



Universität  
Basel

## Research Project

### ULTRADISS

#### Third-party funded project

**Project title** ULTRADISS

**Principal Investigator(s)** Meyer, Ernst ;

**Co-Investigator(s)** Tosatti, Erio ;

**Organisation / Research unit**

Departement Physik / Nanomechanik (Meyer)

**Department**

**Project start** 01.08.2019

**Probable end** 31.07.2024

**Status** Active

Dissipation spectroscopy: Nanomechanical dissipation, experienced by oscillating tip-based Force Microscopy (AFM) instruments, provides an innovative probe of the physics of classical and quantum materials, solids, surfaces. My group made, in the last decade, well-recognized experimental and conceptual advances by exploiting and adapting advanced AFM techniques, especially the ultra-sensitive pendulum-AFM, (p-AFM, dissipation sensitivity 0.1 aW, force sensitivity 10-12N) detecting collective phenomena and phase transitions including structural, electronic, magnetic. This dissipation spectroscopy was applied so far mostly at the equilibrium physics of 3D classical solids.

The challenge: I propose to extend nanomechanical dissipation spectroscopy to pick up much weaker effects caused by non-equilibrium perturbations, by nanomanipulations, and by quantum effects in carefully picked case studies. Such as measuring the imperceptible wind force exerted on a noncontact tip by a thermal or electrical current in the surface below, or the minute mechanical cost of creating and dismantling a single spin Kondo state, or a topological surface state.

Risks, benefits, relevance: None of this was done before, so despite our experience and good feasibility estimates there is some risk. The benefits however will be substantial. Thermal and electrical migration of defects and impurities is important in materials, and electrical contacts. The dragging, peeling, sensing of 2D systems like graphene nanoribbons and twisted bilayers is hot. And quantum dissipation is pertinent to the limiting factor of quantum information processes. To do all this by nanomechanics will be unique.

The opportunity: My group is ready to put its expertise in these exciting new problems, once I can through an Advanced Grant secure the instrumental and experimental human resources, as well as the theoretical support of additional beneficiary SISSA, indispensable in such a frontier context.

1Instructions

**Financed by**

Commission of the European Union

**Add publication**

**Add documents**

**Specify cooperation partners**