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Persistence Properties of Interacting Steps: Qualitative Failure of Mean Field[1] HAILU GEBREMARIAM, T. L. EINSTEIN, U. of Maryland, College Park, CHANDAN DASGUPTA, Indian Inst. of Science, Bangalore — In studying the persistence properties of fluctuating steps on a vicinal surface, we examine the effect of interactions between steps on the correlation function $C(t)$ of step excursions from their mean position. For times much longer than the correlation time τ_c, $C(t) \propto exp(-t/\tau_c)$. The standard way to include step repulsions ($\propto A/l^2$) simply is the mean field, Gruber-Mullins (GM) approximation, in which each step experiences a harmonic potential that narrows with increasing repulsion.[2] Monte Carlo simulations of a terrace-step-kink model show that τ_c then decreases with increasing A. Including the full repulsion between neighboring steps, we find the opposite trend: τ_c increases with A, due to in-phase meandering absent in GM.[3] However, the time constant τ_s associated with the exponential decay of the survival probability decreases with A. The ratio τ_s/τ_c decreases slowly with A, from 0.38 at $A = 0$, thereby satisfying the theorem that this ratio be < 1.[2]. We also discuss the scaling properties of autocorrelation and survival, in particular the dependence on sampling time and on lateral system size.

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[2]C. Dasgupta et al., Phys. Rev. B 69, 022101 (2004)
[3]Hailu Gebremariam, Ph.D thesis, and HG, CD, & TLE, to be published.

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