Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Buckling Instability In Bilayer Membranes A. CONCHA, J. MCIVER, P. MELLADO, R.L. LEHENY, Johns Hopkins University — We have analyzed the patterns generated when a stress field is introduced to the inner layer of a cylindrically symmetric bilayer membrane through a combination of analytic calculations, numerical simulations, and experiments. A wrinkled structure forms that we explain in terms of a competition between bending and stretching energies under a suitable geometrical constraint. The wavelength, λ, at the onset of the instability is found theoretically and experimentally to be $\lambda = \pi\sqrt{8B/T_c}$, where T_c is the critical tension of the inner layer marking the onset of the instability, and B is the bending modulus of the membrane. We have also investigated the formation of pseudo-fractal structures that emerge beyond the onset of the instability. We further explain the existence of defects in the regular pattern as a consequence of multiple metastable states in the effective potential that describes this system.

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Date submitted: 11 Jan 2006 Electronic form version 1.4