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Liquid-state nuclear spin comagnetometers MICAH LEDBETTER, SZYMON PUSTELNY, DMITRY BUDKER, U.C. Berkeley, MICHAEL ROMALIS, Princeton University, JOHN BLANCHARD, ALEXANDER PINES, U.C. Berkeley — We discuss liquid-state nuclear spin comagnetometers based on mixtures of mutually miscible solvents, each rich in a different nuclear spin. In one version thereof, thermally polarized ^{1}H and ^{19}F nuclear spins in a mixture of pentane and hexafluorobenzene are monitored in 1 mG fields using alkali-vapor magnetometers. In a second version, ^{1}H and ^{129}Xe spins in a mixture of pentane and hyperpolarized liquid xenon are monitored with a superconducting quantum interference device. In the former case, we show that magnetic field fluctuations can be suppressed by a factor of about 3400 and that frequency resolution of about 5×10^{-11} Hz may be realized in roughly one day of integration. We discuss the application of liquid-state nuclear spin comagnetometers to precision measurements such as a search for spin-gravity coupling or a permanent electric dipole moment, as well as to sensitive gyroscopes.

Micah Ledbetter
U.C. Berkeley

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