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Theory of fundamental detection limits of carbon nanotube mass sensors JOHANNES LISCHNER, T. A. ARIAS, Cornell University — Starting from *ab initio* calculations of linear and non-linear elastic constants, we use a quantized continuum elastic theory containing both linear and geometric nonlinearities to compute the intrinsic quality factor of the fundamental flexural mode of a semiconducting single-walled carbon nanotube by means of many-body perturbation theory. We analyze both three- and four-phonon loss channels and present results for the temperature, radius and length dependence of the losses. The intrinsic quality factor imposes a fundamental limit to mass differences that can be resolved by nanotube mass sensors. Our calculations suggest that yoctogram mass resolution, necessary to monitor chemical reactions on the nanotube surface, can be achieved at low temperatures if extrinsic losses are reduced sufficiently.

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