

Dynamical Properties of a Tagged Particle in the Totally Asymmetric Simple Exclusion Process with the Step-Type Initial Condition

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The one-dimensional totally asymmetric simple exclusion process (TASEP) is considered. We study the time evolution property of a tagged particle in TASEP with the step-type initial condition. Calculated is the multi-time joint distribution function of its position. Using the relation of the dynamics of TASEP to the Schur process, we show that the function is represented as the Fredholm determinant. We also study the scaling limit. The universality of the largest eigenvalue in the random matrix theory is realized in the limit. When the hopping rates of all particles are the same, it is found that the joint distribution function converges to that of the Airy process after the time at which the particle begin to move. On the other hand, when there are several particles with small hopping rate in front of a tagged particle, the limiting process changes at a certain time from the Airy process to the process of the largest eigenvalue in the Hermitian multi-matrix model with external sources.