



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, 13 June 2024, 4.00 pm

Room D326, Welfengarten 1, building 1101

"Maxwell Matter Waves: Coherence Properties, Generation, and Applications"

This talk introduces a class of matter waves that are temporally coherent, and that are particularly useful for applications such as inertial and other kinds of sensing. The coherence of these waves is of the same type that characterizes electromagnetic fields, such as those associated with a laser or a radio wave emitter. Maxwell's equations tell us that an oscillating electric current gives rise to an oscillating electromagnetic field. Certain ultracold atoms, such as ^{87}Rb , interact through s-wave scattering and repel each other in a manner somewhat reminiscent of the repulsion of identical charges. Through the application of gauge field theory we show that an oscillating current of such ultracold atoms gives rise to a matter wave field that is a faithful analog to the electromagnetic field. This leads naturally to the notion of Maxwell matter waves. The talk begins with a description of Infleqtion's cloud-accessible ultracold matter machine that can be used to produce and study oscillating currents and corresponding matter waves. We motivate the theoretical development with an example inertial sensing application. We close by describing some properties of the Maxwell matterwaves that distinguish them from more familiar de Broglie waves.

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