Elaboration of plasmonic enantiomorphs

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Chirality, by the intrinsic absence of symmetry, induces under the effect of polarized electromagnetic radiation (right or left), a specific optical response according to the polarization related to the dissymmetry factor (g). [1] Such chiroptic effects existing for any chiral object are very weak and even undetectable in natural materials ($g<10^{-3}$), which makes their determination and dosage difficult. An alternative lies in the use of plasmonic nanocrystals (NCs) for which surface plasmon strongly enhances the chiroptic effect ($g>0.1$ to unity). [2] This new branch of plasmonics known chiroplasmonics, [3,4] is expanding rapidly and the asymmetric nanomaterials are an emerging issue in nanotechnology research in physics, chemistry and life sciences. Current chiral metal nanocrystals face a major issue, they are only synthesized with physical processes. Consequently, the amount of nanomaterials is poor for application and the shape availability is quite limited.

In this context, the chemical elaboration, by breaking fcc symmetry, of plasmonic enantiomorphs with low structural dispersion (size, shape, crystallinity) is targeted considering several approaches based on the seed-mediated growth. Such systems will constitute in themselves new model systems for the understanding of chiral plasmonics. On the other hand, comparative studies of the vibrational and plasmonic properties of these unique systems with emerging properties will provide a better understanding of structure-property relationships due to asymmetry, necessary for the development of chiroptic platforms that can be used in asymmetric catalysis or enantioselective detection. The project is quite pluridisciplinar with nanocrystal synthesis, depth structural characterizations and spectroscopies.

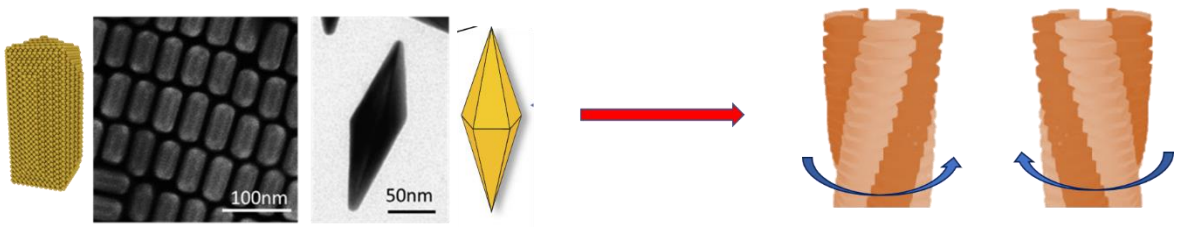

Figure 1 : Anisotropic gold Nanocrystals with high-index facets used as seeds to elaborate gold enantiomorphs

The thesis is mainly experimental.

References :

[1] *Chiral nanophotonics*; Springer Berlin Heidelberg: New York, NY, 2016.

[2] B. M. Maoz, Y. Chaikin, A. B. Tesler, O. Bar Elli, Z. Fan, A. O. Govorov, G. Markovich, *Nano Lett.* **2013**, *13*, 1203.

[3] M. J. Urban, C. Shen, X.-T. Kong, C. Zhu, A. O. Govorov, Q. Wang, M. Hentschel, N. Liu, *Annu. Rev. Phys. Chem.* **2019**, *70*, 275.

[4] A. O. Govorov, Z. Fan, *ChemPhysChem* **2012**, *13*, 2551.

Application:

Motivated student has the opportunity to join the research group " Nanomaterials and nanostructured materials : Reactivity, Characterization and spectroscopy" (NARCOS) at the MONARIS -Sorbonne University.
This doctoral program is aimed at highly qualified students with an enthusiastic interest in the chemical elaboration and structural characterisations of complex nanocrystals. Student must have solid knowledge in inorganic, material chemistry and synthesis of colloidal nanocrystals, acquaintance of electron microscopy techniques and chiral spectroscopies will be appreciated. The student should have strong knowledge in crystallography.
Requests must include a cover letter, a detailed Curriculum Vitae and the contact of at least one contact person.

Requests have to be sent at both:

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