Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Temperature-dependent characteristic velocity and excitations of solid helium-4 ETHAN PRATT, BENJAMIN HUNT, VIKRAM GADAGKAR, Cornell University, MINORU YAMASHITA, Kyoto University, ALEXANDER BALATSKY, Los Alamos National Laboratory, J.C. SEAMUS DAVIS, Cornell University — Excitations that allow shear velocity to inhibit superflow are well known in superfluids, and typically generate temperature-dependent critical velocities that depend sensitively on the physics of these microscopic dissipative mechanisms. By contrast, the nature of the microscopic excitations associated with the low-temperature "supersolid" inertial anomaly and shear stiffening of solid ^{4}He remain unknown, and its temperature-dependent characteristic velocity curve $v_\star(T)$ has not yet been observed. Using a SQUID-based torsion oscillator to map the complete complex rotational susceptibility of solid ^{4}He, we observed that the internal dissipative excitation rates obey power laws of temperature and velocity, and we acquired the full temperature-dependent characteristic velocity function $v_\star(T)$. We compare these observations to the predicted $v_\star(T)$ curves of several microscopic models, including those of a thin-film vortex unbinding and a two-level-system (TLS) momentum deficit.

Ethan Pratt
Cornell University

Date submitted: 28 Nov 2009 Electronic form version 1.4