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Evidence of Bose-Einstein Condensation in solid helium[1]

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The onset of superfluidity in liquid He-4 below 2.176K is associated with Bose-Einstein condensation where He-4 atoms condensed into a single momentum state and acquire quantum mechanical coherence over macroscopic length scales. Bose-Einstein condensation of alkali atoms in the vapor phase was achieved in 1995 and there is strong evidence for superfluidity in these systems. Perhaps counter to intuition, superfluid-like behavior is thought possible even in solid helium. Recent high Q torsional oscillator measurements found evidence of superflow in solid helium confined in porous media (1) and in bulk solid helium (2), indicating Bose-Einstein condensation very likely occurs in all three phases of matter. (1) E. Kim and M. H. W. Chan, Nature 427, 225 (2004) (2) E. Kim and M. H. W. Chan, Science 305, 1941 (2004).

[1]Work performed in collaboration with Eunseong Kim and supported by NSF