Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Stretching DNA by a Constant Field YUKO HORI, ASHOK PRASAD, JANE' KONDEV, Physics Department, Brandeis University — We consider the problem of stretching DNA by a constant field, such as an electric field or a hydrodynamic flow field. We obtain analytical expressions for the elongation of DNA under both weak and strong applied fields, in two and three dimensions. In the weak field limit we consider the effect of self-avoidance, which leads to a 9-fold enhancement of the average end-to-end distance over the result obtained when self-avoidance is ignored in two dimensions, and 3-fold increase in three dimensions. In the strong stretching regime we obtain the exact force-extension relation by mapping the problem to the Schrödinger equation for a simple harmonic oscillator in a time dependent potential. We use our theoretical results to comment on the experiment of Maier *et al.* [1] on DNA adsorbed on a lipid bilayer in the presence of an in-plane electric field. In particular, we find that their estimate for the effective charge density of the DNA molecule, made on the basis of an approximate theory, requires significant corrections in light of our calculations. This work was supported by the NSF through grants DMR-9984471 and DMR-0403997. JK is a Cottrell Scholar of Research Corporation.

[1]B. Maier, U. Seifert, and J. O. Rädler, *Europhys. Lett.*, **60**, 622 (2002).

Yuko Hori
Physics Department, Brandeis University

Date submitted: 02 Dec 2004 Electronic form version 1.4