

Proposition de thèse.

The project GANESH aims to perform the bottom-up synthesis and the study of the optical and electronic properties of particular graphene materials: graphene quantum dots (GQDs) and graphene nanomeshes (GNMs) (regular patterns of holes in 2D graphene sheets). For that, the project will be performed in collaboration with the group of Philippe Dollfus (Institut de Physique Fondamentale, Université Paris-Sud) and with the group of Jean-Sébastien Lauret (Laboratoire Aimé Cotton). This project combines several field of expertise: organic chemistry for the synthesis of the materials (LICSEN), optics for the studies of their optical properties (in particular photoluminescence at LAC), band structure and transport simulations and measurements (at IEF and LICSEN, respectively).

The interest of these graphene materials is multiple: the size, morphology and composition of GQDs will influence their electronic properties (as for inorganic QDs). For example, graphene quantum dots exhibiting luminescence in the red or near-infrared region (at wavelength in which living tissues are transparent) may find application in biology. Similarly, by controlling the structure of the one can think about reaching 1.5 μ m of emission wavelength (telecom wavelength). The 0D electronic structures of these objects may lead to the emission of single photons at these wavelengths. In this view, it is of high interest to investigate the potentialities of graphene quantum dots. The bottom-up synthesis of 2D networks of graphene containing holes or doping element has not been accomplished so far. In our approach we want to combine theory and experiment to reach the best compromise between the size of holes and their distribution in 2D nanomeshes.

The candidate must have a strong background in organic chemistry. He/she will be in charge of the synthesis of the graphene materials and of its characterization. He/she will work under the supervision of experimented scientists.

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