# AKjDPG 1: Tutorial Quantum Simulation and Computing

Time: Sunday 17:00–18:30 Location: B305

**Tutorial** AKjDPG 1.1 Sun 17:00 B305

**A Tutorial on Quantum Simulation** — •Christian Gross — Physikalisches Institut, Universität Tübingen

Quantum simulation is one of the upcoming quantum technologies. In this tutorial we provide an introduction to quantum simulation and discuss different flavors and platforms. We highlight the state of the art of the field for the simulation of fermionic Hamiltonians and discuss key techniques and experiments. We will also discuss the close interconnection between quantum simulation and quantum computation.

**Tutorial** AKjDPG 1.2 Sun 17:45 B305

**Developing utility scale quantum computers with trapped ions** — •Winfried Hensinger — Sussex Centre for Quantum Technologies, Department of Physics and Astronomy, University of Sussex, Brighton BN1 9QH, United Kingdom

Trapped ions are arguably the most mature technology capable of constructing practical quantum computers. Most disruptive quantum computing applications require quantum error correction with quantum computers operating in the fault-tolerant quantum computing operating modus, therefore requiring hundred thousands or millions of qubits. While prototype trapped ion quantum computers have already been built featuring performance specifications featuring world-leading performance specifications, the next challenge consists to develop technologies capable of supporting operation with large number of qubits.

In this tutorial presentation I will provide an introduction to the general field of trapped ion quantum computing and explain key concepts including the fabrication of ion trap microchips. I will will focus on techniques capable of scaling to large qubit numbers including the use of long wavelength radiation for the scalable implementation of trapped ion quantum information processing.

In order to be able to build large scale device, a quantum computer needs to be modular. I will discuss different approaches to modularity and report a recent demonstration to couple different quantum computing modules with specifications sufficient for fault-tolerant quantum computing.