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Current Fluctuations for TASEP with Two-sided Densities

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We consider the TASEP (Totally Asymmetric Simple Exclusion Process) started initially with sites to the left of the origin occupied independently with one given probability and to the right of the origin with a possibly different probability (thus generalizing the step and stationary initial conditions). Prahofer and Spohn conjectured a complete picture of the different orders and scaling limits of the current fluctuations past a moving observer in terms of the two initial occupation densities and the velocity of the observer. Partial, though significant, results towards this full picture have been proved by P. A. Ferrari and Fontes, Johansson, and P. L. Ferrari and Spohn. By relating this fluctuation picture to a LPP (last passage percolation) model with specific boundary conditions, and then relating this to perturbed complex Wishart random matrix ensembles, we provide a complete characterization of the fluctuations of the last passage time in this related LPP model. At the center of this argument is the BBP (Baik, Ben Arous, Peche) transition phenomena, as well as tools from recent work of Borodin and Peche. Relating this complete characterization back to the Prahofer and Spohn conjecture, we prove their conjectured fluctuation picture.