Master Thesis project: **IRON GOLD-ALLOY NANORODS WITH TUNABLE STRUCTURE AND COMPOSITION**

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Iron gold-alloy nanorods (FeAu NR) are promising, multi-functional materials in health applications, since the rod shape favors a more selective chemical affinity, better biocompatibility and also shows an enhancement of both plasmonic and magnetic response. In addition, from the fundamental point of view, they are ideal model systems to study the new magnetic-plasmonic phenomena associated with the so-called particle-like behavior.

The physical and chemical features of FeAu NR can be accurately tuned with the control of the rod shape and composition. For instance, FeAu NR behave as paramagnets when the Fe content is within 0.1-9.9% but they become ferromagnetic when the Fe total content increases above 10%. Besides, It has been seen that the optical response of FeAu NR enhances with the increase of Fe composition. Moreover, modulating the ratio length/width one can tune with precision the position of the plasmon bands, from visible (VIS) up to near-infrared (NIR). As a result of this great variability of possibilities, FeAu NR are promising tools for biomedical applications, being very attractive in sensing, thermotherapy and imaging (see Figure 1). However, there is a lack of chemical methods capable of obtaining FeAu NR with a good control over the rod structure and composition. Consequently, the choice of a suitable synthesis method, where one can get control of the structure, crystallinity and composition, is of key importance to make progress in the fundamental understanding and in the reproducibility of the results.

Within this framework, we propose to obtain FeAu NR with a good control of the structure and alloy composition by the thermal decomposition method using organometallic precursors in a controlled atmosphere. Next, to explore the insights of the coupling phenomena between iron and gold by advanced structural and magnetic characterization techniques. Finally, determine the efficiency of FeAu NR as MRI contrast agents.

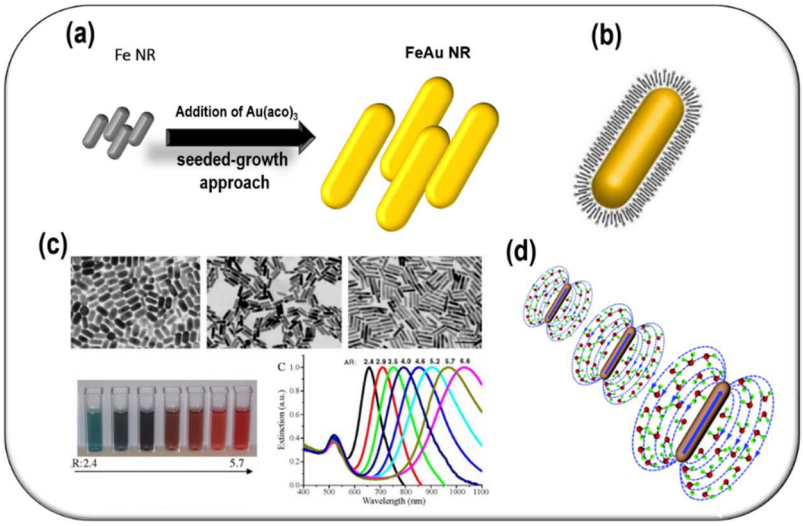

Figure 1. Graphical abstract. (a) Synthesis of FeAu NR using a seed-growth approach. (b) FeAu NR stabilized in water media by DMSA. Tunable Optical (c) and (d) Magnetic properties of FeAu NR with different sizes.