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Topological obstacles and the forces on them in systems of strongly interacting directed polymers DAVID ZEB ROCKLIN, University of Illinois at Urbana-Champaign, PAUL M. GOLDBART, SHINA TAN, Georgia Institute of Technology — Owing to their extended structure and inpenetrability, polymers are strongly influenced by topological obstacles. To shed light on this issue we consider a model system of noncrossing directed polymers in two dimensions. As first exploited by de Gennes [1], the configurations of this system can be mapped onto the worldlines of noninteracting fermions—an analogy that enables the application to the polymer system of techniques initially developed for one-dimensional quantum systems. Via this approach, we discuss how an obstacle that forces a fixed number of polymers to pass to one side of a single topological constraint is associated with a large fluctuation of the quantum system. In addition, via the use of techniques from quantum hydrodynamics, we find that such a constraint on a system of noncrossing polymers generates an effective, long-ranged repulsion between the polymers. This repulsion causes a void to appear in the polymer fluid and generates a super-Hookean force opposing the constraint. [1] P.-G. de Gennes, J. Chem Phys. 48, 2257-2259 (1968).

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