



CRC 1227  
Designed Quantum States of Matter



## GUEST LECTURE

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(Guest of Dr. N. Gaaloul and Prof. K. Hammerer)

Leibniz Universität Hannover  
**DQ-mat Colloquium**  
**Thursday 07 December 2023, 4.00 pm**  
**Room D326, Welfengarten 1**

### **"Quantum Control Tools for Long-Baseline Atom Interferometry"**

Recent technological advances have paved the way for large-scale atom interferometers to contribute to multiple areas at the forefront of modern physics, including searches for wave-like dark matter, gravitational wave detection, and fundamental quantum science. In an atom interferometer, sequences of laser pulses spatially split, recombine, and interfere the atoms' quantum mechanical states. Typically, the sensitivity of the instrument increases as the number of applied pulses grows larger. However, in practice, experimental nonidealities and tradeoffs limit the fidelity with which each pulse can control the quantum states of the atoms, limiting the number of pulses that can be applied. In this talk, as motivation, I will first introduce the MAGIS-100 100-meter-tall atom interferometer under construction at Fermilab and give an overview of its scientific goals. I will then describe some of our recent experimental and theoretical work to develop quantum control techniques that have the potential to reduce limitations from pulse infidelities, opening a path for MAGIS-100 and related detectors to achieve significantly improved sensitivity.

**All DQ-mat members and all interested are cordially invited to attend.**