Step Evolution Toward Equilibrium: Fokker-Planck Equation and the Wigner Surmise[1] ALBERTO PIMPINELLI, LASMEA, CNRS/UBP, Clermont-Ferrand, France, T. L. EINSTEIN, HAILU GEBREMARIAM, U. of Maryland, College Park — The generalized Wigner surmise $P_w(s) = as^\varrho \exp(-bs^2)$, drawn from random-matrix theory, has been shown to provide arguably the best (both conceptually and quantitatively) description of the equilibrium terrace-width distribution (TWD) of steps on a vicinal surface,[2] but with limited formal justification for non-special ϱ.[3] Using a mean-field approach to Dyson's Brownian motion model,[4] we show that $P_w(s)$ can be derived from a Fokker-Planck equation, analogously to the derivation of the Heston model of econophysics.[5] From this formulation we can find how the system evolves from some arbitrary initial distribution toward $P_w(s)$. For a simple initial TWD such as uniformly-spaced straight steps, we can find the solution analytically. In parallel we carry out Monte Carlo studies within the terrace-step-kink model[2] with such initial distributions and confirm that the variance of the TWD evolves as predicted.

[1]Work at UM supported by NSF MRSEC Grant DMR 00-80008.
[2]Hailu Gebremariam, S.D. Cohen, H.L. Richards, & T.L. Einstein, Phys. Rev. B **69**, 125404 (2004) and references therein.
[3]H.L. Richards & T.L. Einstein, cond-mat/0008089.
[4]F.J. Dyson, J. Math. Phys. **3**, 1191 (1962).
[5]A.A. Dragulescu and V.M. Yakovenko, Quantitative Finance **2**, 443 (2002) [cond-mat/0203046].

Theodore Einstein
University of Maryland

Electronic form version 1.4