Condensed Matter Seminar

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Power spectrum of the total occupancy of an open TASEP in low density phase

Monday, August 31

4:00 P.M.

304 Robeson

We focus on the power spectrum of the total occupancy (i.e. the total number of particles inside the lattice at a given instant of time) of the open TASEP model in the low density phase. We perform standard Monte-Carlo simulations with sequential updates along with some analytic calculations to further investigate the findings of Adams et al. In this earlier work, unexpected oscillations in the power spectrum were found; here, we investigate them further to better understand potential boundary effects. We introduce another length scale, namely the window size l. A window is a segment of the whole lattice. Instead of calculating the power spectrum of the total occupancy for the entire system, the power spectrum is calculated inside the window. Typically a window is chosen to be a segment of the bulk far from the boundaries. The power spectrum calculated inside the window, embedded on a much larger lattice, resembles very closely to the power spectrum of entire open TASEP of length comparable to the window size. Motivated by this observation, we computed the power spectrum of the total occupancy inside a window of a periodic TASEP. The power spectrum of the periodic and the open TASEP share some generic features while differing on some others. The power spectrum of total occupancy of the periodic TASEP has two distinct sets of oscillations. We call them the large ω and the small ω oscillations. The large ω oscillations are shared by both the open and the periodic TASEP, while the small ω oscillations are salient features of the periodic TASEP alone. We argue that the small ω oscillations are artifacts of the periodic boundary condition. We present our simulation data to substantiate our claim. We provide a theoretical outlook by using a linearized discrete version of the full stochastic differential equation for the fluctuation of the density. There are two parameters in our theory, namely the diffusion constant and the noise strength. We find that the fitting parameters deviate from the naive bare value. In order to answer this puzzle we incorporate the nonlinear effect. We undertake perturbative calculation to one loop order, both in continuum and for the discrete case. Our calculations show a constant shift in the diffusion constant to one loop order.