

**Plenary Talk** PV XVIII Fri 9:00 RW 1  
**Chaos in the quantum world** — ●ANDREAS BUCHLEITNER —  
Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

Chaos in the classical world is the antithesis of order and predictability. It is associated with noise and the loss of control, but also with chance and change. In its elementary form it emerges from deterministic equations, and gives rise to - often ephemeral - “complex” dynamical structures. These represent an essential ingredient for the diversity, variability and (transient) robustness of patterns we witness in the classical world around us. Yet, their control is not trivial a task.

After accomplishing the isolation and control of individual quantum objects, it remains a challenge for contemporary quantum physics to maintain control when many of these elementary building blocks are

assembled together. Since this often results in the strong coupling of multiple degrees of freedom, it is not surprising that “chaos” and “complexity” are lurking also in the microscopic world of few to many quantum objects - and jeopardize controllability.

Thus, which insights can we gain from our understanding of classical chaotic systems to decipher and, perhaps, control “chaotic” and/or “complex” quantum systems? And how do quantum mechanical uncertainty and complementarity mould the fingerprint of classically chaotic dynamics in the quantum realm? We will try to elucidate these questions with concrete examples within the context of modern atomic, molecular and optical physics, will seek to discriminate single against many-body “quantum chaos”, and discuss a corollary for the emergence of thermodynamic behaviour.