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# Spin dephasing in a magnetic dipole field around large capillaries: approximative and exact results

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## Abstract

We present an analytical solution of the Bloch-Torrey equation for local spin dephasing in the magnetic dipole field around a capillary and for ensembles of capillaries, and adapt this solution for the study of spin dephasing around large capillaries. In addition, we provide a rigorous mathematical derivation of the slow diffusion approximation for the spin-bearing particles that is used in this regime. We further show that, in analogy to the local magnetization, the transverse magnetization of one MR imaging voxel in the regime of static dephasing (where diffusion effects are not considered) is merely the first term of a series expansion that constitutes the signal in the slow diffusion approximation. Theoretical results are in agreement with experimental data for capillaries in rat muscle at 7 Tesla.

Keywords: Transverse relaxation; susceptibility contrast; diffusion dephasing; static dephasing; modeling of MR signal

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