Second class particles in exclusion processes and "jeu de taquin" on infinite Young tableaux

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The Totally Asymmetric Simple Exclusion Process, or TASEP, is a well-known system of randomly interacting particles on the integer lattice Z. When we start the system with a second-class particle at the origin and first-class particles on the negative integers, it is known that the second-class particle will choose a random speed in [-1,1] and then move asymptotically in a straight line with that speed. I will describe recent joint results with Piotr Sniady in which we proved that a similar phenomenon holds for the "Plancherel-TASEP", which is a variant of TASEP in which the probabilistic dynamics are governed by Plancherel measure, or equivalently by an application of the RSK algorithm to a sequence of i.i.d. uniform random numbers in [0,1]. In that case, the motion of the second-class particle turns out to have an equivalent description in terms of the well-known "jeu de taquin" (or "sliding game") operation on Young tableaux introduced by Schutzenberger. This probabilistic version of jeu de taquin also turns out to be very worth studying in its own right, and leads to an interesting ergodic-theoretic isomorphism between two measure-preserving systems.