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### **X-ray scattering experiments on solid helium**

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Using x-ray synchrotron radiation, we have studied the nature of crystals of solid  $^4\text{He}$  at temperatures down to 50 mK. Measurements of peak intensities and lattice parameters do not show indications of the supersolid transition. Between 50 mK and 0.6K the relative change in the lattice parameters is less than  $2 \times 10^{-5}$  and that in  $\langle u^2 \rangle$  less than  $4 \times 10^{-3}$ . Scanning with a small (down to  $10 \times 10 \mu\text{m}^2$ ) beam, we resolve a mosaic structure within these crystals consistent with numerous small angle grain boundaries. The mosaic shows significant motion even at temperatures far from melting. When grown in aerogel, solid  $^4\text{He}$  polycrystalline, with an hcp crystal structure (as in bulk) and a crystallite size of approximately 100 nm. In contrast to the expectation that the highly disordered solid will have a large supersolid fraction, torsional oscillator measurements show a behavior that is strikingly similar to high quality crystals grown from the superfluid phase. The low temperature supersolid fraction is only  $\sim 3 \times 10^{-4}$  and the onset temperature is  $\sim 100$  mK. Work done in collaboration with C.A. Burns, M.H.W. Chan, C.N. Kodituwakku, L.B. Lurio, A. Said and J.T. West.