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Non-Adiabatic/Adiabatic Phase Transitions in Ultra-Clean Suspended Carbon Nanotubes ROHAN DHALL, SHUN-WEN CHANG, ZUWEI LIU, STEPHEN CRONIN, University of Southern California, Los Angeles — We have recently reported pronounced electron-phonon interactions in suspended, nearly defect-free metallic carbon nanotubes, observed through a Kohn anomaly of greater strength than theoretically predicted. This Kohn Anomaly is accompanied by a gate-induced modulation of the G band Raman intensity. In a systematic study of over 20 quasi-metallic carbon nanotubes devices, we have established a quantitative correlation between the strength of the non-adiabatic Kohn anomaly and the modulation of Raman intensity, indicating that the underlying cause that leads to both these effects is the same. We find that metallic nanotubes can switch between a regime in which the non-adiabatic Kohn anomaly is clearly observed and a regime where the non-adiabatic Kohn anomaly is absent, by varying temperature. In the non-adiabatic regime, an enhancement of the Raman intensity is observed under electrostatic gating. However, in the regime where the non-adiabatic Kohn anomaly is not observed, suppression of the Raman intensity with gating is observed.

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