Abstract Submitted for the MAR13 Meeting of The American Physical Society

Quantum Oscillations of Nitrogen Atoms in Uranium Nitride<sup>1</sup> S.E. NAGLER, A.A. ACZEL, G.E. GRANROTH, D.L. ABERNATHY, Quantum Condensed Matter Division, Oak Ridge National Laboratory, W.J.L. BUYERS, Canadian Neutron Beam, Center, National Research Council, G.J. MACDOUGALL, Department of Physics, University of Illinois, G.D. SAMOLYUK, G.M. STOCKS, Materials Science and Technology Division, Oak Ridge National Laboratory — The quantum harmonic oscillator is among the very few soluble fundamental models in quantum mechanics and the foundation for understanding phonons in crystalline solids. Inelastic neutron scattering typically reveals acoustic and optic one phonon modes at low energies, and as energy increases a complex continuum of many-phonon excitations. In contrast, measurements using chopper spectrometers at the SNS have shown that for the binary crystal uranium nitride, where the nitrogen atoms are very light compared to the uranium atoms, the response above the optic phonon modes exhibits a remarkable spectrum of well-defined local levels that are equally spaced by 50 meV intervals and that extend to the tenth order 500 meV. The levels are attributed to nearly isotropic, quantum harmonic oscillator behavior of the nitrogen atoms vibrating within a largely static uranium cage. See Nature Communications 3, 1124 (2012).

<sup>1</sup>Work at SNS supported by the US Department of Energy, Office of Basic Energy Sciences, Scientific User Facilities Division and

Stephen Nagler Quantum Condensed Matter Division, Oak Ridge National Laboratory

Date submitted: 17 Dec 2012

Electronic form version 1.4