Speaker: **Anton Kantz, University of Freiburg**

Title: **Boyle's Law in Single Particle Quantum Systems**

Date: **Friday, February 20th, 14:00 pm**

Place: **Seminar room 915**

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Abstract:

We examine properties of statistically defined pressure in a single-particle quantum system. Previous work has shown that isotropic pressure can be achieved if the corresponding classical system is chaotic, or through averaging over many high-energy quantum states of an integrable system.

An important property of a classical gas is Boyle's law, which states that pressure is inversely proportional to volume. We investigate Boyle's law for a single quantum particle moving in a two-dimensional domain. In analogy to the ideal gas law, we aim to define a temperature using the product of pressure - derived directly from the microscopic spectral structure - and volume. We first consider a two-dimensional rectangular box, which exhibits integrable dynamics, and investigate Boyle's law under various microscopic definitions of pressure. We then turn towards Sinai's billiard, which generates classically chaotic dynamics, and investigate to which extent the structure of the billiard's eigenstates makes Boyle's law emerge.

It becomes clear that Boyle's law cannot be obtained for the integrable box potential, but a notion of Boyle's law can be verified in the chaotic Sinai billiard. With the found relation of Boyle's law in a single-particle quantum system, we define a temperature using the system's eigenstates.