

Information on Brain Tissue Microstructure Obtained from the Signal Phase

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Magnetic resonance imaging (MRI) yields information on iron deposits and myelin content in brain tissue *in vivo* on a submillimeter spatial scale. Both compounds are major contributors to the water spin relaxation and magnetic susceptibility. In the context of this presentation, the focus is on information that can be extracted from the MRI signal phase. Briefly, the phase reflects the mean intravoxel magnetic field distribution. This provides a measure of the local susceptibility distribution, which can be related to tissue composition and microstructure.

On a more fundamental level, anisotropic properties of susceptibility were studied in entire fixed chimpanzee brains by reorienting the specimen in the magnetic field. Such data allow to estimate primary axonal trajectories using mono-tensorial models. An integration of additional information from the decay of the signal magnitude in multi-echo acquisitions achieves a separation of contributions from diamagnetic (dominated by myelin) and paramagnetic (dominated by iron content) compounds. Modeling of more complex fiber structures within a voxel, such as intersecting bundles, or an estimation of orientation distribution functions is also possible providing similar information as obtained with high angular resolution diffusion imaging techniques.