

## **Scientific Report: ESF Short Visit Grant 3359:**

Visiting Professor F. Marchesoni, University of Camerino

Duration of Visit:

Begin: March 01, 2010

End: March 15, 2010

Travel by private car because (1) more cheap than airfare and (2) much more convenient to reach the University of Camerino which is not located nearby a airport.

### **Topic of joint research: Anomalous Transport**

This visit served to collaborate on a joint project that involves stochastic noise induced transport far from thermal equilibrium in small systems in which thermal noise, disorder and entropic effects play a mutually influential role in achieving directed transport on the nanoscale. In particular, we investigated a micro-sized particle of non-spherical shape that is subjected to thermal noise and unbiased external time-dependent driving and placed into a symmetric (!) one-dimensional channel geometry.

In particular we considered a simple concept of nanodevice working in anomalous negative mobility (ANM) regime: The minimal spatial asymmetry required for ANM to occur is embedded in the asymmetric geometry of the transported particle, rather than in the channel design. This allows a tremendous simplification of the device engineering, thus paving the way toward a first experimental demonstration of ANM. Having extensive numerical studies at hand for this situation we discussed analytical approximate approaches that qualitatively can explain the observed features of absolute negative mobility, its directed average speed and issues relating to the dependence on the strengths of rotational and translational diffusion strengths. In addition, we identify parameter values for an in situ experimental implementation. In particular, this set up allows for effective separation of particles that differ in geometric shape (geometric conformational states) thus providing the possibility to engineer artificial geometric sieves to separate and shuttle different forms of micro and nano-sized particles.

Most of all, we started to write up the work for publication and finalized the graphical presentation of the obtained results. We plan to submit this very work for publication within the next 1-2 months.

Respectfully yours, Peter Hänggi