Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Microscopic Dynamics of Liquid Helium Confined in 1D Nanopores TIMOTHY PRISK, PAUL SOKOL, NARAYAN DAS, Indiana University, SOULEYMANE DIALLO, Oak Ridge National Laboratory, NOBUO WADA, Nagoya University, SHINJI INAGAKI, Toyota Central R and D Laboratories — Recently, Toda et al. performed torsional oscillator and heat capacity measurements on liquid He^4 confined within FSM-16. This porous silica glass has 1D pores with a very narrow diameter of $d = 2.8$ nm. This system is an example of a 1D quantum fluid in the sense that the thermal wavelength λ is longer than the pore diameter d. Because neutron time-of-flight (ToF) spectroscopy probes elementary excitations, it can be used to study the microscopic dynamics underlying the thermodynamic properties of this 1D quantum liquid. Using the Cold Neutron Chopper Spectrometer (CNCS) at the Spallation Neutron Source (SNS), we performed the first direct measurements of the elementary excitation spectrum of liquid He^4 confined in FSM-16. Measurements were performed at full pore at temperatures T = 33, 80, 800, and 1500 mK with an elastic energy resolution of approximately 80 μeV. We will discuss the temperature T dependence of the static structure factor $S(Q)$, the energies $\hbar\omega$ and line widths Γ of the phonon-roton spectrum, and the evidence for 2D layer modes in this system. This research was supported by NIST and employed facilities sponsored by the Scientific User Facilities Division of the US Department of Energy.

Timothy Prisk
Indiana University, Department of Physics

Date submitted: 11 Nov 2011 Electronic form version 1.4