Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Dynamical Length-Regulation of Microtubules ANNA MELBINGER, LOUIS REESE, ERWIN FREY, Ludwig-Maximilians University, Munich — Microtubules (MTs) are vital constituents of the cytoskeleton. These stiff filaments are not only needed for mechanical support. They also fulfill highly dynamic tasks. For instance MTs build the mitotic spindle, which pulls the doubled set of chromosomes apart during mitosis. Hence, a well-regulated and adjustable MT length is essential for cell division. Extending a recently introduced model [1], we here study length-regulation of MTs. Thereby we account for both spontaneous polymerization and depolymerization triggered by motor proteins. In contrast to the polymerization rate, the effective depolymerization rate depends on the presence of molecular motors at the tip and thereby on crowding effects which in turn depend on the MT length. We show that these antagonistic effects result in a well-defined MT length. Stochastic simulations and analytic calculations reveal the exact regimes where regulation is feasible. Furthermore, the adjusted MT length and the ensuing strength of fluctuations are analyzed. Taken together, we make quantitative predictions which can be tested experimentally. These results should help to obtain deeper insights in the microscopic mechanisms underlying length-regulation.

[1] L.Reese, A.Melbinger, E.Frey, Biophys. J., **101**, 9, 2190 (2011)

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Date submitted: 20 Nov 2011 Electronic form version 1.4