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Isotropic, nematic and polarized states in active motor-filament solutions[1] APHRODITE AHMADI, M. CRISTINA MARCHETTI, Physics Department, Syracuse University, Syracuse, NY 13244, TANNIEMOLA B. LIVERPOOL, Department of Applied Mathematics, University of Leeds, Leeds LS2 9JT, UK — We characterize the phase diagram of interacting polar biofilaments and motor proteins in terms of experimentally accessible parameters. The active filament solution is described by a set of hydrodynamic equations. These in turn are obtained by coarse-graining the Smoluchowski equation for rods coupled by active crosslinkers that mediate the exchange of forces among the filaments. We find that motor activity and the polarity of motor clusters play a key role in the formation of homogeneous isotropic, nematic and polarized states. We also investigate the stability of such homogeneous states against spatially varying fluctuations in the hydrodynamic fields. Motor-induced bundling can destabilize each homogeneous state at high filament and motor density, albeit via different mechanisms (diffusive versus oscillatory). Our analysis suggests that spatially inhomogeneous oscillatory structures, such as vortices, can be formed in the polarized state.

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