



## Announcement

# Seminar Quantum Technologies

### Description

Quantum Technologies are currently in their biggest upswing and the daily progress promises high impacts in many aspects of science and our daily live. The applications range from the simulations of molecules and high-energy physics, finance and complex optimization problems to high-resolutions sensing and medical imaging.

In this seminar, we will learn about the quantum hardware, but also the software that is necessary to achieve the quantum advantage and where we stand today.

### Content

- How to build a quantum computer
- Hardware platforms: Ion traps, Superconducting qubits, NV centers, Photonics
- Hardware-related programming: Realization of Quantum Gates
- Software: Shor's algorithm, Gate and Measurement based computation, Quantum Error Correction
- Quantum-classical Hybrid Devices for Quantum Chemistry: Quantum Approximate Optimization and Variational Quantum Eigensolver
- Feynman's Dream: The Quantum Simulator
- Fundamentals of Quantum Metrology
- The fierce enemy: Quantum Noise
- Quantum Technologies for Medical Imaging: Hyperpolarization
- Dynamical Decoupling, NMR
- Google: Quantum Supremacy
- Future and near-term applications

### Prerequisites

Basic knowledge of quantum mechanics.

### Literature

- **Depending on the topic, textbook chapters, review and research articles**

### Additional Information

The module refers to bachelor and master students

Seminar: 3 ECTS

Advanced Seminar: 4 ECTS

### Lecturer

Prof. Martin Plenio, Dr. Jan Haase