Supersolid $^4$He Likely Has Nearly Isotropic Superflow

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— We extend previous calculations of the zero temperature superfluid fraction $f_s$ (SFF) vs localization, from the fcc lattice to the experimentally realized (for solid $^4$He) hcp and bcc lattices. The superfluid velocity is assumed to be a one-body function, and dependent only on the local density, taken to be a sum over sites of gaussians of width $\sigma$. Localization is defined as $\sigma/d$, with $d$ the nearest-neighbor distance. As expected, for fcc and bcc lattices the superfluid density tensor is proportional to the unit tensor. To numerical accuracy of three-places (but no more), the hcp superfluid density tensor is proportional to the unit tensor. This implies that a larger spread in data on $f_s$, if measured on pure crystals, is unlikely to be due to crystal orientation. In addition, to three decimal places (but no more) the curves of $f_s$ vs $\sigma/d$ are the same for both the hcp and fcc cases. An expected value for the localization gives an $f_s$ in reasonable agreement with experiment. The bcc lattice has a similar curve of $f_s$ vs $\sigma/d$, but is generally smaller because the lattice is more dilute.

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