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Magnetic Susceptibility Mapping in Human Brain using High Field MRI

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Magnetic Resonance Imaging (MRI) is a powerful imaging method for examining hydrogen protons and their local environment. Inferences can be made about the local environment from the signal relaxation (decay or recovery) or phase evolution. For many years, phase images were largely discarded in favor of magnitude images only, which dominate clinical MRI. Although the sensitive nature of phase images to magnetic field perturbations can cause a high degree of artifact, phase images also provide a means to examine the underlying local susceptibility distribution. Extraction of the local susceptibility requires removing nonlocal field effects that arise from strong air-tissue susceptibility differences, then performing an ill-posed inverse problem on the local magnetic field to yield the susceptibility map. This emerging MRI research area named Quantitative Susceptibility Mapping (QSM) provides a means to discriminate between tissues such as myelin, calcium and iron. This talk will introduce QSM and explore its value in human brain, particularly for measurement of iron accumulation in grey matter. These measures are further enhanced by using higher magnetic field strengths, greater than the clinical standards of 1.5 and 3.0 T. The value of these stronger magnetic fields will also be explored.

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