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## Feasibility of functional MRI at ultralow magnetic field via changes in cerebral blood volume

We investigate the feasibility of performing functional MRI (fMRI) at ultralow field (ULF) with a Superconducting QUantum Interference Device (SQUID), as used for detecting magnetoencephalography (MEG) signals from the human head. While there is negligible magnetic susceptibility variation to produce blood oxygenation level-dependent (BOLD) contrast at ULF, changes in cerebral blood volume (CBV) may be a sensitive mechanism for fMRI given the five-fold spread in spin-lattice relaxation time ( $T_1$ ) values across the constituents of the human brain. We undertook simulations of functional signal strength for a simplified brain model involving activation of a primary cortical region in a manner consistent with a blocked task experiment. Our simulations involve measured values of  $T_1$  at ULF (130  $\mu$ T) and experimental parameters for the performance of an ULFMRI scanner with a noise level of 0.1 fT/Hz-1/2 and a prepolarizing field of 200 mT. Under ideal experimental conditions we predict a functional signal-to-noise ratio of between 3.1 and 7.1 for an imaging time of 30 min, or between 1.5 and 3.5 for a blocked task experiment lasting 7.5 min. Our simulations suggest it may be feasible but challenging to perform fMRI using a ULFMRI system designed to perform MRI and MEG in situ.

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