

Scientific report

The main purpose of my visit to Chalmers University of Technology was to help Prof. Kubatkin and his colleagues with the interpretation of their recent experiment on C_{60} molecules. They have managed to put a single C_{60} molecule in a narrow gap between two silver electrodes and measure the current through this system. In the experiment the molecule apparently switches between two metastable states. This effect manifests itself in the switching of the IV curve between two branches. The corresponding switching histograms between these two states have been recorded at different temperatures and voltages. From these histograms one can, in principle, extract the information about the height of the potential barrier separating the two metastable states, its dependence on applied voltage etc. In order to do that we have developed a theoretical model of this system. That was the point where the experimentalists needed my help. The idea behind our model is simple: the electrons tunneling to the molecule charge it and, since the molecule is placed in the electric field, cause its mechanical oscillations. As long as the oscillations become strong enough the switching to the neighboring minimum of the potential energy occurs. The charge transport through the molecule is described by usual methods developed earlier for quantum dots. We were able to fit the experimental data reasonably well, but some problems still have to be resolved. Afterwards we plan to publish a joint paper.

It is interesting that similar switching has been earlier observed in experiments with different molecules, i.e. it seems to be a common phenomenon. Therefore it is particularly important to understand its origin.

We are going to continue the collaboration in the future. The group of Prof. Kubatkin soon plans the experiments with C_{60} molecules placed between superconducting leads. This system promises interesting physics because energy gap of the superconductor is comparable with the energy quantum of mechanical oscillations.