Contribution ID: **15** Type: **poster**

Non-monotonic temperature dependence of diffusion coefficient in tilted disordered potentials

We study the transport properties of non-interacting overdamped particles, moving on tilted disordered potentials, subjected to Gaussian white noise. We give exact formulas for the drift and diffusion coefficients for the case of random potentials resulting from the interaction of a particle with a "random polymer". In our model the random polymer is made up, by means of some stochastic process, of monomers that can be taken from a finite or countable infinite set of possible monomer types. For the case of uncorrelated random polymers we found that the diffusion coefficient exhibits a non- monotonous behavior as a function of the noise intensity. Particularly interesting is the fact that the relative diffusivity becomes optimal at a finite temperature, a behavior which is reminiscent of stochastic resonance. We explain this effect as an interplay between the deterministic and noisy dynamics of the system. We test our findings by means of numerical simulations of the corresponding Langevin dynamics of an ensemble of noninteracting overdamped particles diffusing on uncorrelated random potentials

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