1023-82-601 **Timothy D Andersen*** (andert@rpi.edu), Amos Eaton 301, Rensselaer Polytechnic Institute, Troy, NY 12180, and **Chjan C Lim**. *Statistical Equilibrium of Slender Vortex Filaments.*

Systems of nearly parallel, slender vortex filaments in which angular momentum is conserved are an important simplification of the Navier-Stokes equations where turbulence can be studied in statistical equilibrium. The exact conditions when 2-D and 3-D models are applicable is not well-known in cases where vortices are nearly straight and parallel, i.e. the system is nearly 2-D. Using Path Integral Monte Carlo methods of Ceperley, (the first application of PIMC to non-quantum fluids) we study the canonical Gibbs distribution of the Klein-Majda-Damodaran model, which involves a logarithmic interaction between vortices and a brownian self-motion. We find significant differences between the second moment of the probability distribution of the 3-D model from that of the point vortex model of Onsager at moderate to high temperature, while virtually no difference at low fluctuation levels, when vortices are fairly straight. We develop a free-energy equation based on the non-interacting case, with a spherical constraint, which we approximate using the method of Kac-Berlin, adding a mean-field term for logarithmic interaction. We use this free-energy equation to predict the Monte Carlo results. (Received September 18, 2006)