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Correlations in Disordered Asymmetric Exclusion Process

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Transport processes in disordered media constitute an important class of problems especially in the light of their relevance to the modelling of a vast variety of phenomena in physics and many interdisciplinary areas. It is a well-established fact the disorder can strongly affect the transport characteristics of equilibrium as well as out of equilibrium systems. Among various non equilibrium systems, low dimensional driven lattice gases have played an important role in describing the transport in many physical and biological processes [1, 2]. A model which has played a paradigmatic role in out of equilibrium statistical physics is the *Asymmetric Simple Exclusion Process* (ASEP) [3]. Recently new strides have been opened in the challenge between disorder, interaction and drive in the processes belonging to ASEP family [4]. The exploration of disordered ASEP began with a single defective site in a periodic chain by Janowsky and Lebowitz [5]. They showed that even one defective site can remarkably lead to global effects on the system current and its density profile. Subsequently, Tripathy and Barma [6] considered the ASEP on a ring with many defective sites. Their investigation revealed the existence of phase segregation in a wide range of global density in the chain. In conjunction with the results of ASEP on ring, investigation on disordered ASEP in an open chain, was introduced by Kolomeisky [7]. He showed that in some ranges of input and output rates, a single defect in the bulk could affect the systems properties on a global scale. Our goal in this talk is to deal in some depth with the problem of interaction of defects in ASEP. Particularly, we focus on the case of two defective sites both having equal hoping rates q. In contrast to normal ASEP, our simulation results reveal the existence of notable correlations in the vicinity of defects. We have developed a theoretical framework which is capable of evaluating the current via combination of mean-field approach and exact solution of finite ASEP chain. Furthermore, we have investigated the short range correlations near defects via a numerical scheme for solving the steady state equations governing the site densities and two points correlation functions. We compare our analytical findings to those recently discussed in [8]. It is shown that the distance between two defects plays a crucial role in the transport characteristics.

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[1] B. Schmittmann and R.K.P. Zia in: *Phase transitions and Crtitical Phenomena*, *vol 17*, ed. C. Domb and L. Lebowitz (London: Academic) 1995.

[2] G. Schütz in: *Phase transitions and Crtitical Phenomena*, *vol 19*, ed. C. Domb and L. Lebowitz, Academic Press, 2001.

[3] B. Derrida, M.R. Evans, V. Hakim and V. Pasquir *J. Phys. A*, **26**, 1493 (1993).

[4] M.E. Foulaadvand, S. Chaaboki and M. Saalehi *Phys. Rev. E*, **75**, 011127 (2007).

[5] S. Janowsky and J. Lebowitz *Phys. Rev. A*, **45**, 618 (1992).

[6] G. Tripathy and M. Barma, *Phys. Rev. E*, **58**, 1911, 1998.

[7] A. B. Kolomeisky, *J. Phys. A: Math, Gen.*, **31**, 1153, 1998.

[8] P. Grulich and A. Schadschneider, *Physica A*, **387**, 1972, 2008.