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Nuclear spin relaxation times in hydrogen-helium and methane-helium slush at 4 MHz using pulsed NMR[1] J.A. HAMIDA, N.S. SULLIVAN, University of Florida — We compare the nuclear spin-lattice and nuclear spin-spin relaxation times observed for small grains of hydrogen suspended in liquid helium (hydrogen-helium "slush") with that of methane-helium "slush." The transport properties of these "slush" materials are critical to NASA's goal of realizing atomic propellant designs for future spacecraft. Atoms of active propellants are stored cryogenically in a host matrix such as hydrogen (H_2) or methane (CH_4) to prevent recombination while liquid helium is ideal for holding the host matrix and for easy transportation. The host matrix must therefore be stable in liquid helium. We find that for hydrogen "slush," NMR rate is consistent with scattering at grain boundaries due to the large electric quadrupole moment of hydrogen; on the other hand the "slush" rate for methane is consistent with internal diffusion as opposed to surface scattering. We conclude that for atomic propellants, methane is a better host than hydrogen because grains of methane are better isolated from the helium bath.

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