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Mechanical interactions may explain synchronized growth of cytoskeletal actin networks in motile cells ANTONIO DESIMONE, LUCA CARDAMONE, ALESSANDRO LAIO, SISSA-International School for Advanced Studies, SISSA TEAM — Growing networks of actin fibers are able to organize into compact, stiff two-dimensional structures inside lamellipodia of crawling cells. We examine critically the hypothesis that the growing actin network is a critically self-organized system, in which long-range mechanical stresses arising from the interaction with the plasma membrane provide the selective pressure leading to organization. We show that a simple model based only on this principle leads to stochastic protrusion of lamellipodia (growth periods alternating with fast retractions) and several of the features observed in experiments: a growth velocity initially insensitive to the external force; the capability of the network to organize its orientation; a load-history-dependent growth velocity. Our model predicts that the spectrum of the time series of the height of a growing lamellipodium decays with the inverse of the frequency. This behavior is confirmed by optical tweezer measurements performed in vivo on neuronal growth cones. References L. Cardamone et al.: Cytoskeletal actin networks in motile cells are critically self-organized systems synchronized by mechanical interactions. PNAS, vol. 108, no. 34, pp. 13978-13983

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