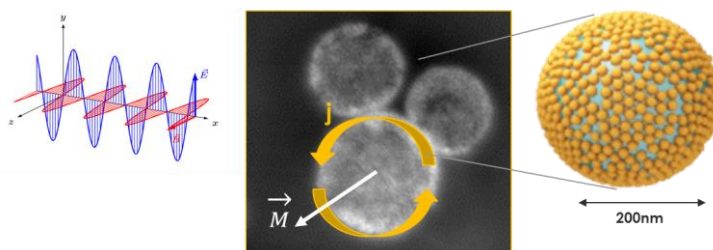


Elaboration of gold nanoparticle-shells via an emulsion route: towards plasmonic nanoresonators

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The elaboration of well-ordered assemblies of nanoparticles by solution routes remains an experimental challenge, with a wide potential of applications. In the case of metallic gold or silver nanoparticles, electromagnetic effects resulting from plasmonic coupling between the nanoparticles are expected. In particular, "hollow" spherical assemblies of such nanoparticles can constitute plasmonic nanoresonators capable of interacting with the magnetic component of light, a phenomenon that does not exist in natural materials. These resonators are the building blocks of metamaterials and metasurfaces.

We have recently developed a process for the formulation of nanoparticle shells, based on an unconventional emulsification (spontaneous and without surfactant): the Ouzo effect. This strategy allows the assembly of nanoparticles around drops of about 100nm in diameter, with excellent size homogeneity. This work, carried out at the Institute of Chemical Sciences of Rennes, opens the way to the elaboration of nanoparticle capsules of all types of materials.



The thesis has two main objectives: (1) to advance in the understanding of Ouzo emulsification in the presence of nanoparticles; (2) To develop the formulation of plasmonic gold nanoparticle shells, and to study by light scattering the parameters influencing the interparticle coupling. We will also focus on up-scaling the process, i.e. the development of large volume synthesis.

The thesis is funded by an ANR project. It will take place at the ISCR in Rennes, in co-direction with the CRPP. Stays at the CRPP in Bordeaux are planned.

Profile: knowledge in physical chemistry of soft matter and/or synthesis of nanoparticles will be appreciated, as well as a taste for interdisciplinarity.

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References:

1. C. Goubault, et al *The Ouzo effect: A tool to elaborate high-payload nanocapsules*, **Journal of Controlled Release**, **2020**, 324, pp. 430-439
2. F. Sciortino, et al, **Structure and Elasticity of Composite Nanoparticle/Polymer Nanoshells (hybridosome®)**, **Soft Matter** **2017**, **13**, 4393-4400. DOI: 10.1039/C7SM00705A
3. F. Sciortino, et al **Simple Engineering of Polymer-Nanoparticle Hybrid Nanocapsules**, **ChemNanoMat** **2016**, **2**, 796 – 799
4. V. Ponsinet, et al., *Resonant isotropic optical magnetism of plasmonic nanoclusters in visible light*, **Phys. Rev. B: Condens. Matter Mater. Phys.**, **2015**, **92**, 220414(R), DOI: 10.1103/PhysRevB.92.220414