

Project: **Molecular electronics**

Title: **Thermoelectric effects in quantum nonequilibrium molecular electronics**

Molecular electronics is most promising to take in future the place of today's silicon based electronics. For this reason, electron transport through molecular junctions (i.e. single molecules placed in between two electrical contacts) has attracted considerable attention.

One particularly important aspect in this context are thermoelectric effects, where electrical and heat currents both flow simultaneously through the molecules and influence each other. For example, flowing heat can cause an electrical current. Also reversely, electrical current can be used to control the (quantum) heat flowing from one contact attached to the molecule to the other contact across the molecule. Heat can be carried by electrons as well as by vibrations of the molecule. In addition, both of these kinds of thermal currents influence each other through electron-phonon coupling.

This project will study how electron-phonon coupling modifies various kinds of thermoelectric effects in small molecules. If time allows, the student will also learn how to incorporate oscillating laser fields by the Floquet approach.