

**Blocks and Gaps  
in the  
Asymmetric Simple Exclusion Process**

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**Abstract**

In earlier work with Harold Widom, we obtained formulas for the probability in the asymmetric simple exclusion process (ASEP) that the  $m$ th particle from the left is at site  $x$  at time  $t$ . These formulas were expressed in general as sums of multiple integrals and, for the case of step initial condition, as an integral involving a Fredholm determinant. In the present work these results are generalized to the case where the  $m$ th particle is the left-most one in a contiguous block of  $L$  particles. The earlier work depended in a crucial way on two combinatorial identities, and the present work begins with a generalization of these identities to general  $L$ .

For the KPZ regime with step initial condition, we determine the conditional probability (asymptotically as  $t \rightarrow \infty$ ) that a particle is the beginning of an  $L$ -block, given that it is at site  $x$  at time  $t$ . Using duality between occupied and unoccupied sites we obtain the analogous result for a gap of  $G$  unoccupied sites between the particle at  $x$  and the next one.

This is joint work with Harold Widom.

References: [arXiv:1707.04927](https://arxiv.org/abs/1707.04927) and [arXiv:1711.08094](https://arxiv.org/abs/1711.08094)