

Abstract for an Invited Paper
for the MAR09 Meeting of
The American Physical Society

The low-force elasticity of single-stranded DNA

OMAR A. SALEH, Materials Dept., UCSB

Single-molecule manipulation experiments, in which a single polymer is stretched with a known force while its extension is measured, are typically described by ideal models (e.g. the worm-like chain or freely-jointed chain) that account only for the polymer's local stiffness, but ignore long-range 'excluded-volume' interactions. Yet, the basic (and successful) Flory scaling theory indicates that long-range interactions must be included to describe the zero-force self-avoiding walk structure of a polymer. Here, we reconcile single-molecule force-extension data with scaling theories of polymer elasticity: measurements of denatured single-stranded DNA show a regime where the extension grows as a non-linear power law with force, in accord with previously-unproven 'tensile blob' models. Analysis of the salt dependence of this regime indicates that the polymer's Kuhn length is proportional to the Debye length. This contradicts the classic Odijk-Skolnick-Fixman theory; I will discuss possible explanations for this discrepancy.