MASTER DE PHYSIQUE ET APPLICATIONS - 2ème année
Spécialité Sciences des Matériaux et Nano-objets
International Nanomat Master Program

Internship proposal 2009-2010

Laboratory : Applied Electromagnetic Lab University "Roma Tre"

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Design of cloaking (electromagnetic invisibility) devices based on metamaterials

Scientific project:
The student will start the research activity gaining some skills about the definition and the concept of cloaking (electromagnetic invisibility) and exploring the different approaches to design cloaking devices (scattering cancellation technique, coordinate transformation technique, plasmonic cloaking, etc.) At this stage, while reviewing the state-of-the-art of cloaking theory and technology, the student will face with the fundamentals of metamaterials, artificial engineered materials with unusual properties that cannot be found in natural materials. By employing such materials, in fact, it is possible to design very efficient cloaking devices, working for any polarization and shape/size of the object to cloak.
The core of this scientific project will consist in the design of cloaking devices working at single and multiple frequencies in the visible regime. The approach used will be the scattering cancellation technique based on the mutual cancellation of the scattering terms originated from the object to hide and from the cloaking device put on it. The first step will be the design of the suitable metamaterials to be used for the proposed application. The second step will be the implementation of the cloaking device. The third step will be the characterization of the device in terms of its robustness to the variation of the geometrical parameters (object size, tolerances in the implementation of the cloaking devices) and the possible losses affecting the metamaterials.
The Applied Electromagnetic Lab is member of the Virtual Institute on Advanced Electromagnetic Materials and Metamaterials (www.metamorphose-vi.org) and is involved in several national and international research projects in the field of metamaterials. The student(s) working on this project will interact with the members of the Virtual Institute and participate in the research projects.

Techniques in use :
Theoretical analysis and numerical simulations

Applicant skills :
Electromagnetic field theory, electrodynamics of complex and dispersive materials.

Granted internship: yes
C'nano IdF laboratory (France only):
Possibility for a thesis: yes , financial support possible after selection according to national rules.
Amount of the grant: approximately 13640 €/year (previdential contribution shall be deducted).