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Third Sound Generation in Superfluid ^{4}He Films Adsorbed on Multiwall Carbon Nanotubes VITO IAIA, EMIN MENACHEKANIAN, GARY WILLIAMS, UCLA — A technique is developed for generating third sound in superfluid ^{4}He films coating the surface of multiwall carbon nanotubes. Third sound is a thickness and temperature wave of the helium film, and in our case we detect the temperature oscillations with a carbon resistance bolometer. The nanotubes are packed in an annular resonator that is vibrated with a mechanical shaker assembly consisting of a permanent magnet mounted on springs, and surrounded by a superconducting coil. The coil is driven with an oscillating current, vibrating the cell at that frequency. Sweeping the drive frequency over the range 100-200 Hz excites the resonant third sound mode of the cell, seen as a high-Q signal in the FFT analysis of the bolometer signal. A problem with our original cell was that the mechanical drive would also shake the dilution refrigerator cooling the cell to low temperatures, and increasing the drive would start to heat up the refrigerator and the cell, which were rigidly coupled together. A new configuration now suspends the cell as a pendulum on a string, with thermal contact made by copper wires. Piezo sensor measurements show this reduces the vibration reaching the refrigerator by two orders of magnitude, which should allow measurements at lower temperatures.

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