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Self-Trapping Random Walks with Attractive Interactions[1]

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Self-avoiding walks on lattices are used to model the statistics of polymer chains. Attractive interactions between adjacent occupied sites can incorporate poor-solvent or low-temperature effects. Here we consider growing self-avoiding walks (GSAWs) on a square lattice, which grow by taking their Nth step into a randomly chosen unoccupied site adjacent to the N-1th step. Chains grow until there are no more unoccupied adjacent lattice sites and the walk becomes trapped, which is known to occur after an average of 71 steps. It has been debates as to whether the GSAW has the same universal behavior as the traditional self-avoiding walk ensemble. Incorporating self-attraction into the GSAW, we find that the mean trapping length has a non-monotonic dependence on the attractive strength, with a global minimum at weak self-attraction and an exponential divergence with strong self-attraction. Examining the statistics of the GSAW ensemble, we find evidence that the theta point is at a different location in the temperature-exponent parameter space compared to the traditional self-avoiding walk ensemble.

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