

# Seminar

Wednesday, June 12, 2024

16:00–17:30

Seminar Room 1

Mathematical Institute

University of Cologne

Weyertal 86–90

Center for  
Data and  
Simulation  
Science

## Speaker:

**Dr. Matthias Möller**

**TU Delft**

## OPPORTUNITIES OF QUANTUM COMPUTING FOR CFD APPLICATIONS

Quantum computing (QC) is an emerging compute technology that has the potential to radically change the way we will be solving computational problems in the future. The potential power of QC stems from the exploitation of quantum mechanical principles, namely, superposition of states, quantum entanglement and quantum parallelism, which makes it possible to solve certain types of computational problems up to exponentially faster or with exponentially less memory storage.

In this talk we will briefly discuss the basic concepts of QC and shed some light on the commonalities and differences of the two different paradigms - analog and digital quantum computing. We will give a brief

overview of applications that might benefit from using the one or the other paradigm.

One of these applications that we will discuss in more detail comes from the field of computational fluid dynamics (CFD). With today's tools and technologies, the fully-resolved direct numerical simulation of large-scale problems such as entire aircrafts or wind-turbine farms is impossible due to excessive compute times and prohibitively high memory requirements. This is the main motivation for our ongoing research on quantum-CFD algorithms. We will outline the working principles of our quantum lattice Boltzmann method and show numerical results that we obtained with high-performance QC simulators.