Abstract Submitted
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Mixing of Diffusing Particles ELI BEN-NAIM, Los Alamos National Laboratory — We study how the order of N independent random walks in one dimension evolves with time. Our focus is statistical properties of the inversion number m, defined as the number of pairs that are out of sort with respect to the initial configuration. In the steady-state, the distribution of the inversion number is Gaussian with the average $\langle m\rangle \simeq N^2/4$ and the standard deviation $\sigma \simeq N^{3/2}/6$. The survival probability, $S_m(t)$, which measures the likelihood that the inversion number remains below m until time t, decays algebraically in the long-time limit, $S_m \sim t^{-\beta_m}$. Interestingly, there is a spectrum of $N(N-1)/2$ distinct exponents $\beta_m(N)$. We also find that the kinetics of first passage in a circular cone provides a good approximation for these exponents. When N is large, the first-passage exponents are a universal function of a single scaling variable, $\beta_m(N) \to \beta(z)$ with $z = (m - \langle m\rangle)/\sigma$. In the cone approximation, the scaling function is a root of a transcendental equation involving the parabolic cylinder equation, $D_{2\beta}(-z) = 0$, and surprisingly, numerical simulations show this prediction to be exact.

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