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Optical Patterning of Nuclear Polarization in Gallium Arsenide JONATHAN KING, University of California,Berkeley, YUNPU LI, CARLOS MERILES, City College of New York, JEFFREY REIMER, University of California,Berkeley — Large enhancements of nuclear spin polarization can quench weak electron-nuclear fluctuations, mitigate electron spin decoherence, and provide control of electron spins in devices for quantum information processing. Such enhancements might include spatially patterned regions of polarized nuclei so as to prepare a spatially-dependent effective Zeeman field acting on electron spins as well as coherently manipulate the spin state of drifting electrons. By exploiting two competing mechanisms for optical nuclear polarization in semi-insulating GaAs, we use high field stray-field NMR imaging to demonstrate all-optical creation of three-dimensional patterns of positive and negative nuclear polarization without the need for ferromagnets or lithographic patterning techniques. These patterns may be controlled on the micron length scale.

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