Eugene Wigner Colloquium

joint event of GRK 1558 and SFB 910

SFB 910

Prof. Christian Flindt

Aalto University

"Lee-Yang zeros in condensed matter physics: theory and experiment"

Statistical physics provides the concepts and methods to explain the phase behavior of interacting many-body systems. Investigations of Lee-Yang zeros – complex singularities of the free energy in systems of finite size – have led to a unified understanding of equilibrium phase transitions. The ideas of Lee and Yang, however, are not restricted to equilibrium phenomena. Recently, Lee-Yang zeros have been used to characterize non-equilibrium processes such as dynamical phase transitions in quantum systems after a quench or dynamic order-disorder transitions in glasses. In this talk, I give an introduction to Lee-Yang zeros illustrated with a molecular zipper that exhibits a thermal phase transition [1]. I then go on to show how Lee-Yang zeros can be experimentally determined from the high cumulants of thermodynamic observables. This method was recently employed to extract the dynamical Lee-Yang zeros of a stochastic process involving Andreev tunneling between a normal-state island and two superconducting leads [2]. Even for systems that do not undergo a sharp phase transition, the Lee-Yang zeros carry important information about the large-deviation statistics and its symmetry properties.

[1] A. Deger, K. Brandner, and C. Flindt, *Lee-Yang zeros and large-deviation statistics of a molecular zipper*, arXiv:1710.01531
[2] K. Brandner, V. F. Maisi, J. P. Pekola, J. P. Garrahan, and C. Flindt, *Experimental Determination of Dynamical Lee-Yang Zeros*, Phys. Rev. Lett. **118**, 180601 (2017).

GRK1558 research training group

Thursday, 21.12.17 · 16:15h · EW 202

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