

## **Combinatorics and statistical physics: a story of hopping particles**

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The asymmetric exclusion process (ASEP) is a model from statistical physics which concerns particles hopping on a 1-dimensional lattice. Although it is very simple, the model is surprisingly rich: for example, it exhibits boundary-induced phase transitions. "Applied" scientists are interested in the model for a variety of reasons: the ASEP is regarded as a primitive model for traffic flow, and it appears in a sequence alignment problem in computational biology.

In my talk I will explain how my work on the combinatorics of the totally non-negative part of the Grassmannian  $Gr_{\{kn\}+}$  led to a surprising connection with the ASEP. One can actually compute the steady state probabilities of all states of the ASEP by counting cells of  $Gr_{\{kn\}+}$  according to certain statistics. Applications include exact formulas for the steady state probabilities and answers to questions such as "which state is most likely in the stationary distribution"? (Most results are joint with Sylvie Corteel.)