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Vectorial Loading of Processive Motor Proteins: Microtubule buckling experiment revisited MICHAEL E. FISHER, Institute for Physical Science and Technology, University of Maryland, College Park, MD 20742, YOUNG C. KIM, Laboratory of Chemical Physics, NIDDK, NIH, Bethesda, MD 20892 — Experiments on the motor protein kinesin by Howard and coworkers (1996) observed the buckling of partially clamped microtubules caused by bound motors responding to the induced parallel, F_x, and perpendicular, F_z, load components. To analyze such results, we have applied simple mechanochemical models for vectorial loads $F = (F_x, F_y, F_z)$ by implementing a three-dimensional free-energy landscape formulation. An expression for the velocity, $V(F_x, F_z; [ATP])$, is obtained by fitting to the velocity and randomness data of Block and coworkers (2003) who imposed both resisting ($F_x < 0$) and assisting ($F_x > 0$) loads. While our results agree qualitatively with the buckling experiments, the analysis predicts that the velocity *decreases* under perpendicular loading ($F_z > 0$) contrary to the conclusion of Howard and coworkers. This suggests the possibility that the geometry of stressed microtubules might influence the motility of kinesin motors.
[1] Y. C. Kim and M. E. Fisher, J. Phys.: Condens. Matter **17**, S3821 (2005).

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