The Statistical Physics of Darwinian Evolution

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Motivated by experiments on laboratory-scale evolution in both microorganisms and biomolecules, we introduce and study a class of multi-locus evolution models. For these models, the population advances via being dragged forward by its most fit members and can be quantitatively studied using ideas from the theory of non-equilibrium spatially-extended processes. A key finding is the anomalously large dependence on population size and the related anomalously large usefulness of genetic recombination. Using this approach, insight can be obtained regarding the indirect selection for mechanisms which speed up adaptation, including becoming mutator-like and going into a state competent for genetic exchange.

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