From Random Walker to Vehicular Traffic: Motion on a Circle

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Summary. Driving of cars on a highway is a complex process which can be described by deterministic and stochastic forces. It leads to equations of motion with asymmetric interaction and dissipation as well as to new energy flow law already presented at previous Traffic and Granular Flow meetings [1].

Here we consider a model, where motion of an asymmetric random walker on a ring with periodic boundary conditions takes place. It is related to driven systems with active particles, energy input and depot. This simple model can be further developed towards more complicated ones, describing vehicular or pedestrian traffic. A particular case, where the coordinate is discrete but the time is continuous, is studied in some detail. In this case we obtain a master equation, which is solved exactly by means of the Fourier transformation. A drift–diffusion equation is derived in a continuum limit. For an infinitely large ring, the solution has a simple form of a spreading–out Gaussian distribution with moving mean value.

References

1. Ch. Liebe, R. Mahnke, J. Kaupužs, H. Weber: Vehicular Motion and Traffic Breakdown: Evaluation of Energy Balance. In: *Traffic and Granular Flow '07*, Springer, Berlin, 2009