

## Third Sound in Superfluid $^4\text{He}$ Films Adsorbed on Packed Multiwall Carbon Nanotubes

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Third sound propagation is observed with thin  $^4\text{He}$  films adsorbed on multiwall carbon nanotubes. At an average diameter of 12 nm and a length of several microns, the powder of nanotubes is lightly packed into a cylindrical resonator, with a resistor bolometer at the cylinder end to detect the temperature oscillations accompanying the waves. The lowest standing-wave mode in the cavity is excited by mechanical vibrations, with FFT analysis allowing measurement of the sound speed as well as the dissipation. A finite-size broadened Kosterlitz-Thouless onset transition is observed with increasing film thickness on the outside nanotube surfaces for temperatures between 1.3 and 1.7 K. At higher thicknesses capillary condensation becomes important, probably at connection points where the nanotubes touch. We have seen no indication of effects that might be attributable to the adsorption of helium on the inner surfaces of the nanotubes.

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