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Probing Active Nematic Films with Magnetically Manipulated Colloids DAVID RIVAS, KUI CHEN, ROBERT HENRY, DANIEL REICH, ROBERT LEHENY, Johns Hopkins University — We study microtubule-based extensile active nematic films using rod-like and disk-shaped magnetic colloids to probe the mechanical and hydrodynamic properties of this quasi-two dimensional out-of-equilibrium system. The active nematics are driven by molecular motors that hydrolyze ATP and cause sliding motion between microtubular bundles. This motion produces a dynamic nematic director field, which continuously creates pairs of +1/2 and -1/2 defects. In the absence of externally applied forces or torques, we observe that the magnetic rods in contact with the films align with the local director, indicating the existence of mechanical coupling between the film and probe. By applying known magnetic torques to the rods and observing their rotation with respect to the director, we gain insight into this coupling. We also find that by rotating magnetic microdisks using magnetic fields, hydrodynamic flows are produced that compete with the films' intrinsic flow, leading to significant effects on the director field and the defect landscape. At certain rotation rates, the disks produce a vortex-like structure in the director field and cause the creation and shedding of defects from the disk boundary.

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