Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Mechanical and thermal stability of adhesive membranes with nonzero bending rigidity TUOMAS TALLINEN, Harvard University / University of Jyvaskyla, JAN ASTROM, CSC - The Finnish IT Center for Science, PEKKA KEKALAINEN, JUSSI TIMONEN, University of Jyvaskyla — Membranes at a microscopic scale are affected by thermal fluctuations and self-adhesion due to Van der Waals forces. Methods to prepare membranes of even molecular scale, e.g. graphene, have been recently developed, and the question of their mechanical and thermal stability is of crucial importance. To this end we modeled microscopic membranes with a short-range attractive interaction and applied Langevin dynamics. Their behavior was also analyzed under external loading. Even though these membranes folded during isotropic compression as a result of energy minimization, the process at high confinement did not differ much from crumpling of macroscopic thin sheets. The main difference appeared when the external load was released. In such cases, for membranes of sufficiently large size L, folded or scrolled conformations emerged. At high enough temperature T entropic effects made such conformations unfavorable, however. Possible conformations of free-standing membranes ("phase diagrams") were determined in the TL-plane.

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Date submitted: 29 Dec 2010 Electronic form version 1.4