

Abstract for an Invited Paper
for the MAR09 Meeting of
The American Physical Society

The effect of order, disorder, and confinement on the NCRI response in solid ^4He ¹

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After a multitude of experimental and theoretical efforts over the past few years attempting to explain the microscopic origin of non-classical rotational inertia (NCRI) signals seen in torsional oscillator (TO) experiments, disorder has emerged as a crucial factor for determining the supersolid behavior. In an attempt to discover the type of disorder relevant to the NCRI effect we have performed TO experiments on solid ^4He samples grown at constant pressure or temperature from the superfluid [1], a method known to reliably produce large helium crystals. We show that similar NCRI signals are seen for samples with grain boundary areas that differ by orders of magnitude, indicating that grain boundaries are largely irrelevant to the supersolid phenomenon. In addition, we probe the effect of confining the helium crystals within several restricted geometries. [1] A.C. Clark, J.T. West, and M.H.W. Chan, Phys. Rev. Lett. **99**, 135302 (2007).

¹Experiments performed in collaboration with A.C. Clark and M.H.W. Chan with support from NSF grant DMR 0706339.