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Source localization of auditory evoked responses from a human brain with an atomic magnetometer K. KIM, H. XIA, A. BEN-AMAR BARANGA, D. HOFFMAN, M. V. ROMALIS, Department of Physics, Princeton University, Princeton, New Jersey 08544, USA — We report first measurements of auditory evoked fields (AEF) in a human brain with an atomic magnetometer system and discuss the techniques for magnetic source localization using this system. Until recent development of spin-exchange relaxation free (SERF) atomic magnetometers with a sensitivity of $0.5 \mathrm{fT/Hz^{1/2}}$, only SQUID magnetometers had sufficient sensitivity to measure a magnetoencephalograph (MEG). With simple multi-channel operation and no cryogenic maintenance, the atomic magnetometer provides a promising alternative for brain activity measurements. A clear N100m feature in AEF was observed after averaging over 600 stimuli. Currently the intrinsic magnetic noise level is 3.5 $\mathrm{fT/Hz^{1/2}}$ at 10 Hz. Optical detection of magnetic fields allows flexibility in magnetic mapping while in the same time imposing certain geometrical constraints. To investigate the magnetic source localization capabilities of the atomic MEG system we performed extensive numerical simulations and measurements with a brain phantom consisting of an artificial current source in a saline-filled sphere. We will discuss the results of numerical analysis and experimental implementation of magnetic source localization with atomic magnetometer.

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