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Self-organization of cytoskeletal systems: formation and dynamics of bundles, rings, and spindles ALEXANDER ZUMDIECK, Max-Planck-Institute for Physics of Complex Systems, Dresden, Germany, KARSTEN KRUSE, FRANK JÜLICHER — The cytoskeleton is a complex network of protein filaments. Driven by active processes such as filament polymerization and depolymerization and the action of molecular motors, it represents an active system which by self-organization can form dynamic patterns and exhibit active mechanical properties. Starting from a microscopic picture, we develop a coarse grained description for the dynamics of bundles of filaments and motors in the presence of filament polymerization and depolymerization. We show that filament treadmilling in the presence of passive cross-linkers can, similarly to motor proteins, generate tensile stresses that may result in bundle contraction. Motivated by contractile rings that cleave cells during cell division we extend our description to cylindrical geometries and show that filament rings with contractile properties can form by self-organization phenomena. Furthermore we discuss the stability of bipolar spindles, taking into account the simultaneous action of several types of motor proteins.

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