Polymer localization in random media versus traffic jams

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One basic example of driven stochastic processes is the so-called ASEP process where particles hop in a preferred direction along a one dimensional chain of discrete sites. This process also is a realization of the Burgers equation, is equivalent to so-called KPZ type interface growth, and describes the equilibrium properties of a directed polymer on a 2 dimensional lattice in the presence of quenched random landscape. Its scaling properties in the stationary state and of temporal fluctuations are well known: the stationary state lacks correlations (the forwardly hopping particles are placed at random) but density fluctuations dissipate as a power law with dynamic exponent z=3/2. This is a rare example of an exactly soluble non-trivial process in non-equilibrium statistical physics. Interestingly, this simple scaling behavior is highly unstable. One example of this is the introduction of a so-called slow bond where the hopping probability is locally reduced. As expected, a macroscopic traffic jam sets-in. In the directed polymer interpretation, the slow bond represents an attractive line defect parallel to the polymer, and the traffic jam that the polymer is bound to this line defect. Over the years the numerical results have been ambiguous about when exactly simple localization sets-in. Some years ago we presented evidence, based on numerical results and analytical arguments, for the existence of an intermediate phase in a range of weak slow bond defect strengths, where the traffic jam density does not decay with distance to a constant, but decays to zero as a power law. In this talk I review the connections between the various interpretations of the process, and focus on what the power law traffic jam means for localization of the quenched random polymer.