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Coupling carbon nanotube mechanics to a superconducting circuit B.H. SCHNEIDER, S. ETAKI, H.S.J. VAN DER ZANT, G.A. STEELE, Tu-Delft — The quantum behaviour of mechanical resonators is a new and emerging field driven by recent experiments reaching the quantum ground state. The high frequency, small mass, and large quality-factor of carbon nanotube resonators make them attractive for quantum nanomechanical applications. A common element in experiments achieving the resonator ground state is a second quantum system, such as coherent photons or a superconducting device, coupled to the resonators motion. For nanotubes, however, this is a challenge due to their small size. Here, we couple a carbon nanoelectromechanical (NEMS) device to a superconducting circuit. Suspended carbon nanotubes act as both superconducting junctions and moving elements in a Superconducting Quantum Interference Device (SQUID). We observe a strong modulation of the flux through the SQUID from displacements of the nanotube. Incorporating this SQUID into superconducting resonators and qubits should enable the detection and manipulation of nanotube mechanical quantum states at the single-phonon level.

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