Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Universal Long-Time Behavior of Nuclear Spin Decays in Solid Hyperpolarized Xenon[1] BRIAN SAAM, STEVEN W. MORGAN, University of Utah, BORIS V. FINE, University of Heidelberg — We have observed a universal long-time behavior of ^{129}Xe FIDs and solid echoes in polycrystalline hyperpolarized xenon at 77 K. In all cases, a decay of the form $F(t) = Ae^{-\gamma t}\cos(\omega t+\phi)$ sets in after just a few times T_2; the behavior is universal in the sense that the decay constant γ and the beat frequency ω, which together characterize the long-time decay are the same for the FID and for solid echoes having different interpulse delay times τ. These findings reveal a fundamental property of nuclear spin dynamics and are thus relevant to theoretical efforts that have been ongoing for decades to understand NMR lineshapes in solids. Moreover, the functional form and universality of this behavior were previously predicted on the basis of analogy with resonances in classical chaotic systems [2]. While we expect this behavior to be characteristic of nuclear-spin solids in general, ^{129}Xe is an ideal system to examine it with high precision because of the relatively long $T_2 \approx 1$ ms and because spin-exchange optical pumping can be used to achieve greatly enhanced magnetization, allowing precise examination of the decay over 3-4 orders of magnitude. [1] S.W. Morgan, *et al.*, PRL **101**, 067601 (2008). [2] B.V. Fine, PRL **94**, 247601 (2005).

[1]NSF PHY-0134980

Brian Saam
University of Utah

Date submitted: 23 Jan 2009 Electronic form version 1.4