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Anomalous transport in periodic systems induced by dichotomous noise.

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Transport phenomena in periodic structures by harvesting the unbiased external time–periodic stimuli and thermal equilibrium fluctuations have been one of the hottest topic in nowadays science. Examples range from biology and biophysics explaining directed motion of biological motors or particle transport in ion channels, through the new separation techniques to meso– and nano–physics covering newest up-to-date experiments with optical lattices, persistent currents in quantum rings and Josephson junctions, to mention only a few.

What almost all of us take for granted is the situation when we apply small force to an object and expect the motion to appear in the direction accordant with the applied force. On the small enough scale, however, this situation is not always intuitively true. For some well established systems like above mentioned Josephson junctions one might observe negative conductance (or it's mechanical analogue – negative mobility) if the system is in the carefully prepared state [1]. The phenomenon of negative absolute mobility (ANM) in periodic systems was first shown theoretically in [2]. There for the tuned system authors found the average current opposite to the constant bias force for the typical periodic system.

What about the possibility of extracting the anomalous features in the system driven not by the constant force but with the help of the random forces? By and large simple replacement of the bias force with the specific random signal of the same average will produce similar characteristics [3]. Fine tuning e.g. for the Poissonian noise will not, however, enhance the average current.

Here we would like to show some preliminary results of the dynamics of the massive Brownian particle within periodic system driven by the external ac–force and the dichotomous noise and show the possibility of not only reproducing the characteristics but also it's enhancement for the situation with the two–state random force. This won't be the first situation in which noise would play a constructive role [4] being in a clear opposition to the general understanding.

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[2] Machura L, Kostur M, Talkner P, Łuczka J and Hanggi P 2007 *Phys. Rev. Lett.* **98** 040601.
[3] Spiechowicz J, Luczka J and Hanggi P, 2013 *J. Stat. Mech.* P02044.
[4] Astumian RD, and Moss F, 1998 *Chaos* **8** 533.