Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Growth of Attached Actin Filaments JIE ZHU, A. E. CARLSSON, Physics Department, Washington University in St. Louis — Actin filaments in cells extend themselves by polymerizing free actin monomers onto their growing ends. The growing filaments can push obstacles and thus do mechanical work. It is known [1] that if the filaments are not attached to the obstacle, new monomers can be added when the obstacle fluctuates away from the growing filament ends. However, experiments [2, 3] show that the growing ends of actin filaments are firmly attached to the obstacle. Based on the idea of the Brownian ratchet model, we develop an energy-based model to investigate the growth of attached actin filaments. In this model, the force field describing the interaction between the actin filament and surface proteins (such as ActA) on the obstacle's surface is given a simplified but plausible analytic form. We use both Brownian-dynamics simulations and analytical approaches to calculate the attachment time and the growth rate. Our results show that a high binding energy (∼28kT) is required for the binding of an actin filament to the obstacle, and the actin filament can remain attached to a 25 nm bead for about 30 s, while still growing at about 50% of the free-filament growth velocity.
*Supported by NSF grant number DMS-0240770.
[1] Peskin, Odell and Oster, Biophys. J. **65**, 316 (1993). [2] Kuo and McGrath, Nature **407**, 1026 (2000). [3] Gerbal, et al. Eur. Biophys. J. **29**, 134 (2000).

Jie Zhu
Physics Department, Washington University in St. Louis

Date submitted: 29 Nov 2004 Electronic form version 1.4