Abstract Submitted
for the NWS09 Meeting of
The American Physical Society

Using Optical Tweezers to Probe the Elasticity of Short Molecules BENJAMIN P.B. DOWNING, ASTRID VAN DER HORST, Department of Physics, Simon Fraser University, Burnaby, BC, V5A 1S6, MING MIAO, FRED W. KEELEY, Molecular Structure and Function Programme, Hospital for Sick Children, Toronto, ON, M5G 1X8, NANCY R. FORDE, Department of Physics, Simon Fraser University, Burnaby, BC, V5A 1S6 — Stretching and relaxing single protein molecules provides quantitative information on their elasticity and other mechanical properties. Optical tweezers can be used to perform such experiments, but require the ends of the protein to be chemically tethered to polystyrene beads used to manipulate the molecule and measure its response. Our goal is to use this method to study the human structural protein elastin, whose mechanical properties are directly related to its physiological function. Elastin's contour length is approximately 170 nm, so the trapped beads must be manipulated at separations small compared to their micron dimensions. The close proximity of the beads introduces experimental complications, primarily the result of optical and hydrodynamic interactions. We discuss these complications along with our efforts to minimize and account for them in our measurements. We then show preliminary evidence addressing a critical question of whether elastin has higher order structure, where our results instead suggest that it exists in solution as a random polymer chain.

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Date submitted: 09 Apr 2009 Electronic form version 1.4