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Directed polymer liquids addressed via the two-dimensional one-component plasma: Implications for the density profile D. ZEB ROCKLIN, University of Illinois at Urbana Champaign, ANTON SOUSLOV, PAUL GOLDBART, Georgia Institute of Technology — We consider the inclusion of one or more particles into a dense, three-dimensional liquid of long, directed polymers. The particles represent an excluded volume within the liquid which raises its free energy. As discussed in the accompanying talk, the statistical mechanics of such a polymer liquid can be described in terms of certain two-dimensional fluids of quantum particles and, hence, via an exactly solvable classical two-dimensional one-component plasma (2DOCP). The free energy cost of a particle inclusion is related to the probability of spontaneous formation of a large void within the quantum fluid or the plasma. We use these relationships to study the effect of particle inclusions in the polymer liquid, as well as large fluctuations of the liquid. We find that displaced polymers accumulate near the edge of the inclusion, in a manner similar to the accumulation of excess charge near the surface of a conductor. In addition, we are able to determine the equilibrium density profile for polymer liquids subject to more general constraints, e.g., ones that force some fixed number of polymers to pass through a ring.

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