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The College of Graduate Studies and the College of Science Cordially Invite You to a

Master Thesis Defense

Entitled

SIMULATION OF T_2 MRI RELAXATION ENHANCEMENT BY MAGNETIC NANOPARTICLES

by

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Abstract

The effect of high concentration of magnetic nanoparticles (MNP) on Magnetic resonance Imaging MRI transverse relaxation rates ($R_2=1/T_2$ and $R_2^*=1/T_2^*$) was studied using Monte Carlo (MC) simulations. Theoretical models assume that particles occupy a small volume fraction of the sample space. This work aims to test if available models based on Motional Averaged (MAR) and Static Dephasing Regimes (SDR) can still represent relaxation rates at large volume fractions. Furthermore, echo-time effects, were tested on both gradient-echo and spin-echo sequences in order to examine if diffusion is involved. Findings will clarify if models need to be modified to take account of high particle concentration. This is especially important for application involving clustering of nanoparticles inside tissues or being trapped inside cells. Another important area is relaxation due to MNP administered through vesicles as a carrier medium. This is important to understand the relaxation mechanism caused by MNP in order to improve their design process.

Keywords: Magnetic nanoparticles, transverse relaxation, Motional Averaged, Static Dephasing, gradient-echo, spin-echo, clustering of nanoparticles.