Asymptotic behavior of the exclusion process with slow boundary

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In this talk, I will present some results about the asymptotic behavior of the simple symmetric exclusion process in a one-dimensional lattice with an open boundary, where there is the creation and annihilation of particles at a slower rate than one of the exclusion processes, we call it by "slow boundary". To be more precise, the results which will be presented are hydrodynamic limit, large deviations, and fluctuations. In simple words, these results are the passage (through a scaling limit) from a microscopic model to a macroscopic model (which is called by hydrodynamic limit) and the study of the rate of deviations and fluctuations of this passage. The choice for this model is because it arouses considerable interest in its applicability, for modeling mass transfer between reservoirs with different densities. But it also arouses interest in its theoretical part because of its non-triviality, for example, the invariant measure is given through matrices of Ansatz, see Derrida. Another interesting theoretical aspect, which will be the main focus of this talk, is that the behavior of time evolution of the particle density (hydrodynamic limit) is given by the heat equation with boundary condition. This boundary condition depends on how slow the rate of creation or annihilation of particles is at the boundary at the microscopic level. More precisely, if, at the microscopic level the rate at the boundary is of order N^θ, where N is the scale parameter of the model and $\theta \in [0, \infty)$, then we get at the macroscopic level the following boundary conditions: Dirichlet boundary conditions, for $\theta \in [0, 1)$; Neumann boundary conditions, for $\theta \in (1, \infty)$; and finally the critical case, when $\theta = 1$, give us the Robin boundary conditions, which can give some interesting opportunities to learn about boundary terms that change with time.