CARL VON OSSIETZKY universität OLDENBURG
FAKULTÄT V
MATHEMATIK UND NATURWISSENSCHAFTEN

Institut für Physik

Theoriekolloquium

Am **16. November 2017** um **14.15 Uhr** in **W2 1-143** hält

Herr Dr. Edgar Roldan (Dresden)

einen Vortrag mit dem Titel

Heat engines and Carnot efficiency at the nanoscale

Sadi Carnot is considered the father of thermodynamics. In his seminal work “Reflexions sur la puissance motrice du feu” Carnot studied the conversion of heat into work that is the basic physical principle that drives heat engines, such as the engine of a car. The Carnot cycle imposes a fundamental upper limit to the efficiency of a macroscopic motor operating cyclically between two thermal baths. Despite being at the core of classical thermodynamics, an experimental realization of the Carnot cycle has been elusive to experimentalists during almost two centuries.

Recent advances in micromanipulation techniques have allowed the construction of heat engines at the nanoscale using optically trapped colloids as the working substance. At the nanoscale, thermodynamic fluxes such as energy or particle currents are fluctuating and the first and the second law have to be reinterpreted using stochastic theory.

In this talk I will introduce the theoretical framework of stochastic thermodynamics that allows describing the fluctuating behavior of the energy fluxes that occur at mesoscopic scales, and then discuss recent experimental implementations of the colloidal equivalents to the macroscopic Stirling, Carnot and steam engines. These small-scale motors exhibit unique features in terms of power and efficiency fluctuations that have no equivalent in the macroscopic world. In particular, I will discuss an experimental realization of a Carnot engine where a microscopic sphere plays the role of the working substance and optical tweezers and electrostatic fields the role of the cylinders of the engine. I will discuss the fluctuating energetics and efficiency of the Brownian Carnot machine showing that the Carnot bound can be surpassed for a small number of non-equilibrium cycles, an insight that is inspiring new strategies in the design of efficient nanomotors.

Interessierte sind herzlich eingeladen.

gez. Prof. Dr. Andreas Engel