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Magnetic Nanoparticles as Contrast Agents for Magnetic Resonance Imaging

Iron oxide-based magnetic nanoparticles (MNPs) are exploited as Contrast Agents (CAs) for Magnetic Resonance Imaging (MRI). The magnetic nature and high magnetization values induce sizable inhomogeneities in the local magnetic field, perturbing the surrounding hydrogen nuclei present in the biological tissues according to their bio-distribution. The perturbations at nuclear sites shorten the *spin-lattice* (T_1) and *spin-spin* (T_2) nuclear relaxation times, enhancing the contrast in the MRI images.

The relaxation mechanisms involved in these processes are correlated to the shape, size, composition, and coating of the particles, which our group has been investigating for years. Specifically, we investigate iron-oxide nanospheres with different size, elemental composition and covering layer, different-sized/coated magnetite nanoflowers, and Au-Fe hybrid compounds. The dispersant medium is also a factor of interest, so the spin-dynamics in agarose matrix and toluene was also studied.

These studies aim to highlight a tunable feature of MNPs to improve MRI contrast efficiency.

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