the master thesis: “Enhancement of absorption and nonlinearities in nanostructures”

Name of the master thesis supervisor: Crina Cojocaru / Jose Trull

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Keywords: nonlinear optics, nanostructures, graphene, second harmonic generation.

Summary of the subject (maximum 1 page):

The main goal of this project is to conduct experimental studies in nanostructured photonic materials and metamaterials, in order to study the feasibility to enhance/inhibit and manage simultaneously linear and nonlinear absorption. The peculiarities of these modulated nanostructures have emerged as being pivotal for applications in the field of nanotechnology and all-optical devices.

This is an experimental project that will involve the student in the design and building of different experimental set-ups and in the related measurements. Besides, numerical simulations will be done for the compression of the experiments will be explained.

We will focus our attention on the enhancement of absorption and, in some of the cases, nonlinear frequency conversion in different nanostructures as, for example:

- (1) 3D semiconductor photonic crystals containing with graphene layers;
- (2) 2D gold nano gratings
- (3) 3D photonic nanostructures with chirped periodicity

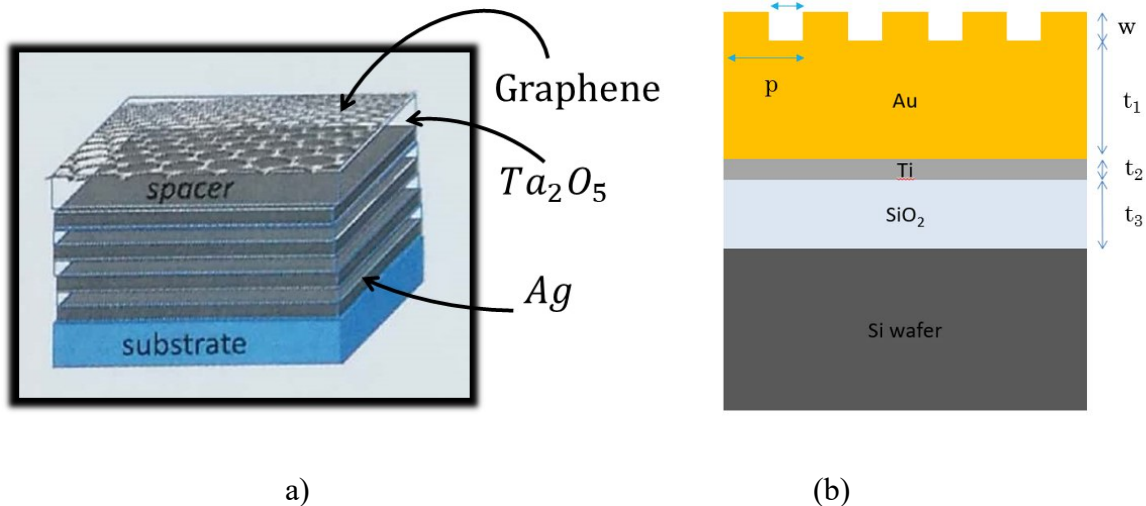


Figure 1: (a) Schematic 1D nanostructure with graphene; (b) Schematic representation of the gold nanograting

The objectives of the Master thesis may be summarized as:

Objective 1: Linear characterization of different sub-wavelength modulated structures by the measurement of reflectance, transmittance and absorption as a function of wavelength and incident angle.

Objective 2: Prove of the enhancement of linear absorption at resonances in structures with and without graphene.

Objective 3: Experimental study of second harmonic generation in photonic nanostructures made of metals or dielectrics.

Additional information:

* Required skills: background in photonics and experimental skills

* Miscellaneous: This position is particularly suitable for students interested in gaining experimental experience.