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Collective dynamics of molecular motors pulling on fluid membranes[1] JAUME CASADEMUNT, Universitat de Barcelona, OTGER CAMPAS, Universitat de Barcelona / Institut Curie, YARIV KAFRI, Institut Curie / Technion, Haifa, KONSTANTIN B. ZELDOVICH, Harvard University, JEAN-FRANCOIS JOANNY, Institut Curie — The collective dynamics of N weakly coupled processive molecular motors when an external force is exerted on the first one, are considered theoretically. We show, using a discrete lattice model, that the velocity-force curves strongly depend on the effective dynamic interactions between motors and differ significantly from the mean field prediction. They become essentially independent of N when this number is large enough. For strongly biased motors such as kinesin, this may occur for N as small as 5. The study of a two-state model shows that the existence of internal states can induce effective interactions. Several analytical predictions are discussed and checked numerically both for the discrete lattice model and the two-state model with Langevin dynamics. Typically, motors cooperate constructively so that the collective stall force and the mean velocity are larger than the mean field expectations. The implications on the interpretation of previous experiments on membrane tubes pulled by collective motors and possible design of new experiments are discussed.

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