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A Vibrating String Model to Explain Microwave Heating of Carbon Nanotubes JAMES ROBERTS, ZHOU YE, BILL DEERING, KROKHIN ARKADY, University of North Texas — Heating of carbon nanotubes (CNTs) by microwaves is described in terms of nonlinear dynamics of a vibrating nanotube. Results from the model provide a way to understand several observations that have been made. It is shown that transverse vibrations of CNTs during irradiation can be attributed to parametric resonance, as occurs in the analysis of Melde's experiment on forced longitudinal vibrations of a stretched elastic string. For many kinds of carbon nanotubes (SWNT, DWNT, MWNT, ropes and strands) the resonant parameters are found to be located in an unstable range of the parameter space of Mathieu's equation. Third degree wave equations are used to qualitatively describe the effects of phonon-phonon interactions and energy transfer from microwaves to CNTs. This result provides a way to input energy from microwaves to carbon nanotubes besides the usual Joule heating via electron-phonon interaction. This paper appears to be the first to point out the role of nonlinear dynamics in the heating of CNTs by microwaves

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