

Nanoscale magnetism and its biomedical applicability

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Magnetic nanomaterials to be used in biomedicine cover a significant part of the market for several tens of € billions. Biomedical nanomagnetism is a multidisciplinary area of research in science, engineering and medicine with broad applications in imaging, diagnostics and therapy (Figure 1). In this field, magnetic nanoparticles with several well-defined and reproducible structural, physical, and chemical properties are required. Eventually, magnetic nanoparticles are proven to be highly effective carrier platforms for both diagnostic and therapeutic purposes by carrying various bioactive molecules such as imaging probes and genes. Recent developments offer exciting possibilities in personalized medicine providing a truly integrated approach, since chemistry, materials science, physics, engineering, biology and medicine are incorporated.

In this talk, I will focus on the magnetic behavior at the nanoscale with emphasis on the relaxation dynamics, synthesis and surface functionalization of magnetic nanoparticles, concluding eventually on the biological constraints and opportunities for in vitro and in vivo applications. More specifically, I will discuss the physics of self-assembly and nanomagnetism in an effort to provide enhanced multifunctional magnetic nanoparticles.



Figure 1: Biomedical applicability schemes of multifunctional magnetic nanoparticles.