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Effects of Osmotic Force and Torque on Microtubule Bundling and Pattern Formation YONGXING GUO, YIFENG LIU, Physics Department, Brown Univ., RUDOLF OLDENBOURG, Marine Biological Laboratory, JAY TANG, JAMES VALLES, Physics Department, Brown Univ. — We report the effect of Polyethylene Glycol (PEG, MW=35kd) on microtubule bundling and pattern formation. Without PEG, polymerizing microtubule (MT) solutions of a few mg/ml [1,2] can spontaneously form striated birefringence patterns through MT alignment, bundling and buckling in coordination. With PEG, bundles become more distinct and the birefringence pattern weakens. Using quantitative birefringence measurements, the average number of MTs in the cross section of a bundle induced by 1% w/w PEG 35kd is determined to be around 26, with a wide spread in size. The amplitude of the buckling is reduced with increased PEG concentration. At sufficiently high PEG concentration ($\sim$0.5% w/w), the pattern is totally suppressed and the sample contracts laterally during the development of a microtubule bundle network. We propose that the decrease of the buckling amplitude is due to the depletion of the dispersed MT network, which is essential for the pattern formation. We attribute the anisotropic contraction to an osmotic torque that drives bundles that cross to align. [1] Y. Liu, *et al.*, PNAS 103, 10654 (2006). [2] Y. Guo, *et al.*, PRL 98, 198103 (2007). [Supported by NASA (NNA04CC57G, NAG3-2882) and NSF (DMR 0405156)]

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