Solid helium in long path length torsional oscillators

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For macroscopic quantum phenomena, it is natural to wonder about the spatial extent of phase coherence. The non-classical rotational inertia of solid helium have been studied heretofore only in samples with physical dimension on the order of few centimeters. We have investigated solid helium in longer path length torsional oscillators. The solid samples were grown inside long narrow capillaries wound as a helical slinky. Solid helium samples in length scale from 1 m to 6 cm were studied. The inner diameter of the capillary ranges from 0.4 mm to 2.7 mm. NCRIs were found to be less than 0.01% in all samples. These results suggest that a network of defects, presumably dislocations, in solid helium may play an important role in the appearance of NCRI and the connectivity of the dislocation is severely weakened in these long and narrow capillaries. More investigations in different aspect ratio and geometry may clarify the relation between supersolidity and the network of defects. Support of this experiment was provided by NSF Grants No. DMR 0706339.