Abstract Submitted for the MAR10 Meeting of The American Physical Society

Thermally Induced Local Failures in Quasi-One-Dimensional Systems: Collapse in Carbon Nanotubes, Necking in Nanowires and Opening of Bubbles in DNA¹ CRISTIANO NISOLI, CNLS and T-Division, Los Alamos National Laboratory, DOUGLAS ABRAHAM, R. Peierls Centre for Theoretical Physics, Oxford, TURAB LOOKMAN, AVADH SAXENA, CNLS and T-Division, Los Alamos National Laboratory — We present a general framework to explore thermally activated failures in quasi one dimensional systems. We apply it to the collapse of carbon nanotubes, the formation of bottlenecks in nanowires, both of which limit conductance, and the opening of local regions or "bubbles" of base pairs in strands of DNA that are relevant for transcription and danaturation. We predict an exponential behavior for the probability of the opening of bubbles in DNA, the average distance between flattened regions of a nanotube or necking in a nanowire as a monotonically decreasing function of temperature, and compute a temperature below which these events become extremely rare. These findings are difficult to obtain numerically, however, they could be accessible experimentally.

¹This work was carried out under the auspices of the National Nuclear Security Administration of the U.S. Department of Energy at Los Alamos National Laboratory under Contract No. DE-AC52-06NA25396.

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Date submitted: 17 Dec 2009

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