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Selective microstructure-size filters for non-invasive quantitative imaging by magnetic resonance

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Extracting quantitative microstructure information of living tissue by non-invasive imaging is an outstanding challenge for understanding disease mechanisms and allowing early stage diagnosis of pathologies. Magnetic Resonance Imaging (MRI) is a promising and widely used technique to pursue this goal, but still provides low resolution to reveal microstructure details [1]. We here report on a method to produce images of filtered microstructure-sizes based on selective probing of nuclear-spin dephasing induced by the molecular diffusion within specific tissue-compartments [2]. The microstructure-size filter relies on suitable dynamical control of nuclear spins that sense magnetization decay-shifts rather than the commonly used spin-echo decay-rates. The feasibility and performance of the method are illustrated with proof-of-principle experiments and simulations on typical size-distributions of white-matter in the mouse brain [3]. These results show that spin-echo decay-shifts can be a new MRI paradigm to advance towards unravelling diagnostic information based on microstructure parameters that characterize biological tissues.

Referencias:

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