Master internship offer

Electromagnetic modelling of complex nanostructures for the customization of secure ID documents

Identity theft has become a criminogenic phenomenon that threatens all sectors of activity, as well as all of society. The use of false documents has a considerable economic impact and affects more and more people each year. **In the framework of a recently-funded ANR project, we ambition to develop innovative secure printing solutions for visual authentication of physical ID documents to prevent their counterfeiting** (illegal reproduction of a genuine document) **and forgery** (alteration of a part of a genuine document to give misleading information).

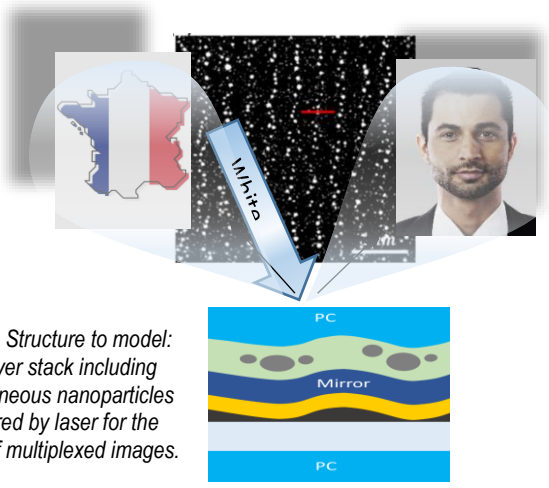

Figure 1: Structure to model: multilayer stack including heterogeneous nanoparticles structured by laser for the printing of multiplexed images.

ID documents are designed as stacks of polycarbonate (PC) sheets laminated together, in which different mass-produced security features or materials are inserted to produce generic cards. For about two decades, **laser technologies** have been involved in the **customization of ID documents** to reach high spatial resolution printing with increased security, and contactless engraving of information inside the card to allow customizing the generic cards once finalized. Their main limitation was to print in grey levels.

The **objective of this Master internship** is to understand, by **numerical simulations**, the capabilities offered by disordered ensembles of metallic nanoparticles in layered environments to **create vivid colors in reflection**. The intern will use a **home-made code** to simulate the optical response of such complex nanostructures and investigate how the various nanostructure parameters (nanoparticle size and spatial distribution, nature and thickness of the embedding layers) impact the **colored appearance of the surface**.

Expected candidate profile

- Good knowledge in optics and electromagnetism
- Experience in programming (preferably with MATLAB, Python, C++)
- Ability to take initiatives and work in autonomy, good writing and communication skills
- At least B2 level in English

Period: March 2024-July 2024

Place: Institute for Light and Matter (ilm.univ-lyon1.fr) at the University Claude Bernard Lyon 1 in Villeurbanne, France, in collaboration with the Hubert Curien Laboratory (laboratoirehubertcurien.univ-st-etienne.fr/) in Saint-Etienne, France.

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