Spécialité de M2 : Concepts Fondamentaux de la Physique
Ecole Doctorale de Physique de la Région Parisienne (ED107)

PROPOSITION DE SUJET DE STAGE DE M2 ET/OU DE THESE
(Attention: ne pas dépasser une page)

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Stage uniquement : OUI/ NON Thèse uniquement: OUI/ NON
Stage pouvant déboucher sur une thèse : OUI/ NON
Financement proposé : OUI/ NON si oui, type de financement : Demande ANR en cours

Synthesis and Optical properties of Cu nanorods
Résumé (demi page maximum)

Nanomaterials have attracted many technical and scientific interests since they have shown novel properties compared to their bulk counterparts. Particularly, nanoparticles composed of coinage metals such as copper, silver, or gold present very interesting optical properties. When excited with an electromagnetic field, these nanoparticles produce an intense absorption attributed to the collective oscillation of electrons on the particle surface, termed a plasmon resonance. The resonant frequency is highly dependent on particle size, shape, material and environment. By altering these characteristics, the frequency can be shifted over a wide range of wavelengths, making nanoparticles attractive as functional materials for many applications. Some examples include electronic and optical devices, chemical and biological sensors, optical energy transport, and thermal ablation.

At the MPQ laboratory, the Me’ANS group (Microscopie électronique Avancée et Nano-Structures) conducts research on the fabrication and the characterization of nanostructured materials. Me’ANS scientists use and develop electron microscopy techniques to understand the complex size-dependent phenomena observed in nanosciences.

We have recently discovered a new way to synthesize Cu nanorods by using the pulsed laser deposition method. This method allows the control of the size, shape and surface structure of the rods. The goal of the present training is to understand the influence of all these parameters on the plasmonic properties of the nanorods. In that regards, electron microscopy is one of the most complete characterization tools, because the shape (using tomography), the structure (using high resolution imaging) and the plasmon modes (using electron spectroscopy) can be studied on individual nanoparticles.

![Image](image_url)

a) Conventional TEM image of a Cu nanorod. b) 3D shape of copper nanorods reconstructed by electron tomography. c) Longitudinal Plasmon mode observed in a nanorods with an energy of resonance of 1.70 eV (electron energy loss spectrum in insert).

Indiquez le ou les parcours (ex DEA) qui vous semblent les plus adaptés au sujet :

- Physique de la matière condensée : OUI/ NON
- Physique des Liquides : OUI/ NON
- Physique Quantique: OUI/ NON
- Physique Théorique : OUI/ NON