Comparison of an optical pumped gradiometric system and a multichannel SQUID system for magnetorelaxometry

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The characterization of magnetic nanoparticles for medical and biological applications such as hyperthermia, magnetic particle imaging, cell separation, magnetofection, in vitro and in vivo alternating current biosusceptibility, and magnetic resonance contrast agents is an important issue, which demands for reliable and sensitive magnetic measurement techniques. Magnetorelaxometry (MRX) is a powerful technique for specific detection of MNPs that relies on the detection of the decay of the magnetization of MNPs after switching off a short moderate magnetizing field. Until very recently SQUIDs were the main detectors employed to perform MNP characterization by MRX [1], but Optically Pumped Magnetometers (OPM) are now an attractive alternative, since OPMs can be smaller, do not need liquid helium, and are simpler to operate than SQUIDs. Here, we present the recently developed OPM-based device for MRX measurements [2] and compare this system with a SQUID based MRX device by measurements of different MNP types. The OPM system is capable to detect the relaxation in most of them, the magnetic response being complementary to MRX signals detected with the SQUID system, covering different time intervals.

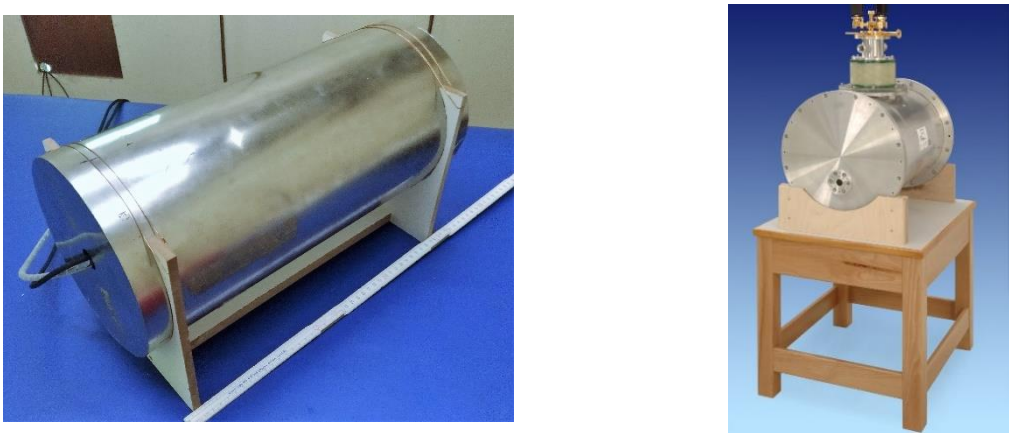

Figure 1: OPM (left) inside a 40 cm long shielding and SQUID (right) based magnetorelaxometry device for characterization of magnetic nanoparticles.

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[2] O. Baffa, R. H. Matsuda, S. Arsalani, A. Prospero, J.R.A. Miranda, and R. T. Wakai. Development of an optical pumped gradiometric system to detect magnetic relaxation of magnetic nanoparticles JMMM **475**:533-538, 2019.