MASTER 2 INTERNSHIP

2024-2025

Title of the project: "Listening" to nano-objects using inelastic light scattering

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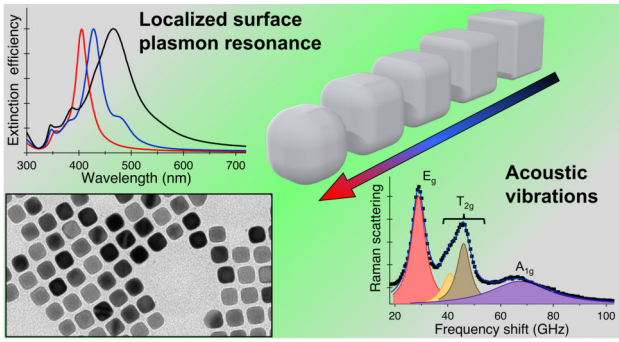
Collaborations: CHIRNATIO project (ANR AAPG 2022)

Summary:

One of the current expanding scientific challenges is the elaboration of chiral plasmonic nanostructures due to their unprecedented multidisciplinary potentialities in nano-optics, asymmetric catalysis, polarization-sensitive photochemistry but also for the detection of molecules. The CHIRNATIO project targets the design of chiral colloidal enantiomorphs with low structural dispersion. Various anisotropic chiral objects are developed in order to modulate the optical properties. This challenge is supported by an original approach combining techniques as low frequency Raman spectroscopy from nanocrystal acoustic modes and chiral surface enhanced Raman spectroscopy (SERS). The Nanosciences department of the ICB laboratory[1] is involved in this project for the low-frequency Raman studies.

Nano-objects have vibrations in the "low-frequency" range (for example see [2]) which can be detected by inelastic light scattering (low frequency Raman and Brillouin spectroscopies). These vibrations depend on the material the nano-objects are made of, their shape, their inner structure and their environment. This makes inelastic light scattering a method of choice to gain some insight into these parameters. The frequencies scale as the inverse of the size and fall in the GHz to THz range for sizes between 1 and 100 nm.

The goal of this internship is to "listen to nano-objects" by measuring such low-frequency Raman spectra and interpret the observed experimental features. Low-frequency Raman measurements will be carried out, and numerical calculations based on the finite element method will be used to help assign the observed experimental features. A special attention will be paid to the gold nanocrystals of interest in the CHIRNATIO project. Other nano-objects will also be considered.



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[1] https://icb.u-bourgogne.fr/en/nanosciences-eng/

[2] https://saviot.cnrs.fr/rus/cubic/index.en.html

Type of project (theory / experiment): both

Required skills: basic knowledge of the physical-chemistry of solids and the optical properties of metallic nanoparticles required