Abstract Submitted
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Precise neutron diffraction study of hcp and bcc ^{4}He[1] RALPH SIMMONS, ROBERT BLASDELL, Department of Physics, University of Illinois at Urbana-Champaign — Precise lattice parameter measurements are reported for ^{4}He in both bcc and hcp phases at low density and low temperature. The results can be used to set limits on a proposed incommensurate equilibrium state of solid ^{4}He near $T = 0$. "Incommensurate" means a net difference between atomic sites and atoms. The relative difference is defined as ϵ. Present measurements were made by carefully calibrated neutron diffraction. The value established at melting, by comparison with published bulk density values, is $\epsilon = 0.4 \pm 0.4\%$. Much of the uncertainty comes from uncertainties in the bulk values. These neutron results on hcp ^{4}He are also consistent with previous precise x-ray diffraction work on bcc ^{4}He and, at higher densities, on both ^{4}He and ^{3}He. Published isochoric measurements of changes in x-ray lattice parameters as T is reduced from melting can be used to extrapolate ϵ toward zero T, where its most probable value is zero, with the same uncertainty. The present neutron work on hcp phase agrees with published high-resolution synchrotron x-ray work in showing that the (c/a) ratio is slightly smaller than that corresponding to ideal close-packing.

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