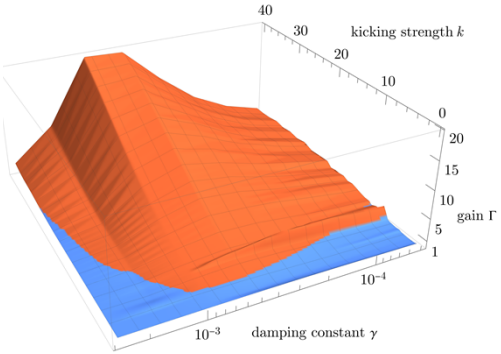
Physikalisches Kolloquium

Universität Konstanz

Di 15.01.19
15:15 Uhr
14:45 Uhr, Kaffee/Tee
R 513

Prof. Dr. Daniel Braun
Universität Tübingen



Quantum-metrology and the quest for ultimate precision

One of the best known consequences of quantum mechanics is the limited precision with which two complementary observables can be measured at the same time. While Heisenberg's uncertainty relation was originally formulated for quantum-mechanical observables, it was generalized about thirty years ago to the estimation of classical parameters that parametrize quantum states. It allowed, for example, a precise statement of the energy-time uncertainty relationship, even though time is not a Hermitian operator in quantum mechanics.
These works have flourished meanwhile to a well-established pillar of quantum-measurement theory, and it has become clear that quantum mechanics can also help to make certain measurements more precise than possible with comparable classical resources. Developing quantum sensors based on these principles is one of the cornerstones of the current efforts of developing quantum technologies, alongside quantum information processing.
In the talk I will give an overview of the state of the art of this field, with examples ranging from the sensitivity of artificial noses, over general strategies to improve sensitivity, to the question how precisely natural constants such as the speed of light can be measured in principle, with important fundamental consequences for the falsifiability of candidates of quantum gravity theories.